PROPOSED COASTAL PROTECTION SCHEME,
ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

ENVIRONMENTAL IMPACT REPORT

DEDEAT REFERENCE NUMBER: EC08/C/LN2/M/01-2021

DRAFT

Prepared for	On behalf of
St Francis Property Owners NPC PO Box 18 St Francis Bay 6312	Kouga Local Municipality PO Box 21 Jeffreys Bay 6330

Prepared by

36 Pickering Street, Newton Park, Port Elizabeth, 6045

Also in Grahamstown, East London, Johannesburg, Cape Town and Maputo

www.cesnet.co.za

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REVISIONS TRACKING TABLE

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CES Report Revision and Tracking Schedule

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Authors	Mr Gregory Shaw	Coastal & Environmental Services
Reviewers	Dr Ted Avis	Coastal & Environmental Services

ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

Port Elizabeth
36 Pickering St,
Newton Park
Port Elizabeth
6045
Info@cesnet.co.za
www.cesnet.co.za
Also in Grahamstown, Cape Town, East London Johannesburg and Maputo

AUTHOR AND EAP DETAILS

Details of the EAP

Dr Anthony Mark (Ted) Avis
Coastal & Environmental Services (CES)
Physical Address (Head Office): 67 African Street, Grahamstown 6139
Physical Address (Branch): 36 Pickering St, Newton Park, Port Elizabeth, 6001
Postal Address: P.O. Box 934, Grahamstown 6140
Telephone: +27 46 622 2364 (Head Office);
Website: www.cesnet.co.za
Email: g.shaw@cesnet.co.za

Expertise of the EAP

CES is a South African based company, with its head office in Grahamstown, and offices in Cape Town, Port Elizabeth, East London and Johannesburg, South Africa, as well as a wholly owned subsidiary in Maputo, Mozambique (CES is registered as an Environmental Practitioner with the Mozambican authorities). Coastal and Environmental Services (Pty) Ltd was established in 1990, to service a then fledgling market in the field of Environmental Management and Impact Assessment. The Company has grown apace with the increased market demand for environmental and social advisory services, in South Africa and numerous other African countries. Our principal area of expertise is in assessing the impacts of projects on the natural, social and economic environments through, among other instruments, the environmental impact assessment process, and in so doing contribute towards sustainable development.

Our staff is currently comprised of a number of professional and support staff. All professional staff members are well qualified, and as many as 90% have advanced postgraduate qualifications, including PhD, MSc and MA degrees in the biological, social and environmental sciences. In addition, CES has well-developed working relationships with a number of other individual specialist and specialist consulting companies who provide us with expertise in various disciplines. We have a demonstrated ability to manage EIAs for large and complex projects. This experience was initially gained during the undertaking of integrated environmental management studies, as well as the management of large and complex environmental and social impact assessments. CES has managed numerous large EIAs from pre-feasibility through to operation for international clients in six southern African countries. These have been rigorously reviewed by parties such as the World Bank, MIGA, European Investment Bank, IFC, German Investment Bank (KFW), African Development Bank, BHP Billiton international peer review team and the Dutch Development Bank (FMO).

Dr Ted Avis *(Role: Project Leader and Report Review)*
Ted Avis is a leading expert in the field of Environmental Impact Assessments, having project-managed numerous large-scale ESIAs to international standards (e.g. International Finance Corporation). Ted was principle consultant to Corridor Sands Limitada for the development of all environment aspects for the US$1billion Corridor Sands Project. He has managed ESIA studies and related environmental assessments of similar scope in Kenya, Madagascar, Egypt, Malawi, Zambia and South Africa. Ted has worked across Africa, and also has experience in large scale Strategic Environmental Assessments in southern Africa, and has been engaged by the International Finance Corporation (IFC) on a number of projects. Ted was instrumental in establishing the Environmental Science Department at Rhodes University whilst a Senior lecturer in Botany, based on his experience running honours modules in EIA practice and environmental. He is an Honorary Visiting Fellow in the Department of Environmental Sciences at Rhodes. He was one of the first certified Environmental Assessment Practitioner in South

Africa, gaining certification in April 2004. He has delivered papers and published in the field of EIA, Strategic Environmental Assessment and Integrated Coastal Zone Management and has been a principal of CES since its inception in 1990, and Managing Director since 1998. Ted holds a PhD in Botany, and was awarded a bronze medal by the South African Association of Botanists for the best PhD adjudicated in that year, entitled “Coastal Dune Ecology and Management in the Eastern Cape”. Ted is a Certified Environmental Assessment Practitioner (since 2002) and a professional member of the South African Council for Natural Scientific Professionals (since 1993).

Mr Gregory Shaw *(Role: Project Management and Report Author)*
Gregory is a Principal Environmental Consultant and Business Development Manager. Greg has 12 years’ experience in conducting environmental consultancy services in the energy, transport, maritime and agricultural sectors on behalf of South African and oversees government departments and agencies, local government authorities, private developers, international funding organisations, and non-government organisations. He has a strong track record of projects completed within budget, on time and in accordance with national and/or international environmental legislation and guidelines. Greg’s skills include ESIA, environmental survey development, management, execution and monitoring, report writing, project management and strategic planning.

Ms Nicole Wienand *(Role: Report Assistance)*
Nicole is an Environmental Consultant with less than 1 years’ experience, based in the Port Elizabeth branch. Nicole obtained her BSc Honours in Botany (Environmental Management) Cum Laude from Nelson Mandela University (NMU) in December 2018. She also holds a BSc Degree in Environmental Management (Cum Laude) from NMU. Nicole’s honours project focused on the composition of subtidal marine benthic communities on warm temperate reefs off the coast of Port Elizabeth (a baseline survey) and for her undergraduate project she investigated dune movement in Sardinia Bay. Although she is new to the environmental consulting field, her key interests include marine ecology, GIS Mapping, the general EIA process, Public Participation Process (PPP) and Ecological Impact Assessments.

EXECUTIVE SUMMARY

Introduction

The St Francis Property Owners Non Profit Company (SFPO NPC), on behalf of the Kouga Local Municipality (Kouga LM), has proposed the implementation of a coastal protection scheme for St Francis Bay beach, located within the Eastern Cape Province. The proposed project area is situated approximately 100 km west of Port Elizabeth, within the Kouga LM, seated within the Sarah Baartman District Municipality (SBDM). The coastal protection scheme will include sand material sourcing from the Kromme River (and any other viable sources), beach nourishment of St Francis Bay beach and the development of coastal structures to retard the erosion of St Francis Bay beach.

CES were appointed by the SFPO NPC to apply for an Environmental Authorisation (EA) by means of conducting a Scoping and Environmental Impact Reporting (S&EIR) process. This was initiated in 2018. In 2019, CES together with the SFPO produced a Draft and Final Scoping Report and Sand Sourcing Specialist Report which was subject to the mandatory 30-day public participation process (PPP) between 20th of August 2019 until the 18th of September 2019. Following on from the approval of the Scoping Report by the Department on the 25th October 2019, CES progressed with the development of the Draft EIR and Draft Estuarine and Dune Assessment Specialist Report which were subject to PPP between 19th December 2019 – 5th February 2020.

It was decided that the Final EIR would not be submitted and the application (EC08/C/LN2/M/42-2019) was allowed to lapse in order to re-visit the design based on comments from I&APs and the Department. The update to the design (re-alignment of groynes) required additional technical studies (estuarine and coastal modelling), which have now been completed and this report has been updated to include the additional information and design available.

Location of the proposed beach nourishment scheme (from Advisian, 2018).

Project Description

The implementation of beach nourishment (i.e. the placement of a large volume of sand on the beach over time) together with the development of short stub groynes (i.e. a low solid barrier built into the sea) was considered to be the most suitable option for long-term coastal protection. The details of the other alternatives which were considered are provided in Chapter 3 of this report.

Sand Sourcing and Transportation of Material

In order for beach nourishment to be implemented, sand must first be obtained from a suitable source area. The identification of a suitable source area was based largely on finding an area where sand will consist of similar grain size to that which is required on the beach, as well as being feasible and cost effective to extract and place along the beach. Three (3) potential source areas have initially been identified and all are located within the Kromme River estuarine functional zone (see Appendix I). The maximum volume of sand which will need to be sourced is approximately 854 000 m^3 and will be transported either via dredger and pipeline or on occasion trucks.

Beach Nourishment

The option to artificially nourish the beach with sand from suitable borrow sources has been identified as the least environmentally intrusive method to protect the St Francis Bay coastline from further erosion. The aim of the beach nourishment will be to establish a minimum horizontal dry beach width of 40 m. This additional sand will provide a wide enough beach at the right level to act as the primary defence against erosion as waves will dissipate their energy over this re-established sand beach before reaching the existing eroding area. Long term maintenance will be required to maintain the required beach width and level.

Revetment Structures

To prevent further sea breaching through the St Francis Bay beach spit during a strong storm surge event, revetment structures have been implemented by Kouga Municipality along the length of the beach spit as a temporary coastal protection to prevent further erosion of the spit. This temporary revetment needs to be integrated within the long-term coastal protection scheme consisting of stub groynes and beach nourishment. The design of the temporary revetment needs to be reviewed so its suitability and long-term functionality can be assessed as the revetment would form an integral part of the long-term coastal protection infrastructure and would be the last defence against wave action, should the proposed re-nourished beach not be sufficient.

Stub Groynes

In order to retain the sand in the nearshore and beach area following the implementation of beach nourishment, and to promote increased sedimentation in the future, six (6) stub groynes will be constructed along the length of the beach. These stub groynes will extend from the back end of the beach and reach a length of between 170m and 200m offshore. The stub groynes will be angled perpendicular to the shoreline (except groyne 5 which is oblique), and will be shorter than full length groynes which are generally used for erosion prevention. The shorter (stub) groynes will allow a percentage of sediment (expected to be around 50% of the long-shore drift) to pass between each groyne. This is to facilitate sand movement through the longshore drift process since it is not the intention of the project to trap all sediment moving along the coastline. Maintaining this sand movement along the coast is also anticipated to mitigate for the potential of accelerated erosion “downstream” of the groynes, particularly of the northern most groyne. In addition to the natural movement of sediment, nourishment of the shoreline in the lee of the northern most groyne will be included as part of the project. The volume of sediment will be monitored and re-nourishment will be carried out and form part of the annual maintenance regime.

A maximum of approximately 44 300 m^3 of rock material will be required for the proposed stub groynes. The rock material used for the groynes will be sourced from a licenced local quarry, the details of which will be subject to availability and grading of rock material, and will become known during the detail design stage of the project.

Alternatives

The preferred alternative considered in this Environmental Impact Report involves the implementation of the proposed coastal protection scheme, which will include sand material sourced from the Kromme River, beach nourishment of St Francis Bay beach and the development of coastal structures to retard the erosion of St Francis Bay beach and to protect the beach spit. The preferred alternative was determined by the SFPO NPC, in conjunction with the Kouga Local Municipality, coastal engineers (Advisian), and CES. Following extensive engagement with stakeholders and Interested and Affected Parties, additional alternatives were considered and resulted in a revised design. The revised design considers the movement of the groyne locations to avoid impacting negatively on surfing breaks. The design also re-orientates the groynes to perpendicular as opposed to oblique to facilitate more even wave breaking along the frontage. Advisian also conducted more extensive modelling to provide insight into the changes that might be experienced in the estuary and marine environment as a result of the project.

The impacts associated with the various locations and technology (revetment) alternatives have been assessed in this Environmental Impact Report.

Project Need and Desirability

The proposed coastal protection scheme provides a viable solution for increasing the accumulation of sediment and decreasing the potential adverse effects associated with the loss of the beach amenity. Besides the loss of all beaches within the project area in recent years, the need for this intervention became self-evident during 2020 when the sand spit at the marina was breached on four occasions, resulting in emergency repairs and reinforcement of the spit to protect properties on the marina.

The project aligns with the planning and development objectives from municipal to national level in the following ways:

- *"to create a safe environment with diverse opportunities for economic growth and development'* as per the Kouga LM Integrated Development Plan (IDP) 2017-2022. The proposed project will assist in achieving this important objective by (a) decreasing the exposure of the beachfront and municipal infrastructure such as roads, access stairs and parking facilities to dynamic coastal processes, thereby increasing the safety and quality of the beachfront area; (b) decreasing the potential of shifting sand bars in the Kromme river, thereby increasing the navigation ability and safety of boaters; (c) increasing the width of the beaches, thereby promoting tourism and economic growth and development, and (d) preventing the loss of physical infrastructure in both the public and private sector by arresting the current rapid rate of beach erosion.

- At district level St Francis Bay has been recognised as an important tourist destination. This project is referred to in the final Sarah Baartman District Municipality Coastal Management Programme as an opportunity to protect coastal infrastructure and particularly to maintain public access to the beach, car parks and ablutions.

- Assist with attaining the strategic objectives and actions set out in the Provincial Development Plan. It is also aligned with the Eastern Cape Vision 2030 Provincial Development Plan (2014) as it will contribute to employment creation and social development, tourism, coastal protection and maintenance of coastal infrastructure through preventing the loss and erosion of the St Francis Bay beaches and public and private land and amenities.

- Support the 2030 National Development Plan (NDP, 2013) on the development of economic infrastructure including water resources and services where "*water will be recognised as a foundation for activities such as tourism and recreation, reinforcing the importance of its protection*." A key development policy outlined under economic infrastructure is that of tourism infrastructure, including accommodation and tourism products, which will play an important role in attracting a variety of tourists to different parts of South Africa. It also outlines the importance of ensuring environmental sustainability while allowing for the delivery of cultural benefits, including recreational opportunities, in order to achieve the national social and economic development objectives.

Through the protection of coastal infrastructure and property and the enhancement of the local amenities which are considered attractions to tourism and recreational activities the project can be regarded as very desirable.

Relevant Legislation

The implementation of the proposed St Francis Bay coastal protection scheme will be subject to various South African legislative requirements. In addition to the environmental authorisation, there are other permits, contracts and licenses that will need to be obtained by the project proponent for the proposed project, some of which fall outside the scope of this S&EIR process. The relevant national legislation, policies and conventions to which South Africa is a signatory to, must be used to guide the proposed project in order to ensure that it remains fully legal and compliant.

Based on the listed activities identified in Listing Notice 2 of GN R 325 (2014 EIA Regulations, as amended on 7 April 2017), the proposed project will be subject to an S&EIR process. In order to comply with NEMA, the impacts associated with the activities listed above will need to be identified and assessed during this process and will include the necessary specialist reports required. The Competent Authority (CA) for this project is identified as the Member of the Executive Council (MEC) of the Eastern Cape Department of Economic Development, Environment Affairs and Tourism (DEDEAT).

Identification of Potential Impacts

The no-go alternative assumes that the status quo will remain unchanged and that there will be no new development. Under the No-go alternative, the erosion of the St Francis Bay beach will continue and as has occurred during the course of 2020, breaches in the spit will occur again and damage to infrastructure and property along the entire length of the beach will continue. The No-go alternative will mean that there will be no groyne construction, beach nourishment and therefore no protection of backshore infrastructure and residential properties.

A total of 41 impacts have been identified for this project. These are a combination of construction (30) impacts and operational (10) impacts. This is due to the scale of the activity during construction as opposed to operation which essentially only involves maintenance related activity. One (1) cumulative impact was identified.
After mitigation, there are no negative impacts of HIGH significance.

Seventeen construction impacts (Table 9.1), prior to mitigation, were considered to have moderate negative significance while nine impacts had low significance. Three of the impacts were seen as moderately beneficial as a result of the construction. One impact had no significance attached to it's assessment.

All but three impacts identified as moderately negative were reduced to low negative significance as a result of the suggested mitigation measures. In these three cases, it is not possible to carry out the construction of the project without loss or damage to estuarine and dune ecology. Given the sensitivity and conservation status of these habitats the impact remains of moderate negative significance.

The beneficial impacts are associated with the potential increase in available habitat for both marine flora and fauna and socio economic benefits. The groynes may provide for additional hard substrate for algal species, while the gaps in the rocks making up the groynes create crevices for crustaceans etc. This is considered more of a by-product of the project rather than a specific design decision.

The construction activities will lead to temporary and permanent job opportunities both directly associated with this project and indirectly through hospitality.

During the operational phase (Table 9.1), five impacts of negative significance have been identified.

The changes to the hydrodynamics of the Kromme estuary are not considered to be significant other than in the mouth area temporarily following the dredging activity. The removal of sand material from the channels will facilitate vessel traffic through more states of the tide and with increased vessel traffic is the impact of erosion from vessel wake. It should be noted that wind generated waves on the estuary throughout the year also result in erosion.

The visual impact of the groynes are anticipated to result in a negative impact since they will result in an altered landscape and seascape. The presence of the groynes may also result in rip tides. These rip tides are often in close proximity of the groynes structures themselves. The structure will also not be designed for public access. However, it is anticipated that the public will try and access these structures. Therefore, a health and safety impact has been identified.

Five beneficial impacts have been identified resulting in moderate to very high beneficial impacts. These beneficial impacts as associated with the nourishment of the beach providing additional local amenity and coastal protection. Two socio-economic benefits are of HIGH positive significance (Increased boat access during all tidal cycles and potential increased tourism). The protection of Coastal Public Property is seen as a benefit of VERY HIGH significance, as the no-go option will eventually result in the loss of almost all beach amenities, and quite possible over time portions of marina properties.

The only cumulative impact identified, since no other specific projects are planned, is the potential for the scheme to result in an increase in boat traffic. This in turn could result in accelerated erosion to the banks of the estuary. The impact is deemed to be of moderate negative significance prior to mitigation. However, since vessel numbers are monitored and managed, this impact can be reduced to low.

IMPACT	SIGNIFICANCE	RISIDUAL RISK
CONSTRUCTION PHASE IMPACTS		
Estuarine Physical Characteristics – Change in hydrodynamics	LOW –	LOW –
Estuarine Physical Characteristics – Alteration of water channel due to scour	LOW –	LOW –
Estuarine Physical Characteristics - Erosion of the Kromme riverbanks and beach spit (also applicable for operation phase)	LOW-	LOW-
Surface Water Pollution (machinery)	MODERATE –	LOW –
Estuarine Ecology – Suspended sediment / turbidity (also applicable for maintenance dredging during operation phase)	MODERATE –	LOW --
Estuarine Ecology – Flora (Direct loss of estuarine floral species) (also applicable for maintenance dredging)	MODERATE –	LOW –
Estuarine Ecology – Estuarine Functional Zone (also applicable during operation phase)	MODERATE-	MODERATE-
Estuarine Ecology – Fauna (Direct loss of faunal) (also applicable for maintenance dredging)	MODERATE -	LOW –
Estuarine Ecology – Fauna (Loss of sandbank habitat)	MODERATE-	LOW-
Estuarine Ecology – Fauna (Impacts on bird species)	LOW –	LOW –
Dune Ecology – Loss of dune vegetation (Sand River)	MODERATE-	MODERATE-
Dune Ecology – Impacts on foredunes due to site access	LOW -	LOW-
Dune Ecology – Impacts on nearshore and beach ecology	MODERATE-	MODERATE -
Marine Ecology – Flora (Loss of nearshore reef)	MODERATE-	LOW-
Marine Ecology – Flora (Increased hard substrate/habitat for attachment of benthic species)	MODERATE+	MODERATE+
Marine Ecology – Fauna (Increased hard substrate/habitat for attachment of benthic species)	MODERATE+	MODERATE+
Local Amenity – Estuary (Temporary restricted access in areas)	MODERATE-	LOW-
Local Amenity – Estuary (Decreased area available for bait digging)	MODERATE-	LOW-
Local Amenity – Beach (Restricted access to areas during construction)	MODERATE-	LOW-
Visual Impact – Dredging and construction machinery	MODERATE-	LOW-
Loss of Archaeological Resources	LOW –	LOW +
Loss of Cultural Heritage (built environment)	NO SIGIFICANCE	NO SIGNIFICANCE
Loss of Cultural Landscape	LOW--	LOW-
Loss of graves	MODERATE-	LOW-
Loss of marine archaeological / heritage resources	LOW -	LOW -
Solid Waste Pollution (Relevant to all project aspects) (also relevant to operation phase)	LOW –	LOW –
Dust Pollution (Implementation of coastal protection infrastructure)	LOW –	LOW –
Increased Traffic (Relevant to sand sourcing should the option of truck transportation be implemented) and vehicle movements related to groyne and revetment construction and material transportation	MODERATE –	LOW –
Noise Disturbance (Relevant to all project aspects)	MODERATE –	LOW –
Employment Creation and Economic Benefits (Relevant to all project aspects)	MODERATE +	MODERATE +
OPERATIONAL PHASE IMPACTS		
Estuarine Physical Characteristics (Increased erosion due to boat traffic)	MODERATE-	LOW-
Dune Ecology (Restoration of beach habitat)	MODERATE+	MODERATE+
Marine Hydrodynamics - Impact (erosion) as a result of the infrastructure and dredging	MODERATE-	LOW-
Marine Hydrodynamics - Impact (reduction of sediment supply) to the northern beaches	MODERATE-	LOW-
Local Amenity – Estuary (Increased boat access during all tidal cycles)	MODERATE+	MODERATE+
Local Amenity – Estuary (Potential increased tourism)	MODERATE+	HIGH+
Local Amenity – Beach (Increased recreational use)	VERY HIGH+	VERY HIGH +
Visual Impact – Presence of groynes	MODERATE -	LOW -
Protection of Coastal Public Property (Relevant to all project aspects)	VERY HIGH +	VERY HIGH +
Public Health and Safety	MODERATE-	LOW-
CUMULATIVE IMPACTS		
Erosion of the banks of the estuary through increased boating activity	MODERATE-	LOW-

Public Participation

The previous EIA process for the project has been subjected to a rigorous Public Participation and stakeholder engagement process (PPP) to date, as comprehensively described in Section 8 of this EIR.

The following public participation has already been conducted as part of the S&EIR process.

Phase	Requirement	Date
Inception Phase	Site notices	Placed on 21 December 2018 and 9 April 2019.
	Pre-Assessment Public Meetings	Held on 20 December 2018.
	Pre-Assessment consultation with DEDEAT	Held on the 18 April 2019 and 1 March 2019.
Scoping Phase (30 day Pre-Assessment PPP period)	Newspaper Adverts	Placed in the Herald on the 27th of March 2019, Kouga express on the 28th of March 2019 and the St Francis Chronicle on the 4th of April 2019.
	Letters of notification	Sent at the commencement of the PPP period on the 1st of April 2019.
	Commenting Period	29th of March 2019 until the 29th of April 2019.
	Public Meeting	Held on the 15th of April 2019.
Scoping Phase (Formal Mandatory 30 day PPP Period)	Newspaper Adverts	Placed in the Herald on the 20th of August 2019, Kouga Express on the 22nd of August 2019 and the St Francis Chronicle on the 19th of August 2019.
	Letters of Notification	Sent at the commencement of the PPP period on the 20th of August 2019.
	Commenting Period	20th of August 2019 until the 18th of September 2019.
	Public meeting	Held on the 27th of August 2019.
	Ongoing consultation meeting with DEDEAT	Held on the 29th August 2019
EIA Phase (Formal Mandatory 30 day PPP Period)	Newspaper Adverts	Placed in the Herald on the 18th December 2019. Kouga Express 19th December 2019.
	Letters of Notification	Sent at the commencement of the PPP period – 19th December 2019.
	Commenting Period	19th December 2019 – 5th February 2020.
	Public Meeting	19th December 2019
	Newspaper Adverts	Placed in the Herald 17th January 2020.
	Letter of notification	Sent out on the 16th January 2020.
	Public Meeting	25th January 2020

Comments received to date have varied between those related to the engineering solutions and those regarding environmental / social considerations.

There has been a history of coastal protection in St Francis Bay, of which only one long term solution was implemented and was not successful. Concerns over the suitability of the proposed solution included groyne design, their orientation and the effects of the design on the coastline and waves.

A large number of stakeholders questioned how the Kromme Estuary may be impacted through the extraction of sand material. These were both environmental (i.e. habitat and species impacts) and social (i.e. reduction of sand bank amenity).

Additional key issues were:

- Inclusivity of the PPP process for all members of the community (specifically disabled and those in the informal settlements);

- Consideration of the design to accommodate the surfing community;
- Concern over the lack of specific ecological data collected to inform the EIA process;
- Alignment with national, district and local planning policies;
- Erosion of the bank of the estuary through increased vessel traffic;
- Questions regarding the engineering design and its suitability;
- The impacts to the Kromme Properties Shareblock;
- Validity of the information used to inform the impacts..

DOCUMENT CHECKLIST

Requirements for the Environmental Impact Report in terms of Appendix 2 of GN R. 982 (as amended in GN R. 326) and where the relevant information can be found within this Report.

Item in GN R.982 (Appendix 2)	Requirement	Relevant Chapter/ Section
3	An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include—	
(b) The location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including:	(i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	**Refer to Chapter 2, Table 2.1.**
(c) A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is—	(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	**Refer to Figure 1.1 and Figure 2.1.**
(d) A description of the scope of the proposed activity, including—	(i) all listed and specified activities triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development;	**Refer to Chapter 2, Section 2.2 to 2.4 and Chapter 5**
(e)	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	**Refer to Chapter 5.**
(f)	A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report;	**Refer to Chapter 4.**
(g)	A motivation for the preferred development footprint within	**Refer to Section 3.4.**

Item in GN R.982 (Appendix 2)	Requirement	Relevant Chapter/ Section
	the approved site as contemplated in the accepted scoping report;	
(h) A full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including:	(i) details of the development footprint alternatives considered; (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; (iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts— (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated; (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks; (vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (viii) the possible mitigation measures that could be applied and level of residual risk;	**Refer to:** **(i) Chapter 3;** **(ii) Chapter 8 and Appendix B;** **(iii) Appendix B;** **(iv) Chapter 6;** **(v) Chapter 7, Section 7.2;** **(vi) Chapter 7, Section 7.1;** **(vii) Chapter 7;** **(viii) Chapter 7;** **(ix) n/a;** **(x) Section 3.4.**

Item in GN R.982 (Appendix 2)	Requirement	Relevant Chapter/ Section
	(ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such; and (x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report;	
(i) A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including—	(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	**Refer to Chapter 7, Section 7.2.**
(j) an assessment of each identified potentially significant impact and risk, including—	(i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated;	**Refer to Chapter 7, Section 7.2.**
(k)	where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	**Refer to Chapter 2 and Chapter 6.**
(l) an environmental impact statement which contains—	(i) a summary of the key findings of the environmental impact assessment: (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and	**Refer to Chapter 9.**

Item in GN R.982 (Appendix 2)	Requirement	Relevant Chapter/ Section
	infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	
(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	**Refer to Chapter 9.**
(n)	the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	**Refer to Chapter 3, Section 3.4.**
(o)	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	**Refer to Chapter 9**
(p)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	**Refer to Section 1.3**
(q)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	**Refer to Chapter 9**
(r)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	**Refer to Chapter 9**

Item in GN R.982 (Appendix 2)	Requirement	Relevant Chapter/ Section
(s) an undertaking under oath or affirmation by the EAP in relation to—	(i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any	**Refer to Appendix A.**
(t)	where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	**Not applicable.**
(u) an indication of any deviation from the approved scoping report, including the plan of study, including—	(i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation;	**Not applicable.**
(v)	any specific information that may be required by the competent authority; and	**Please refer to the comments on the previous Draft EIR, provided by DEDEAT, which are included in the IRT (Appendix B).**
(w)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	**The requirements of Section 24(a) and (b) have been met in this EIR.**

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1 INTRODUCTION

1.1 Project Background

The St Francis Property Owners Non Profit Company (SFPO NPC), on behalf of the Kouga Local Municipality (Kouga LM), has proposed the implementation of a coastal protection scheme for St Francis Bay beach, located within the Eastern Cape Province. The proposed project area is situated approximately 100 km west of Port Elizabeth, within the Kouga LM, seated within the Sarah Baartman District Municipality (SBDM) (Figure 1.1).

The coastal protection scheme will include sand material sourcing from the Kromme River, beach nourishment of St Francis Bay beach and the development of coastal structures to retard the erosion of St Francis Bay beach.

CES were appointed by the SFPO NPC to apply for an Environmental Authorisation (EA) by means of conducting a Scoping and Environmental Impact Reporting (S&EIR) process. This was initiated in late 2018. In 2019, CES together with the SFPO produced a Draft and Final Scoping Report and Sand Sourcing Specialist Report which was subject to the mandatory 30-day public participation process (PPP) between 20th of August 2019 until the 18th of September 2019. Following on from the approval of the Scoping Report by the Department on the 25th October 2019, CES progressed with the development of the Draft EIR and Draft Estuarine and Dune Assessment Specialist Report which was subject to PPP between 19th December 2019 – 5th February 2020.

It was decided that the Final EIR would not be submitted and the application (EC08/C/LN2/M/42-2019) was allowed to lapse in order to re-visit the design based on comments from I&APs and the Department.

The update to this report includes the following considerations:

- The amendment of the orientation of the groynes from oblique to perpendicular (to the wave direction);
- The updating of the shoreline modelling to consider the possible erosion to the coastline as a result of the installation of the groynes;
- Modelling of the shoreline evolution and the impact on the beaches to the north of the scheme following the installation of the groynes and beach nourishment;
- Collection of updated bathymetry and topographic data for the estuary;
- Completion of numerical modelling of the pre- and post-dredging scenarios and the changes to the hydrodynamics of the Kromme Estuary.

1.2 Objective of this report

This Environmental Impact Assessment Report (EIR) has been compiled in accordance with the requirements as stipulated in Section 23 and Appendix 3 of the 2014 EIA Regulations (as amended in April 2017 (GN R 982, as amended by GN R 326), which clearly outlines the content of an EIR.

The objective of the environmental impact assessment process is to, through a consultative process—

(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;

(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the development footprint on the approved site as contemplated

in the accepted scoping report;

(c) identify the location of the development footprint within the approved site as contemplated in the accepted scoping report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

(d) determine the—

(e) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and

(f) degree to which these impacts—

(g) can be reversed;

(h) may cause irreplaceable loss of resources, and

(i) can be avoided, managed or mitigated;

(j) identify the most ideal location for the activity within the development footprint of the approved site as contemplated in the accepted scoping report based on the lowest level of environmental sensitivity identified during the assessment;

(k) identify, assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity;

(l) identify suitable measures to avoid, manage or mitigate identified impacts; and

(m) *identify* residual risks that need to be managed and monitored.

Figure 1.1: Location of the proposed project (nourishment and groynes) together with the proposed priority and secondary sand sourcing areas.

This EIR is structured as follows:

Chapter 1 – Introduction: Provides background information on the proposed project, a brief description of the EIA process required by the National Environmental Management Act (NEMA) (Act No. 107 of 1998, as amended) and its associated regulations, and describes the key steps in the EIA process that have been undertaken thus far, and those that are still to be undertaken.

Chapter 2 – Project Description: Provides a description of the proposed development, a description of the activities and technical details of the project, the proposed location/properties on which the development is to occur and the preliminary layout of the development and its associated infrastructure.

Chapter 3 – Alternatives: Identifies all the potential alternatives associated with the project including the fundamental, incremental and no development alternatives. An analysis of the alternatives is provided as well as a motivation for not considering certain alternatives. The preferred alternative is also identified and reasons are given as to why this is the preferred alternative.

Chapter 4 – Need and desirability of the project: Provides motivation on the need and desirability of the proposed development with respect to national and local plans and policies.

Chapter 5 – Relevant Legislation: Identifies all the legislation and guidelines that have been considered in the preparation of this EIR and outlines the Listed Activities triggered by the proposed development.

Chapter 6 – Description of the Affected Environment: Provides an overview of the biophysical and socio-economic characteristics of the site and its environs that may be affected by the proposed development, compiled largely from published information, but supplemented by information from the site visits.

Chapter 7 – Impact Assessment: Identifies the positive and negative impacts on the environment and the community that will result from the proposed activity. This will include the assessment of geographical, physical, biological, social, economic, heritage and cultural aspects and will include possible mitigation measures for each identified impact. The direct, indirect and cumulative impacts will be assessed using a prescribed methodology.

Chapter 8 – Public Participation Process: Provides the activities conducted during the mandatory 30-day Public Participation Period, as legislated. This will include details regarding the public meeting events that were held during this period, the advertisements and notifications which were placed, the comments or queries received from Interested and Affected Parties as well as the responses provided by the EAP.

Chapter 9 – Conclusions and Recommendations: Provides a final statement from the EAP which sums up the EIR and the overall impact that the proposed project will have on the environment. The key mitigation measures, which should be included in the EA, are summarised in the concluding statement.

References: Cites any texts referred to during preparation of this report.

Appendices: Contains all supporting and supplementary information.

1.3 Assumptions and Limitations

This report is based on information that is currently available and, as a result, the following limitations and assumptions under which this report was compiled are implicit:

- Descriptions of the natural and social environments are based on limited fieldwork and available literature;
- The report is based on a project description taken from preliminary design specifications and site layouts for the proposed project that have not yet been finalised, and are likely to undergo a number of iterations and refinements (based on environmental and technical inputs) before they can be regarded as definitive; and
- It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the project maps. Therefore, this information cannot be applied to any other area without a detailed investigation being undertaken.

2 TERMS OF REFERENCE

2.1 Location and Site Description of the Proposed Project

The proposed coastal protection scheme is situated along the coastal areas of St Francis Bay, a town located approximately 100 km west of Port Elizabeth, within the Eastern Cape Province (Figure 2.1). The proposed project will take place over coastal public property and within the confines of the Kromme River estuary. As a result, there are limited defined farm, erf or property portions assigned to this project (Table 2.1). The proposed beach nourishment will take place over land defined by the Chief Surveyor-General as "parks." The areas where sand will potentially be sourced for the beach nourishment are likely to be located within or adjacent to the Kromme River estuary and the land is defined as "Humansdorp Administrative Area 5."

Table 2.1: Properties Associated with the Proposed Project (as defined by the Chief Surveyor-General)

DESCRIPTION OF AFFECTED FARM PORTION			
Property Name and Number	21 digit SG Code	Ward	Municipality/ Province
A portion of Humansdorp Administrative Region 5	C034	12	Kouga Local Municipality
Parks 720 1076655	C03400140000072000000	12	Kouga Local Municipality
Parks 1343 1073783	C03400140000134300000	12	Kouga Local Municipality
Parks 623 1073698	C03400140000062300000	12	Kouga Local Municipality
Parks 2257 1073784	C03400140000225700000	12	Kouga Local Municipality
Parks 185 1073697	C03400140000018500000	12	Kouga Local Municipality
Parks 53 1077075	C03400140000005300000	12	Kouga Local Municipality
Parks 184 1073696	C03400140000018400000	12	Kouga Local Municipality
Parks 625 1076606	C03400140000062500000	12	Kouga Local Municipality

2.2 Project Concept

As a result of significant erosion events occurring over the past few decades the St Francis Bay beach has lost a considerable amount of sand material, and the existing dune area across the frontage. This has resulted in existing infrastructure becoming more vulnerable to loss and damage, should more significant erosion events take place.

The erosion has led to a reduction in the width of the beach (see Appendix F). The width of beach is not only important from a recreational and tourism amenity point of view but offers significant coastal protection by reducing the wave energy. A reduction in wave energy reduces the ability for sediment to be moved and therefore reduces the severity of erosion. The effects of the erosion of the beach (in both width and depth of sediment) has been realised across the full frontage, stretching from the car park at the end of Nevil Rd in the south to the Kromme Estuary mouth in the north (Figure 2.2).

Approximately 700 m of the frontage, referred to as "the spit" is particularly vulnerable. The erosion has been significant and dramatic, such that over the 42 year period between 1975 and 2017, the high water mark has retreated by 75 metres (Figure 2.3). As a result, the beach has effectively been lost, and erosion of the vegetated sand spit is occurring. In 2020 the spit breached four times during particularly high tides and storm swell. This caused damage to infrastructure and it continues to pose a risk for as long as the spit remains "unprotected".

Consequently, various interventions including a beach nourishment scheme, revetment construction and the construction of groynes is required to arrest the rapid erosion of the beach, and ultimately restore it to its pre-erosion status, or at least to a condition that affords protection from storm attack, sea level rise and erosion events associated with these natural perturbations.

A number of interventions have been implemented in the past, including the construction and subsequent maintenance, repair work and upgrading of rock revetments, sand-pumping, Pressure Equalization Modules (PEM) and nourishment of the St Francis Bay beach. However, these are short term solutions and a more long term solution has been proposed in order to protect this section of coastline from undergoing further erosion. Numerous historic studies have been undertaken to investigate and evaluate the erosion problems, and several studies have proposed possible remedial solutions (Figure 2.4). These solutions have proved insufficient over the past twenty to thirty years (an example being the collapse of the tarred road at Anne Avenue and Ralph Road and ablution facilities at Ann Avenue in 2006/2007 into the sea) and therefore a more permanent solution is required.

The existing Environmental Authorisation (EA) (DEDEAT Ref No: EC08/C/LN1&3/M/21-2015), issued to the Kouga LM on the 1st of June 2016, for the coastal protection along the St Francis Bay beach states that "*the rock revetments as authorised in this Environmental Authorisation are only a temporary, intermediate solution*." The Environmental Authorisation further states that "*the second phase will be subject to a separate environmental assessment and will focus on beach nourishment and installation of various alternatives to provide further protection and encourage sand accumulation on the beach by means such as groynes, off-shore reefs and/or additional revetments*." This environmental process responds directly to the directive given in the EA issued on the 1st of June 2016. Please refer to Appendix H for the EA dated the 1st of June 2016.

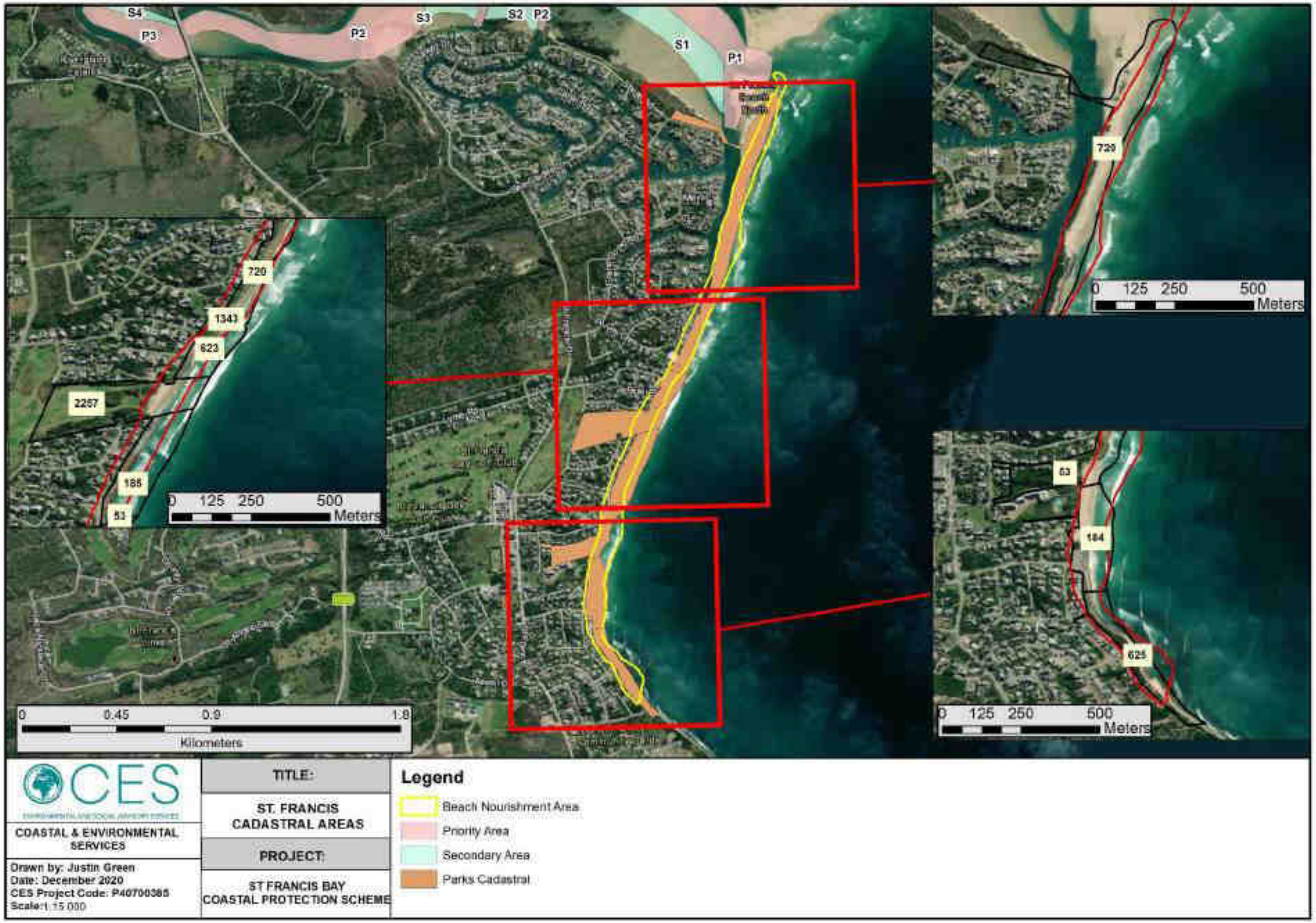


Figure 2.1: Locality map of the proposed project properties.

Figure 2.2: Location of the proposed beach nourishment scheme (from Advisian, 2018).

Figure 2.3: Spit retreat observed between 1975 and 2017.

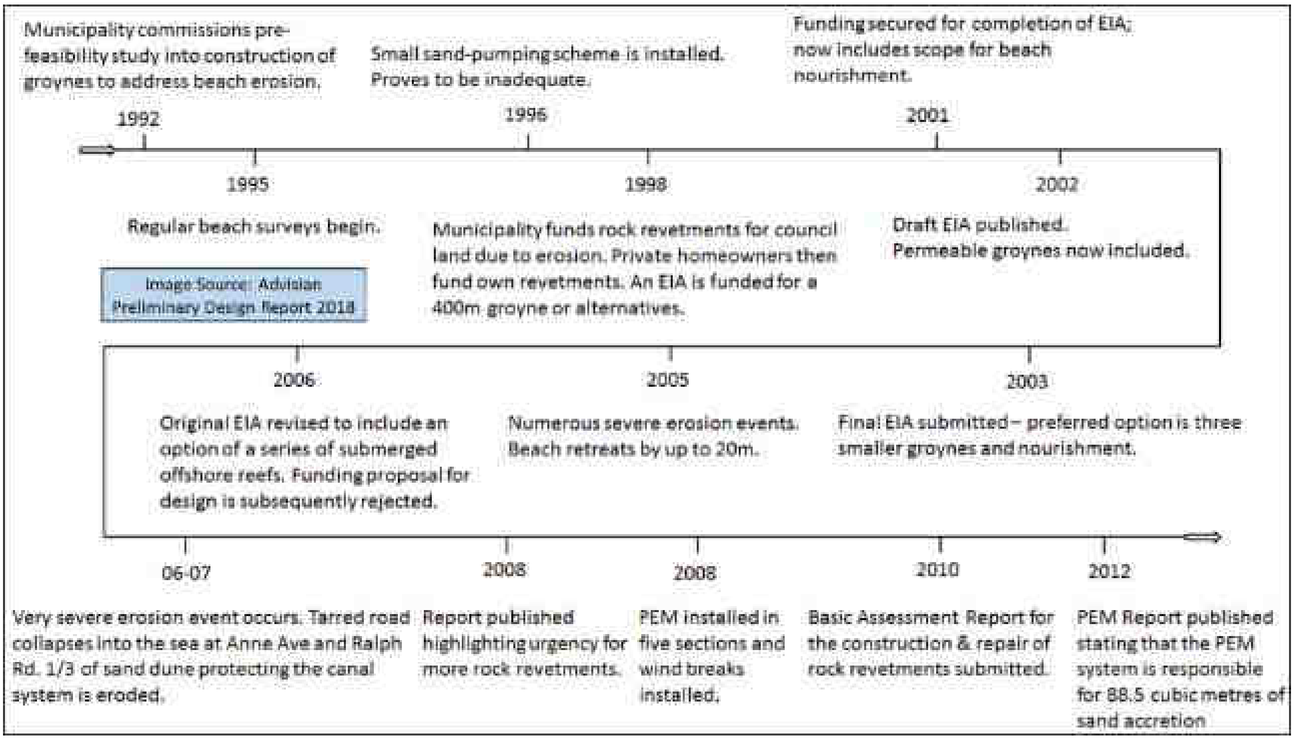


Figure 2.4: Time-line showing the historical report and interventions which were implemented for the St Francis coastal protection scheme (from Advisian, 2018).

2.3 Detailed Description of the Proposed Project

Several conceptual options were initially investigated by Advisian (refer to the preliminary design reports prepared by Advisian, which are included in Appendix F of this Draft EIR). The preferred solution is the implementation of beach nourishment (i.e. the placement of a large volume of sand on the beach over time) together with the development of short stub groynes (i.e. a low solid barrier built into the sea). The details of the other alternatives which were considered are provided in Chapter 3 of this report.

Sand Sourcing (supported by the Sand Sourcing Specialist Study)
In order for beach nourishment to be implemented, sand must first be obtained from a suitable source area. The identification of a suitable source area was based largely on finding an area where sand will consist of similar grain size to that which is required on the beach as well as being feasible to extract and place along the beach (see Section 3.3.2 and Appendix I). Three potential source areas were initially identified and all were located within the Kromme River estuarine functional zone. However, as the investigations into possible sources progressed, and through considering feedback from the public, more discreet areas were identified and classified as priority and secondary areas (Figure 2.5).

To characterise the intertidal areas in the Kromme Estuary and the open beach, two sampling campaigns were completed on the 18th of December 2018 and the 15th of April 2019. The samples collected were taken to Tosca Lab (Pty) Ltd in Port Elizabeth for analysis. The particle size analyses that were undertaken as part of this study included the dry sieving of the samples that had been collected (as per SANS 3001: AG1 - Particle size analysis of aggregates by sieving).

The comparisons showed that overall the particle sizes of the sediment in the estuary are slightly finer than along the beach. There are many samples (mainly in the 2018 data collection) that have median particle sizes less than 0.3 mm, of which there are none in the set of beach samples. However, there is significant overlap of the particle size envelopes from the estuary and beach, particularly between the data collected in 2019. The 2019 estuary samples have median particle sizes (0.31 mm to 0.35 mm) that are compatible with the median particle sizes of the beach (0.3 mm to 0.38 mm). Also, the compatibility at the finer and coarser ends of the envelopes is good.

Given the similarity of the particle size envelopes from the intertidal areas on the south side of the Kromme Estuary and the beach of St Francis Bay, it is concluded that the source (intertidal estuary) and receiver (beach) sites are compatible with respect to particle size distribution. The similarity of particle size distributions between the upper, middle and lower intertidal parts of the estuary indicates that, based on particle size alone, there is no preferred location for extraction of sediment. Also, it is likely that sediments in the subtidal channel, which were not sampled, would be coarser than the adjacent intertidal areas (due to higher current velocities), and so also compatible with the beach.

The proposed coastal protection scheme does not intend to remove all of the features (sand banks) of the estuary, but to rather harvest as much sand material as possible while being cognizant of the ecological and social importance of those features. The current locations for potential extraction are based on high-level GIS mapping of the sand banks and estuarine channel, including vegetated sand bank areas where necessary (Figure 2.5).

The total sand that can be extracted, based on depths of 1m in priority areas and 2m in secondary areas, equates to 1 074 000 m^3 (Table 2.2). According to the engineers appointed for the development of the proposed coastal protection scheme, the required volume of sand for capital nourishment is approximately 854 000 m^3. Additional sand may be required to account for losses during the nourishment process (e.g. dredging and pumping losses).

Table 2.2: Potential sand available from each source area (assuming 1m deep excavations from the channel and 2m deep excavations from the intertidal areas). See Figure 2.5 for locations

Priority / Secondary Area	Label	Area (m^2)	Depth (m)	Volume (m^3)
Priority Area	P1	167 000	1	167 000
Secondary Area	S1	108 000	2	216 000
			Subtotal	***383 000***
Priority Area	P2	296 000	1	296 000
Secondary Area	S2	19 000	2	38 000
	S3	20 000	2	40 000
			Subtotal	***374 000***
Priority Area	P3	57 000	1	57 000
	P4	42 000	1	42 000
Secondary Area	S4	35 000	2	70 000
	S5	74 000	2	148 000
			Subtotal	***317 000***

Priority Areas	562 000
Secondary Areas	512 000
GRAND TOTAL	1 074 000

Advisian advised that the current loss of sand material from the beach is 50 000 m^3 to 100 000 m^3 per annum, but that the loss after full implementation of the preferred solution can be expected to be in the order of 25 000 m^3 to 50 000 m^3 per annum. The analysis of the data collected for the preliminary design suggests that much of the material being transported by longshore drift (South to North) finds its way into the estuary under natural conditions. Given that the design will be such to facilitate the current longshore sediment transport, it is anticipated that the majority of the 25 000 m^3 to 50 000 m^3 "lost" from the nourishment will be deposited into the estuary providing suitable material for the maintenance requirements. The volume of sand required for maintenance will differ as the project progresses through the various phases, but will be limited to a maximum of approximately 25 000 m^3 to 50 000 m^3 per annum (Table 2.4).

Beach Nourishment

The option to artificially nourish the beach with sand from suitable borrow sources has been identified as the least environmentally intrusive method to protect the St Francis Bay coastline from further erosion. The aim of the beach nourishment will be to establish a minimum horizontal dry beach width of 40 m measured from the back of the beach (please refer to Appendix F for a detailed description of the proposed long-term protection solution). This additional sand will provide added protection from erosion as waves will dissipate their energy over this re-established sand beach before reaching the existing eroding area. Long term maintenance will be required to maintain the required beach level.

Revetment Structures

To prevent further sea breaching through the St Francis Bay beach spit during a strong storm surge event, revetment structures have been constructed by Kouga Municipality along the length of the beach spit as temporary coastal protection to prevent further erosion of the spit. This temporary revetment needs to be integrated within the long-term coastal protection scheme consisting of stub groynes and beach nourishment. The design of the temporary revetment needs to be reviewed so its suitability and long-term functionality can be assessed as the revetment would form an integral part of the long-term coastal protection infrastructure, and would be of the last defence against wave action, should the proposed re-nourished beach not be sufficient.

Stub Groynes

In order to retain the sand in the nearshore and beach area following the implementation of beach nourishment, and to promote increased sedimentation in the future, six (6) stub groynes will be constructed along the length of the beach. These stub groynes will extend from the back end of the beach and reach a length of between 170m and 200m offshore (Figure 2.6 and Figure 2.7). The stub groynes will be angled perpendicular to the shoreline (except groyne 5 which is oblique), and will be shorter than full length groynes which are generally used for erosion prevention. The shorter (stub) groynes will allow a certain percentage of sediment (expected to be approximately 50% of the long shore drift) to pass between each groyne. This is to facilitate sand movement through the longshore drift process since it is not the intention of the project to trap all sediment moving along the coastline. Maintaining this sand movement along the coast is also anticipated to mitigate for the potential of accelerated erosion "downstream" of the groynes, particularly of the northern most groyne. In addition to the natural movement of sediment, nourishment of the shoreline in the lee of the northern most groyne will be included as part of the project. The volume of sediment will be monitored and re-nourishment will be carried out and form part of the annual maintenance regime.

A maximum of approximately 44 300 m^3 of rock material will be required for the proposed stub groynes. The rock material used for the groynes will be sourced from a licenced local quarry, the details of which will be subject to availability and grading of rock material, and will become known during the implementation stage of each phase of the project.

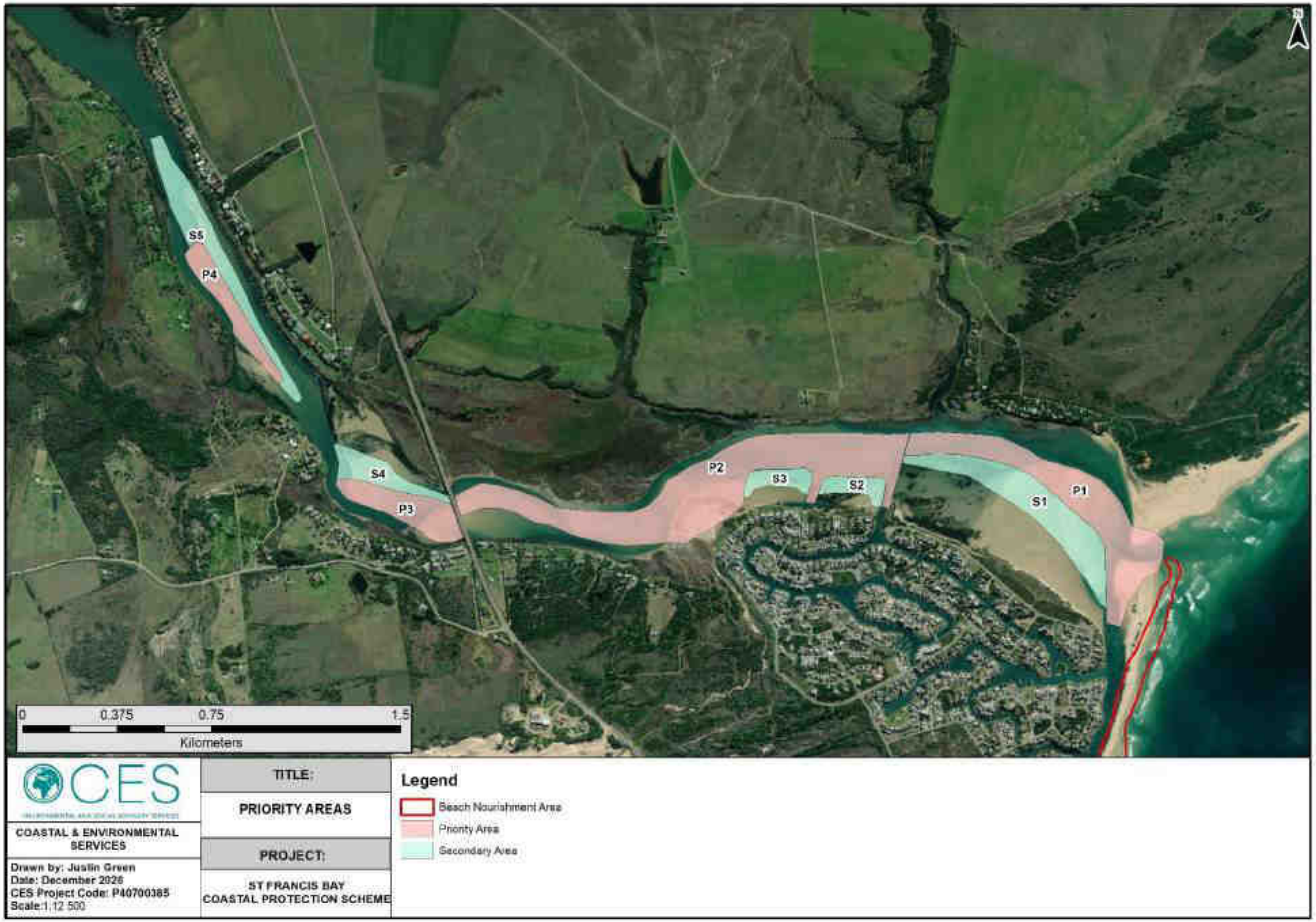


Figure 2.5 Potential areas to be used to source sand material.

2.4 Phases of the Development Process

A phased implementation of the abovementioned coastal beach protection infrastructure will most likely be required due to financial constraints. Should funding for the full scheme be available at the time of construction then the full scheme will be developed. However, the design of the scheme is such that each phase can be regarded as a standalone project, allowing for funding for additional phases to be sourced prior to their construction.

The advantage associated with a phased approach is that the performance of the first groyne(s) can be assessed, and any desired adjustments can be made to groynes constructed in the subsequent phases. The phased implementation is based on five (5) areas along St Francis Bay beach (Figure 2.6). Area 1 will consist of a 650 m length of beach which will undergo beach nourishment as well as the construction of two (2) 200 m long groynes, one at each end. The long shore drift is northwards, and it is therefore sensible to construct the northernmost groynes first to intercept the transported sand (Figure 2.7). Area 2 will consist of 470 m of beach with one (1) groyne 170 m long and Area 3 a 340 m length of beach with two (2) groynes of 170 m in length. Areas 4 and 5 are flanked by the groynes constructed during previous phases and are 280 m and 390 m long respectively. Area 5 also includes a groyne 170 m long. This phased approach will ensure that construction of infrastructure in any phase will only commence when sufficient funding for that particular phase has been secured, thus negating the risk of partially constructed infrastructure.

In order to widen the beach by 40 m with the use of beach nourishment only, a total of between 850 000 to 1,2 million m^3 of sand material would be required (depending on the losses and the state of the beaches at the time of nourishment). Table 2.3 presents the estimated volume of material required for each stage.

Table 2.3: Total initial nourishment requirements of each phase of the coastal protection scheme.

Nourishment Phase	Estimated Initial Sand Volume Required (m^3)
Phase 1	259 000 - 361 000
Phase 2	166 000 -247 000
Phase 3	167 000 - 205 000
Phase 4	78 000 - 134 000
Phase 5	182 000 - 235 000

The operational phase material is considered a top up of the construction material and dependent on the erosion of material from the beach. The volume of sand required for maintenance will differ as the project progresses through the various phases, but will be limited to a maximum of approximately 25 000 m^3 to 50 000 m^3 per annum (Table 2.4). This material is anticipated to be available from the Kromme Estuary.

Table 2.4: Anticipated annual maintenance requirements at the completion of each phase of the coastal protection scheme.

Nourishment Phase	Cumulative maintenance requirement	
	From	To
Annual Maintenance at Completion of Phase 1	8 000	16 000
Annual Maintenance at Completion of Phase 2	13 250	26 550
Annual Maintenance at Completion of Phase 3	17 550	35 200
Annual Maintenance at Completion of Phase 4	20 350	40 850
Annual Maintenance at Completion of Phase 5	24 950	50 050

As detailed below, similar equipment and construction methodologies are anticipated for both construction and operational phases with the scale of the activity being reduced during the "operational" phase.

2.5 Construction methodology

In this section potential methodologies are described for the construction of the groynes, beach nourishment and revetment construction. Specific construction methods employed will be finalised through the procurement of a contractor for each phase of the project.

The potential methodologies described below include sourcing of material, transporting, stockpiling and the incorporation thereof into the works. It is likely that the project will be implemented in phases, as funding becomes available. The methodology comments on the duration of each of the phases with an estimated timeframe should the project be implemented without the phases. It is worth noting that there may be a number of years between each of the phases. Therefore, each phase should be considered a discreet project in itself and assumed that all activities and associated machinery will be mobilised and demobilised for each phase. This is expected for both the beach nourishment and the groyne development.

Similarly, potential methodologies to be employed during maintenance of the infrastructure is described below.

2.5.1 Construction stage:

The following activities are envisaged during the construction stage:

2.5.1.1 Groyne construction:

Rock for the construction of groynes will be obtained from nearby commercial quarries. The rock will be transported by truck via the R330 provincial road to St Francis Bay and then along the internal road network through St Francis Bay to a potential stockpile area or to access points onto the beach at George Road Parking Area and/or a temporary access point at Aldabara Road Parking Area. The rock will be further transported along the beach to the groyne positions where it will be placed by way of back-tipping and placing the material by excavators, where needed.

This activity will most probably be affected by tides and is expected to be limited to approximately 6 to 8 hours per day. The rate of construction is expected to be in the order of 240 m^3/day. Depending on the size of the trucks approximately 30 - 40 truckloads per day will be required and depending on the haul distance it is envisaged that approximately 10 trucks will be used. The expected duration of this part of the work is:

- For Phase 1: 3 Months
- For Phase 2: 2 Months
- For Phase 3: 3 Months
- For Phase 5: 2 Months
- Should the complete solution be implemented without phasing (highly unlikely): 8 Months

2.5.1.2 Beach nourishment:

Sand will be sourced from the Kromme River Estuary by way of dredging. To ensure that dredging of the estuary is undertaken in a manner which does not significantly alter the current orientation of the existing main estuarine channel, the dredging will have to be undertaken from the existing channel outwards.

A dredger or dredgers with a combined capability to deliver between 250 - 300 m^3 sand per hour will be required. There are various types of dredgers available (i.e. cutter suction, jet suction, bucket) that would be suitable for this type of work. The depth of the water will limit the size of the vessels since the vessels will require a shallow draft. While a suitable dredger will be decided upon by a contractor it is likely the dimensions of the dredger will be in the region of 21 m long, 4.8m wide and 1.4 m of hull. It may or may not be self-propelled and likely to have spud legs to secure it.

It is expected that in-line booster pumps will be employed when sand is transported over long distances. The discharge pipes are expected to range between 250 mm to 350 mm in diameter. Depending on the nature of the pumps it is likely that the pumps would occur at intervals of 1 000 m. The sand will be dredged through pipelines along the channel attached to buoys or in places it may be placed on sandbanks.

The noise level associated with the dredging and nourishment activity is expected to be approx. 80 dB at source. Depending on the size of the booster pumps, noise levels are expected to be 92 dB at source, reducing down to 60 dB at 500 m (ICF Jones and Stokes, 2008). To provide context normal conversation is about 60 dB, a lawn mower is about 90 dB, and a loud concert is about 120 dB.

Dredged sand may be spread along the beach using equipment such as a dozer.

Assuming that dredging for the construction phase will take place 8 hours per day, 5 days per week, the expected duration of this part of the work is:

- For Phase 1: 8 Months
- For Phase 2: 5 Months
- For Phase 3: 4 Months
- For Phase 4: 3 Months
- For Phase 5: 5 Months
- Should the complete solution be implemented without phasing (highly unlikely): 16 Months.

It may be that it becomes feasible to transport sand by truck from the upper reaches of the source area identified in the Sand Sourcing Specialist Study. In such a case it is envisaged that the sand will be dredged to a suitable point, where it will be loaded by a loader or TLB onto trucks. The trucks will then transport the sand along the internal road network of St Francis Bay onto the beach. This option is not really envisaged, and if it is employed, it is expected to be relatively limited.

It is envisaged that limited clearing of vegetation, as well as separation of vegetation and debris from the sand will be required at the mouth of the Sand River, and that this vegetation and debris will have to be spoiled at an approved spoil site. Such clearance will be done using mechanical equipment such as excavators or TLB's, and the material will have to be loaded onto trucks and transported off-site. It is foreseen that this will be a limited operation.

2.5.1.3 Revetment construction:

This activity will pertain to the revetment for the spit area. This revetment may be a rock revetment, a geotextile sand container revetment or a composite revetment (rock / geotextile sand container revetment).

Rock for the construction of a rock revetment will be obtained from nearby commercial quarries. The rock will be transported by truck via the R330 provincial road to St Francis Bay and then along the internal road network through St Francis Bay to a potential stockpile area or to an access point onto the beach at George Road Parking Area or via a temporary access point at Aldabara Road Parking Area. The rocks will be further transported along the beach to the position where it will be placed against the spit sand dune.

The activity may be affected by tides and is expected to be limited to approximately 6 to 8 hours per day. The rate of construction is expected to be in the order of 65 m^3/day. Depending on the size of the trucks approximately 11 truckloads per day will be required and it is envisaged that approximately 3 trucks will be used. The expected duration of this part of the work is 3 months.

Sand for a geotextile sand container revetment will be taken from the beach or be dredged from the canal system, and this activity can take place 8 hours per day. A fairly small dredger can be employed to fill the geotextile containers should sand from the canals be used.

2.5.1.4 Storage of plant and equipment:

A suitable open area on disturbed land, available at the time of construction of any phase, should be identified prior to tender stage for the Contractor's camp. This area must be sufficient and suitable to house overnight the contractor's plant, such as trucks, loaders, TLB's and the like.

If the dozer used to spread the sand on the beach is stored on the beach overnight, then such storage area must be safely barricaded or fenced to ensure safety of the public.

2.5.1.5 Stockpiling of material:

It may be that it would be necessary to stockpile rock, should the quarry supplying the rock blast a specific rock size required for the project and removal thereof be required because of limited storage at the quarry. In such a case a suitable open area on disturbed land, available at the time of construction of any phase, should be identified prior to tender stage for such temporary stockpiling of rock. The area should be fenced off and access controlled to ensure public safety.

2.5.2 Maintenance:

Annual maintenance of the infrastructure will be required. This will mainly entail sand nourishment necessary to ensure that the beach width and level remain stable. It will be a dredging operation, using sand obtained from the Kromme Estuary and the canal system. It will not be a continuous operation, but will be performed from time to time, influenced by the requirement for sand on the beach. The point of sand sourcing will change, depending on where dredging is required to ensure navigability of the estuary and canal system. It may be necessary to use mechanical equipment from time to time to spread the placed sand along the beach.

Ad hoc maintenance of the groynes and revetment may also be required over the design life of the infrastructure, but this is not expected to happen at regular intervals.

Assuming that dredging for the operational phase will take place 8 hours per day, 5 days per week, the expected duration of this part of the work is:

- At completion of Phase 1: Between 2 and 4 weeks
- At completion of Phase 2: Between 3 and 5 weeks
- At completion of Phase 3: Between 4 and 7 weeks

- At completion of Phase 4: Between 4 and 8 weeks
- At completion of Phase 5: Between 5 and 10 weeks

Dredging for maintenance purposes will take place from areas in the river and canals where build-up of sand has taken place, and dredging in any particular area in the river and canals will probably be limited to a period of less than two weeks. As noted earlier it is possible that there would be a number of years between phases and therefore, maintenance dredging will take place as required for each of the phases as completed.

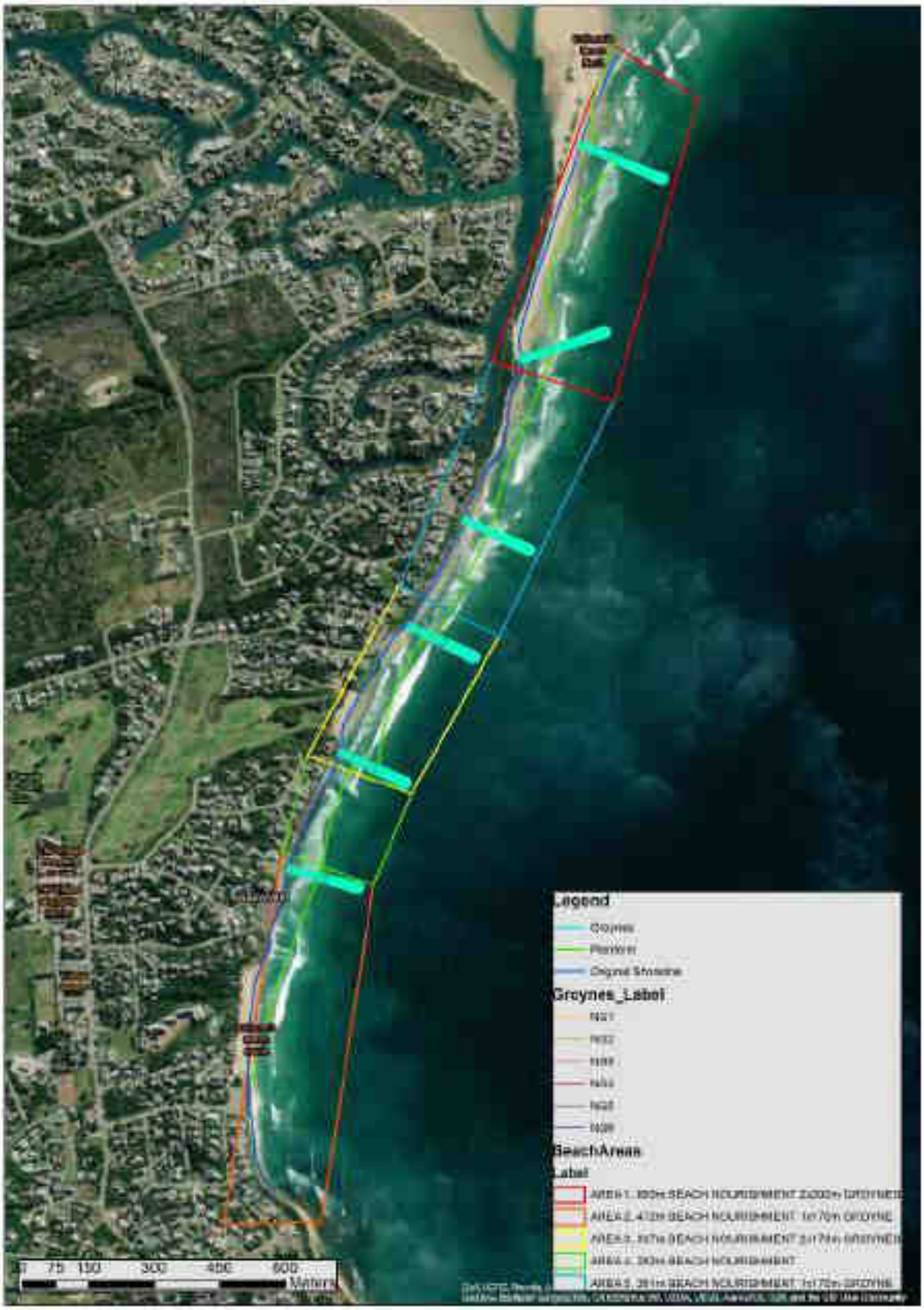


Figure 2.6: Proposed layout for the stub groynes.

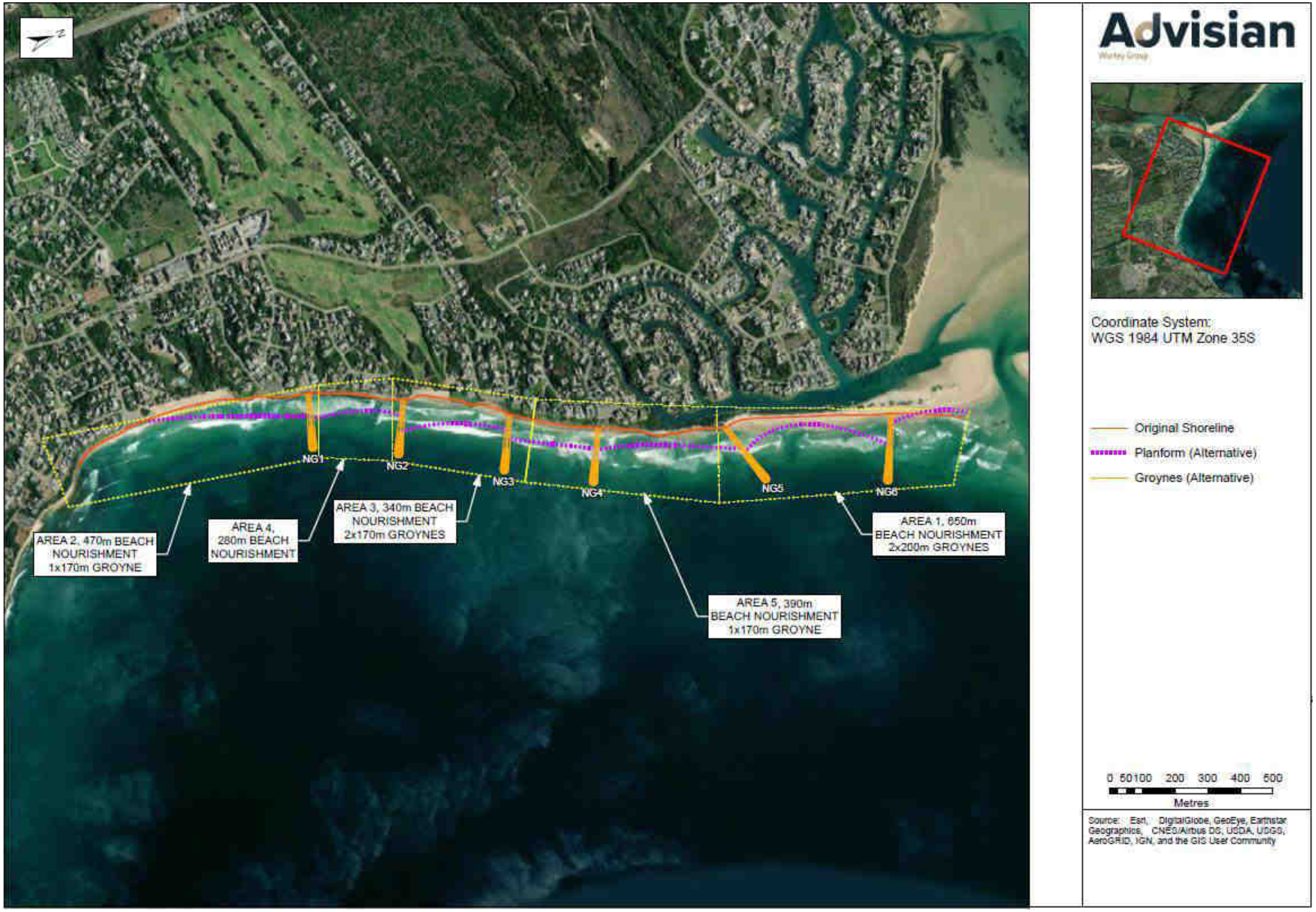


Figure 2.7: General layout of proposed coastal protection infrastructure.

3 ALTERNATIVES

According to Appendix 3, Section 3 (1), of the 2014 EIA Regulations (as amended), "an environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include—

(g) a motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;

(h) a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including:

(i) details of the development footprint alternatives considered;

(ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such; and

(xi) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report;

(n) the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;

3.1 Reasonable and feasible alternatives

Alternatives should include consideration of all possible means by which the purpose and need of the proposed activity could be accomplished. The no-go alternative must also, in all cases, be included in the assessment phase as the baseline against which the impacts of the other alternatives are assessed. The determination of whether the preferred activity or site location is appropriate is informed by the specific circumstances of the proposed project and its environment.

"Alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to—

(a) the property on which or location where it is proposed to undertake the activity.
(b) the type of activity to be undertaken.
(c) the design or layout of the activity.
(d) the technology to be used in the activity.
(e) the operational aspects of the activity.
(f) the option of not implementing the activity.

There are two types of alternatives: Fundamental Alternatives and Incremental Alternatives.

3.2 Fundamental Alternatives

Fundamental alternatives are developments that are entirely different from the proposed project and usually involve a different type of development on the proposed site, or a different location for the proposed development.

3.2.1 *Location alternatives*

The proposed project location occurs along the St Francis Bay beach. There are no alternatives to the location of the beach nourishment activity as this is determined by the need to prevent further erosion from occurring along the St Francis Bay beach, to protect existing infrastructure and properties and to restore the beach as an amenity for the community.

3.2.2 *Sand sourcing alternatives*

The alternatives for the sources of sediment were assessed (see Appendix I). In order for beach nourishment to be implemented, sand must first be obtained from a suitable source area. The identification of a suitable source area is based largely on finding an area where sand will consist of similar grain size to that which is required on the beach, as well as being technically and financially feasible to extract and place along the beach. The Kromme River estuary has been identified as the most accessible potential sand source which also is likely to contain the volume of sand required for the proposed beach nourishment.

In 2002, Entech undertook a study of the potential sand sources for beach nourishment, concluding that the two most viable sources were the Sand River dunes and the Kromme Estuary. The extraction of sand from the lower intertidal sand flats of the Kromme Estuary was considered sustainable due to the flood dominated character of the estuary, caused by the damming of the upper reaches and resulting in consequent sand build-up in the lower reaches. At that stage, a total of 500 000 m^3 was the estimated requirement for beach nourishment.

The Sand River dunes have since been declared as a protected area and are therefore no longer considered a viable source of sand material. According to ASR (2006), the Kromme River has previously been used as a source of 'sporadic and un-sustained sand and approximately 600 000 m^3 of sand is available for beach nourishment'.

Other alternative sand sources include the use of sand from an off-shore source, the marina canal system and/or material from an external source. Off-shore sources have been considered previously. However, the conclusion with those studies suggested that using the material from an offshore source would have high cost implications due to the off-shore dredging and pumping operations. The marina canal system requires dredging on a regular basis. The material within the marina system is likely to be suitable but the volume available would not be sufficient for the required beach nourishment project. Other alternative sources that have been proposed by several parties include sand material from Oyster Bay and from the port of Port St Francis. Both these alternatives do not provide sufficient material and the cost of transporting 1 m^3 of material would be significantly more than that obtained from the Kromme Estuary.

For example, Advisian has, on Page 78 of their report in Appendix F, estimated the cost of sand pumping (read dredging) to be R58-85/m^3. Escalated to current costs this amounts to approximately R65/m^3.

Trucking sand from Oyster Bay will cost in the order of 25km @ R15/m^3.km which equates to a transport cost alone of R375/m^3.

Trucking sand from Paradise Beach (Jeffrey's Bay) will cost in the order of 22 km @ R15/m^3.km which equates to a transport cost alone of R330/m^3.

Within the Kromme Estuary, three (3) potential locations, based on proximity to the site, were identified as the sand source for the proposed beach nourishment:

1. The sand bank located at the Kromme River mouth;
2. The sand bank located at the Sand River mouth; and
3. The Kromme River channel.

It was proposed that more than one of these sources be used depending on sediment availability, suitability and feasibility. A separate study, compiled by CES (Appendix I), considered these three sand source areas and determined whether one (1) or more of these areas would be required in order to satisfy the volume requirements of the proposed beach nourishment.

The advantages and disadvantages of each location alternative were assessed on a broad scale and presented here (Table 3.1). Further information is contained in the Sand Sourcing Specialist Report in Appendix I.

Table 3.1: Assessment of preliminarily identified sand sources.

<table>
<tr><th>Sand Source Alternative</th><th>Location Illustration</th><th>Potential Advantages</th><th>Potential Disadvantages</th></tr>
<tr><td>Sand bank located at the Kromme River mouth</td><td></td><td>Close proximity to the St Francis Bay beach (will require less transportation);
Is a suitable sand source (similar grain size properties);
Improved navigability of the lower reaches of the Kromme River channel;
Limited environmental impact.</td><td>Volume of sand material may be insufficient;
Popular recreational beach area;
No improvement to navigability of the middle and upper reaches of the Kromme River channel.</td></tr>
<tr><td>Sand bank located at the Sand River mouth</td><td></td><td>Limited environmental impact, but there will be loss of pioneer dune vegetation;
Improved navigability of the middle reaches of the Kromme River channel;
No disturbance to popular recreational beach area;
Sand is a suitable source for beach nourishment.</td><td>Volume of sand material may be insufficient;
No improvement to navigability of the upper and lower reaches of the Kromme River channel;
Relatively further from the St Francis Bay beach (will pose transportation and access challenges)</td></tr>
</table>

Sand Source Alternative	Location Illustration	Potential Advantages	Potential Disadvantages
Kromme River channel		• Will improve the navigability of the Kromme River channel; • Likely to provide sufficient volume of sand material; • Fewer ongoing transportation and access challenges; • Limited disturbance to popular recreational beach area.	• Long distance and hence potentially costly pipelines required.

The conclusion was that the sediment within the Kromme Estuary and particularly those sites identified as source sites contained similar grain size to that of the St Francis Bay beach. This suggests that the sources in the Kromme are compatible with the beach and suitable for nourishment.

Certain contaminants such as clays and ash could have an effect on the suitability of the source. However, vegetation is easily separated. The separation of the vegetation from the sand will affect the cost of the operation, but will not prevent the sand from being a suitable source for beach nourishment.

In addition to the grain size, the sources within the Kromme Estuary are anticipated to be able to provide the volume of sediment required for the nourishment of the beach (approx. 854 000 m^3) as well as the ongoing maintenance (between 25 000m^3 and 50 000m^3 per annum). These areas were further refined during the scoping phase of the project and classified into priority and secondary areas based on whether material would be dredged from the channels or from the sandbanks within the estuary (Figure 2.5). Comments from Interested and Affected Parties were also considered and further refinement of the boundaries of these areas were made. For example: the priority areas in the channel were moved away from the Northern Banks to reduce the potential for impacts to the northern banks and the saltmarsh vegetation. The secondary areas, mostly associated with sandbank features were also modified to accommodate the amenity that these areas provide for local community members.

3.2.3 *Activity Alternatives*

Due to the increasing need to protect the St Francis Bay beach and public and private property from ongoing erosion, and to restore the beach as an amenity, the activity of beach nourishment and construction of coastal protection infrastructure (stub groynes) is the only reasonable and feasible activity identified for this project. This conclusion is based on the results of the Advisian Design Report which incorporated a number of design standards and best practice guidelines, as presented in Box 3.1 below. No other activity alternatives will be assessed further in this study.

Box 3.1: Design Standards and Best Practice Guidelines incorporated into the Advisian Design Report (after Advisian, 2018).

STANDARDS:

- BS 6349-1:2000. British Standards for Maritime Structures: Part 1 Code of practice for general criteria.
- BS 6349-2: 1988. British Standards for Maritime Structures: Part 2. Design of Quay wall, jetties and dolphins.

- BS EN 1997. Eurocode 7: Geotechnical design.
- BS EN 1992. Eurocode 2: Design of Concrete Structures.
- BS EN 1993. Eurocode 3: Design of Steel Structures.
- BS EN 1998. Eurocode 8: Design of structures for earthquake resistance.
- UK National Annex to BS EN1997- Eurocode 7: Geotechnical design – Part 1: General rules.
- BS EN 13383 Parts 1 and 2 European Armourstone Specification.
- SANS 10160 Basis for structural design
- SANS 10100-1 Structural use of concrete

BEST PRACTICE GUIDELINES:

- The Rock Manual: the use of rock in hydraulic engineering (2nd edition), C683, CIRIA. London (CIRIA, CUR, CETMEF, 2007).
- Wave overtopping of sea defences and related structures: Assessment Manual. Environment Agency, UK www.overtopping-manual.com (EurOtop, 2007).
- Coastal Engineering Manual, US Army Corps of Engineers, 2003.

3.3 Incremental Alternatives

Incremental alternatives are modifications or variations to the design of a project that provide different options to reduce or minimise environmental impacts. There are several incremental alternatives that can be considered, including:

- The design or layout of the activity;
- The technology to be used in the activity;
- The operational aspects of the activity.

3.3.1 *Layout Alternatives*

This pertains to the layout of the proposed development of coastal structures to retard the erosion of St Francis Bay beach (i.e. the construction of stub groynes along the length of the beach). A number of specific layout alternatives have been considered (Table 3.2).

Table 3.2: Assessment of preliminarily identified layout alternatives (after Advisian, 2018).

Layout Alternative	Location Illustration	Potential Advantages	Potential Disadvantages
Beach Nourishment Only		• Soft solution (no hard structures) • More economical • Simple construction • Aesthetically attractive • Least environmental impact	• Sand expected to be lost more rapidly • Highest maintenance requirement • Initial high levels of erosion • Possibly not a long term solution due to inadequate supply of sand for ongoing nourishment

Layout Alternative	Location Illustration	Potential Advantages	Potential Disadvantages
Beach Nourishment And Groynes		• Prevents loss of sand deposited through nourishment • Encourages sedimentation and deposition of sand on the beach and within the nearshore area • Limits loss of sediment from St Francis Bay system, and hence offers a long-term solution	• Expensive • Not suited for near perpendicular wave attack • Can induce new local currents or change local current patterns • Can cause downdrift erosion • Interrupts traversing of beach
Beach Nourishment And Offshore Breakwaters		• High level of coastal protection • Less beach maintenance expected	• More complex constructability • Larger volumes of sand nourishment required • Large visual impact • May cause hazardous rip currents • Very expensive • High level of environmental impact on the marine system
Beach Nourishment and Oblique Groynes		• Moderate level of coastal protection • Additional area behind headland would be protected and could be used to create amenity features • Angled alignment ensures some beach areas would be stable • Offers both partial longshore and cross-shore transport control	• Some beach maintenance required • Expensive • Can induce new local currents or change local current patterns • Moderate environmental impact

Layout Alternative	Location Illustration	Potential Advantages	Potential Disadvantages
Beach Nourishment and Short Stub Groynes		• More economical than other options. • Angled alignment ensures some pockets will be stable • Low environmental impact • Staged approach makes it more financially feasible	• Lower level of coastal protection • Beach maintenance required • Sand in some stretches of coast will not be retained by coastal structures • Moderate to low environmental impact

The Advisian preliminary design report outlined a number of potential layout alternatives, of which the most feasible has been adopted for this project (Beach Nourishment and Short Stub Groynes, specifically Option 1B in Figure 3.2 above). At present the design layout in Figure 2.6 and 2.7 in Chapter 2 shows the most accurate and effective representation of the proposed development layout.

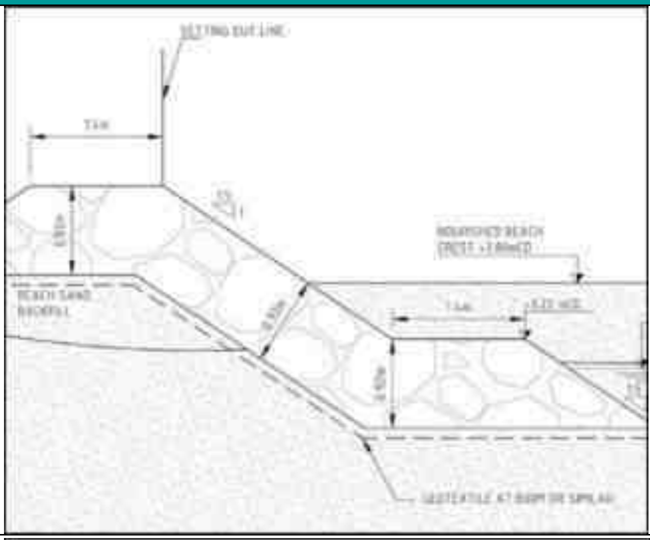
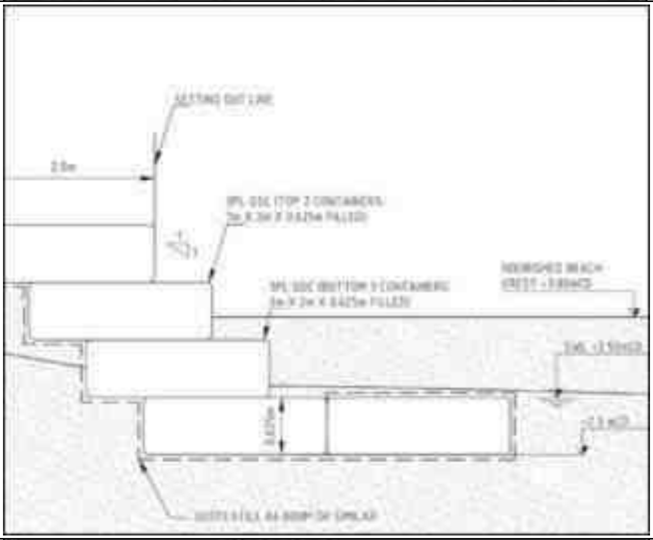
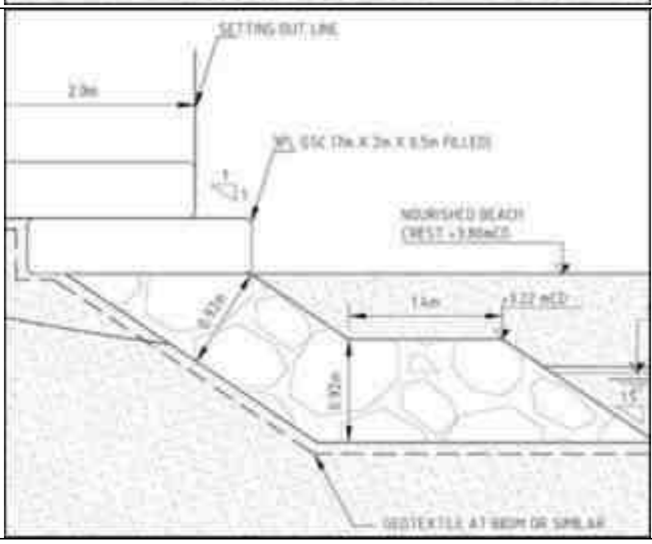
Comments regarding the orientation (angle) of the groynes as well as the positioning of the groynes were received from the community and amendments made accordingly. These amendments are reflected in the latest design drawings in Chapter 2 and supported by supplementary design reports in Appendix F.

3.3.2 *Technology Alternatives*

As the activity is related to the protection of the St Francis Bay coastline by means of beach nourishment and construction of coastal protection infrastructure (stub groynes), the most appropriate construction methods will be used based on what is available in terms of equipment and materials at the time of commencement of each phase of the project. The technology used for the maintenance of the beach infrastructure (operational phase) will depend on what is available on the market at the time.

The Kouga Local Municipality constructed an emergency revetment during 2020 in response to breaches of the spit. This emergency revetment is vulnerable and could be undermined or damaged at any time by wave activity and storm surges. Advisian will evaluate the condition of the emergency revetment when the long term coastal protection scheme is implemented, and incorporate it appropriately in their detail design (Table 3.3).

Table 3.3: Assessment of preliminarily technology alternatives for the revetment structures (after Advisian, 2019).

Revetment Alternative	Revetment Design	Potential Advantages	Potential Disadvantages
Rock revetment solution		• Guaranteed design life • Shorter construction duration • Proven to work efficiently along St Francis Bay when properly designed and maintained.	• Less aesthetically attractive • More construction vehicles required on beach
Geotextile sand container (GSC) revetment		• Soft solution (no hard structures) • More aesthetically pleasing • Easily disassembled • Less construction vehicles required on beach • Procured GSCs are available for use	• No design life guaranteed and tends to be short term solution in harsher wave conditions. • Highest cost • Longer construction duration • More complex constructability • More maintenance required • Vulnerable to vandalism
Composite revetment option		• More aesthetically attractive • Procured GSCs are available for use • Lowest cost	• Longer construction duration • More maintenance required • Vulnerable to vandalism

3.3.3 *Operational Alternatives*

The operational phase of the project will consist of activities related to the maintenance of the proposed beach infrastructure, which may include repair work, additional beach nourishment, ongoing dredging and continued monitoring of the beach erosion. It is envisaged that the dredging undertaken during the operational phase will be similar to that of the construction phase (albeit on a much smaller scale, non-continuous, and using smaller dredgers) and therefore the impacts associated with dredging will be similar to that of experienced during the construction phase.

It is considered that the maintenance material can be obtained from the Kromme Estuary (See Appendix I). Should other suitable sand sources be identified during the operational phase of the scheme these will be investigated. If necessary, additional environmental authorisations would be sought to allow the use of such material during beach maintenance activities.

This will be the only operational alternative relevant to the project and, therefore, this EIR has not considered any other operational alternatives.

3.4 Preferred Alternative

The preferred alternative considered in this EIR involves the implementation of the proposed coastal protection scheme, which will include sand material sourced from the Kromme River, beach nourishment of St Francis Bay beach and the development of coastal structures to retard the erosion of St Francis Bay beach and to project the beach spit. The preferred alternative was determined by the SFPO NPC, in conjunction with the Kouga Local Municipality, coastal engineers (Advisian), and CES. The impacts associated with the various location and technology (revetment) alternatives will be assessed in this EIR.

3.5 No-Go Alternative

It is mandatory to consider the “no-go” option in the EIA process. The no-action option assumes that no sand sourcing is conducted and therefore no beach nourishment is implemented, as well as no coastal protection infrastructure is constructed along the St Francis Bay beach. This was predicted to result in the continued erosion of the St Francis Bay beach with potential damage to backshore infrastructure and properties, which will have significant negative ecological impacts on the dune and beach system, and the Kromme River mouth and estuary.

In 2020, these risks were realised and the spit at St Francis Bay breached on four occasions. The breaches occurred during periods of high tides and storm swells which resulted in strong currents and large waves. The breaches resulted in the infrastructure on and in the marina being directly exposed to the ocean and resulted in damage.

Environmentally, large areas of dune habitat has been lost with much of the sand on the beach being reworked to repair the breach on each occasion.

The no-go alternative will be assessed in an objective manner as part of this EIR.

4 PROJECT NEED AND DESIRABILITY

According to Appendix 2, Section 2 (1) of the 2014 EIA Regulations (as amended), a "*scoping report must contain the information that is necessary for a proper understanding of the process, informing all preferred alternatives, including location alternatives, the scope of the assessment, and the consultation process to be undertaken through the environmental impact assessment process, and must include—*

(f) a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location."

4.1 Alignment with National Development Plans

The National Development Plan - The 2030 National Development Plan (NDP, 2013) places emphasis on the development of economic infrastructure including water resources and services and states that "*water will be recognised as a foundation for activities such as tourism and recreation, reinforcing the importance of its protection*." A key development policy outlined under economic infrastructure is that of tourism infrastructure, including accommodation and tourism products, which will play an important role in attracting a variety of tourists to different parts of South Africa. It also outlines the importance of ensuring environmental sustainability while allowing for the delivery of cultural benefits, including recreational opportunities, in order to achieve the national social and economic development objectives. The main goal outlined in the NDP is to boost economic growth, increase employment opportunities and reduce overall poverty.

Operation Phakisa - In order to ensure the implementation of the NDP, the South African government initiated Operation Phakisa. This initiative encourages government and stakeholder engagement and provides a framework for the setting of concrete plans and targets, as well as ongoing monitoring, to ensure the achievement of the objectives set out by the NDP. Operation Phakisa translates detailed plans and objectives into identifiable results. In 2013, Operation Phakisa launched the Oceans Economy Lab in order to unlock the potential of South Africa's extensive coastline, thereby contributing to employment creation and improving the country's GDP. It focuses on six (6) priority growth areas, namely (1) marine transport and manufacturing work stream, (2) offshore oil and gas exploration, (3) the aquaculture work stream, (4) marine protection services and ocean governance work stream, (5) small harbours work stream and lastly, and (6) the coastal and marine tourism work stream.

The nourishment of St Francis Bay's beach therefore aligns itself with the Operation Phakisa's Ocean Economy, particularly focus area number 6, the coastal and marine tourism work stream. The aim of the coastal and marine tourism work stream is to "*identify high impact, coastal tourism initiatives, interventions and projects*". Due to the threat posed by coastal erosion on the high tourism value of the recreational amenity that is the St Francis Bay beach area, the proposed development can be regarded as a 'high impact, coastal tourism initiative, intervention or project' as defined by the coastal and marine tourism stream of Operation Phakisa's Ocean Economy Lab. Phakisa projects are focussed on development of coastal towns with approximately R 20 million designated for the Eastern Cape province.

The Kouga Local Municipality submitted a proposal to the Phakisa representatives for several projects in St Francis Bay, including the proposed coastal protection infrastructure. In addition, the rural development strategy for the transformation of society and creation of equal opportunities aims to ensure that job creation is achieved in various sectors including the tourism sector (NDP, 2013). The proposed nourishment of St Francis Bay's beaches aligns itself with the NDP (2013) as it will be contributing to job creation, tourism, and environmental sustainability, thereby promoting social and economic development.

***National Coastal Management Programme* -** This project, which will take place within Coastal Public Property, is not a programme but a specific intervention with goals aligned to the provisions of the ICMA. It is to improve access to the coastline, improve its recreational value; ensure that the coastlines coastal protection functions can continue; and assist in protecting natural and built assets from sea level rise. In the absence of a local CMP the project must align with the ICMA and the National Coastal Management Programme of South Africa. Note that the District level CMP has been finalised.

The majority of the project (i.e. the borrowing of material, nourishment of the beach and construction of the groynes) will be below the highwater mark. This project is the protection of coastal infrastructure which supports important coastal and marine tourism, and aligns with priorities 1 and 2 of the National Coastal Management Programme, namely:

Priority 1: Effective planning for coastal vulnerability to global change (including climate change)

Goal: Ensuring that all planning and decision-making tools applied by all organs of state within the coast zone address coastal vulnerability by taking into account the dynamic nature of our coast, sensitive coastal environments, health and safety of people, illegal structures within coastal public property, and appropriate placement of infra-structure so as not to compromise investment by the state, as well as the rehabilitation of coastal ecosystems.
Management Objective 1.3: Rehabilitation of areas along the coast that have been adversely effected.

Priority 2: Ensuring equitable public access in the coastal zone

Goal: Ensuring that the public has safe and equitable access to coastal public property through the establishment of sufficient coastal access land that is cognisant of the sensitivity of coastal ecosystems, the needs and livelihoods of coastal communities or other socio-economic considerations, as well as the removal of inappropriate and unsafe coastal access points.
Management Objective 2.3: Provide capacity strengthening mechanisms for municipalities to effectively implement, maintain and monitor coastal access.

4.2 Alignment with Provincial Development Plans

Grounded in the NDP (2013), the Eastern Cape Vision 2030 Provincial Development Plan (PDP) (2014) outlines several strategic objectives to improve social development and increase economic growth, particularly through employment creation. The Eastern Cape's PDP (2014) also recognises the importance of the tourism industry and aims to grow and develop the tourism industry, as well as grow and develop the ocean economy. According to the PDP, over 70% of the Eastern Capes tourism is based in the coastal zone, with 52% of international tourism based around the Eastern Cape's beaches. In order to grow the provinces coastal economy, the need for coastal monitoring and protection is recognised (Eastern Cape Vision 2030 Provincial Development Plan, 2014).

Some of the Strategic Objectives and Actions outlined in the PDP include protecting the coast and other sensitive areas from environmental degradation, focusing on the development of domestic tourism, particularly beach holidays near Port Elizabeth, and upgrading beachfronts and associated tourism attraction throughout the province. Other sector strategies for the Eastern Cape include growing the eco-tourism industry, building stronger local tourism networks and taking advantage of the provinces extensive coastline.

The proposed project at St Francis Bay will assist with attaining the strategic objectives and actions set out in the PDP. It is also aligned with the Eastern Cape Vision 2030 Provincial Development Plan (2014) as it will contribute to employment creation and social development, tourism, coastal protection and maintenance of coastal infrastructure through preventing the loss and erosion of the St Francis Bay beaches and public and private land and amenities.

4.3 Alignment with District and Local Development Plans

The Sarah Baartman Coastal Management Programme was finalised in January 2020. The broad objectives, which have driven the development of management actions in the draft plan are listed below. Those to which the current project are aligned are shown in bold italics:

Natural, archaeological and cultural diversity and resource management

- Adopt a catchment management approach in coastal zone management.
- Apply a risk-averse approach in development planning, where high risk areas are avoided, and where important biodiversity areas, unique habitats, ecological processes and other natural areas are protected.
- ***Manage the coastal environment and its catchment area to be resilient to the impacts of climate change.***
- ***Allow ecological processes to function, and avoid disturbance to dynamic coastal areas.***
- Protect archaeological, cultural and heritage resources.
- Facilitate equitable and sustainable utilisation of natural resources.
- Promote collective responsibility and co-operative governance in managing the coastal zone, through education and awareness programmes, capacity building, and skills development.
- Facilitate information sharing and transparency to allow for participatory management of the coastal zone and informed decision-making.

Coastal Pollution

- Maintain good coastal water quality that is safe for recreational exposure and resource use, and that is needed by natural organisms to persist.

Coastal Development

- Plan for sustainable coastal development that protects natural habitats and archaeological/cultural/heritage features and the ecological processes that support these, and enhances the livelihoods and well-being of the local community.
- Prioritise low impact development that is suitable to the area, and retains 'sense of place'.
- ***The coast must be developed in a manner that allows for safe access and enjoyment by all people.***
- ***Coastal development must be designed to build resilience to the impacts of climate change and sea-level rise.***

The Kouga LM Integrated Development Plan (IDP) 2017-2022 lists several objectives in its mission statement. Among these objectives is "*to create a safe environment with diverse opportunities for economic growth and development*'. The proposed project will therefore assist in achieving this important objective by (a) decreasing the exposure of the beachfront and municipal infrastructure such as roads, access stairs and parking facilities to dynamic coastal processes, thereby increasing the safety and quality of the beachfront area; (b) decreasing the potential of shifting sand bars in the Kromme river, thereby increasing the navigation ability and safety of boaters; (c) increasing the width of the beaches, thereby promoting tourism and economic growth and development, and (d) preventing the loss of physical infrastructure in both the public and private sector by arresting the current rapid rate of beach erosion.

The IDP lists several municipal desired outcomes and development priorities required to improve local economic growth. One of the key performance areas is tourism and the objective within this sector is "*to create an enabling environment for economic growth that attracts investors and tourists, encourages innovation and facilitates pro-poor inventions*". The relevant priorities for this objective include employment and job creation, tourism and investment opportunities.

4.4 Project Desirability

The St Francis Bay beach is a major tourism attraction and contributes significantly to the Kouga Local Municipality's social and economic development, and its rates and taxes base. As noted earlier, over the 42 year period between 1975 and 2017, the high water mark of the St Francis beach retreated by 75 metres. As a result the beach, and the amenities it offers, has effectively been lost. Erosion of the vegetated sand spit is resulting in ecological impacts on the dune system. The system will continue to erode, as it is no longer in a dynamic state of equilibrium. This lack of equilibrium has resulted in the system being in a constant state of erosion.

This erosion has been caused by a number of factors, but primarily the stabilisation of the St Francis Bay headland bypass dune system in the 1970's, and the construction of two large dams in the catchment. The former has been reported on in scientific literature from as early as 1985 (see Lubke, 1985[1]). Stabilisation of the headland bypass dune reduced the amount of sediment blowing into the Kromme, which would then be flushed out to sea during flood event. A further cause was the establishment of the Impofu dam, which was completed in 1983, and numerous small impoundments on tributaries of the Kromme River. These dams have significantly reduced flow volumes and velocities, which in turn resulted in large amounts of sediment being deposited in the river and estuarine systems. Reduced flow and the large number of impoundments has restricted the frequency and velocity of high flow (flood) events, which would normally have occurred frequently enough to flush deposited sediment from the system. This sediment would have been deposited immediately offshore in a sand bar, with much of it being redeposited on St Francis Bay beach due to natural wave action.

Consequently, various interventions including a beach nourishment scheme, revetment construction and the construction of groynes is required to arrest the now rapid erosion of the beach, and ultimately restore it to its pre-erosion status, or at least to a condition that affords protection from storm attack, sea level rise and erosion events associated with these natural perturbations.

Studies on current and projected rates of erosion indicate that with sea level rise over a 50 year period, the current beach crest (at +3,8m above Chart Datum - CD) will recede by between 15 and 25m. This means the existing beach crest will 15 to 25m inland, but over-wash of sediment during storm events will reach 40m inland. This is likely to result in the complete loss of the current sand spit and Ski Canal,

[1] Lubke, RA (1985) Erosion of the beach at St Francis Bay, Eastern Cape, South Africa. Biol. Conserv.,32:99-127

and the likely loss of the houses on its banks (Advisian, 2018).

The ongoing erosion and eventual loss of the beach and dune system will have a number of potentially adverse effects, which are outlined and described below. As mentioned above a number of these risks were realised in 2020:

1. Decrease in the width of beaches and the consequent loss of area available for recreational activities;
2. Loss and erosion of the sand spit between the Kromme river and the Indian ocean that protects the popular St Francis Ski Canal and the marina;
3. Damage to infrastructure including roads, houses, parking bays, access stairs and ablution facilities located adjacent to beaches;
4. Decreased navigation ability of the river channel due to shifting sand bars, posing as a safety hazard for boaters;
5. Loss of a functional coastal dune system along the sand spit, and
6. Severe alterations to the Kromme River estuary with resultant significant ecological impacts on the system;
7. Loss of future residential development in the St Francis Bay area; and
8. The impact of the loss of potential employment in the Sea Vista settlement due to reduced development and fewer holiday makers.

Beach nourishment will ensure a beach wide and high enough to protect backshore infrastructure and properties, the groynes will reduce sand loss due to long-shore drift, and revetments will add to the protection of backshore infrastructure and properties.

The proposed coastal protection scheme therefore provides a viable solution for increasing the accumulation of sediment and decreasing the potential adverse effects listed above. The proposed project will ensure that local communities obtain employment during both the construction and operational phases of the project. This will include the creation of approximately thirty (30) temporary jobs during the construction phase and five (5) during the operation phase. In addition, by securing the recreational amenities, tourism will continue and permanent jobs in this sector and temporary employment in the domestic sector will be sustained. The proposed project therefore aligns itself with national, provincial, district and local development plans as well as the local spatial development framework. It will contribute to tourism, job creation and sustainable economic development. In addition, and as described in Section 4.2 of this report, this environmental process responds directly to the directive given in the EA issued by the DEDEAT on the 1st of June 2016.

The availability of suitable material within the Kromme Estuary provides an opportunity to reduce the distance and resources associated with the movement of material required for the beach nourishment. It also allows areas of the Kromme Estuary, which have become shallower over time, to facilitate greater movement of water during lower states of the tide. It also facilitates the ability for recreational and commercial vessels (boats, barges, etc.) safer passage throughout the lower reaches. While not a primary objective, facilitating safe vessel passage within the estuary is a benefit of the dredging activity.

The project is therefore regarded as very desirable, as it is required to protect both the natural and built capital of St Francis Bay.

5 RELEVANT LEGISLATION

According to Appendix 3, Section 3 (1), of the 2014 EIA Regulations (as amended), "an environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include—

> *(e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context."*

5.1 Overview of applicable legislation

The implementation of the proposed St Francis Bay coastal protection scheme will be subject to various South African legislative requirements. In addition to the environmental authorisation, there are other permits, contracts and licenses that will need to be obtained by the project proponent for the proposed project, some of which fall outside the scope of this S&EIR process. The relevant national legislation, policies and conventions to which South Africa is a signatory to, must be used to guide the proposed project in order to ensure that it remains fully legal and compliant (Table 5.1).

Table 5.1: Relevant Legislation.

Legislation	Relevance to the Proposed Project	Permit / Licence Required	Comment
ENVIRONMENTAL			
The Constitution of South Africa (Act No. 108 of 1996)	The developer has an obligation to ensure that the proposed activity is ecologically sustainable, will not result in pollution and ecological degradation while demonstrating economic and social development and upholding environmental rights.	-	-
National Environmental Management Act (NEMA) (Act No. 7 of 1998)	This S&EIR will be undertaken in terms of NEMA requirements. The applicant must be mindful of the principles, broad liability and implications associated with NEMA and must eliminate or mitigate any potential impacts.	-	-
Environmental Impact Assessment (EIA) Regulations, 2014 (as amended in April 2017)	The proposed project triggers the three lists of activities, published on 4 December 2014 (as amended on 7 April 2017), as Listing Notices GN R.983, R.984, and R.985 (as amended by R.327, R.325 and R.324). These Listing Notices define the activities that require, respectively, a Basic Assessment or an S&EIR process. Based on the NEMA EIA listed activities identified by EAP, namely the Listing Notice 2 (GN R.984, as amended by GN R. 325), the proposed project will be subject to the S&EIR process as stipulated in the Regulations. The relevant competent authority is the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT). This Assessment will be submitted to DEDEAT to ensure that the national environmental principles, fair decision making and integrated environmental management approach is applied throughout the process. The assessment and associated environmental management plan aims to prevent pollution and ecological degradation, promote conservation and secure ecological sustainable	✓	Environmental Authorisation required

Legislation	Relevance to the Proposed Project	Permit / Licence Required	Comment
	development and use of natural resources while promoting justifiable economic and social development, as outlined in the Act.		
The National Environment Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004)	The project is located within the Eastern Cape in an area considered to be a Critical Biodiversity Area (CBA) which means there is potentially sensitive and potentially irreplaceable vegetation. To avoid and or mitigate threats to any endangered ecosystems all impacts on sensitive ecosystems will be assessed in detail during the EIA process to ensure the impacts of the proposed project are understood and can be mitigated. If the specialist assessments identify protected species on site that will be at risk due to project related activities, the developer will require the necessary permit(s) in terms of this act. The proposed activities could leave the project area susceptible to alien vegetation. To avoid alien vegetation from establishing on disturbed areas, appropriate measures will be implemented.	✓	A permit may be required for the removal of indigenous vegetation.
Conservation of Agricultural Resources Act (43 of 1983) & Subdivision of Agricultural Land Act (No. 70 of 1970)	The Act provides a list of declared weeds and invader plants as well as indicators of bush encroachment.	-	-
National Environmental Management: Waste Act (Act No. 59 of 2008)	Construction activities will generate construction related waste that will need to be disposed of at a registered landfill site if the waste cannot be recycled or reused. Waste generated will be dealt with in a manner compliant with the requirements of the Act.	-	-
National Water Act (NWA) (Act No. 36 of 1998)	The proposed project and its associated infrastructure will alter the bed, banks, course or characteristics of a watercourse. Once the layout is finalised and exact locations of the affected areas of the watercourse are confirmed, the developer will apply for the relevant water use authorisations from DWS. It is noted however, that estuaries do not fall under the jurisdiction of DWS and, instead, must be contemplated under the National Environmental Management: Integrated Coastal. Management Amendment Act (Act No. 24 of 2008, as amended).	TBC	The requirements in terms of Water Use Authorisations, if any, will be discussed with DWS

Legislation	Relevance to the Proposed Project	Permit / Licence Required	Comment
National Environmental Management: Integrated Coastal Management (ICM) Act (Act No. 24 of 2008)	The proposed project occurs within Coastal Public Property (CPP) as it aims to maintain the existing beach located in St Francis Bay. The roles and responsibilities of key stakeholders must be clearly defined to encourage ownership of the ICM goals. The potential impacts associated with the coastal environment will be identified and further assessed in the EIA phase of the project. The ICM Act provides for additional criteria that must be considered by the competent authority when evaluating an application for an activity which will take place in the coastal zone. The EIR must assess the potential risks and impacts that the natural environment will have on the proposed project in terms of storm surges, sea level rise and other coastal processes which occur in the area.	✓	The use of vehicles in a coastal protection zone and the reclamation of land, as well as the dredging of the Kromme Estuary, may require a permit (coastal lease) from the Coastal Conservation and Strategies Directorate of the Department of Environment Affairs (DEA), Oceans and Coast Branch.
	Measures affecting erosion and accretion 15. (1) No person, owner or occupier of land adjacent to the seashore or other coastal public property capable of erosion or accretion may require any organ of state or any other person to take measures to prevent the erosion or accretion of the seashore or such other coastal public property, or of land adjacent to coastal public property, unless the erosion is caused by an intentional act or omission of that organ of state or other person. (2) No person may construct, maintain or extend any structure, or take other measures on coastal public property to prevent or promote erosion or accretion of the seashore except as provided for in this Act.	-	-
20.(1) (h)	A municipality in whose area coastal access land falls, must describe or otherwise indicate all coastal access land in any municipal coastal management programme and in any municipal spatial development framework prepared in terms of the Municipal Systems Act;	-	-
48.(2)	Before adopting a programme contemplated in subsection (1)(a), a municipality must by notice in the Gazette invite members of the public to submit written representations on or objections to the programme in accordance with the procedure contemplated in Chapter 4 of the Municipal Systems Act	-	-
48. (4)	A municipality may prepare and adopt a coastal management programme as part of an integrated development plan and spatial development framework adopted in accordance with the Municipal Systems Act and if it does so, compliance with the public participation requirements prescribed in terms of the Municipal Systems Act for the preparation and adoption of integrated development plans will be regarded as compliance with public participation requirements in terms of this Act.	-	-

Legislation	Relevance to the Proposed Project	Permit / Licence Required	Comment
51	An environmental implementation or environmental management plan in terms of Chapter 3 of the National Environmental Management Act, an integrated development plan in terms of the Municipal Systems Act and a provincial or municipal land development plan must (a) be aligned with the national coastal management programme and any applicable provincial coastal management programme; (b) contain those provisions of the national coastal management programme and any applicable provincial coastal management programme that specifically applies to it; and (c) give effect to the national coastal management programme and any applicable provincial coastal management programme.	-	-
National Environmental Management: Air Quality Act (Act No. 39 of 2004)	The clearing of vegetation, excavations, stockpiles and transportation of materials might result in construction-related dust. It is expected to be below the dust control regulations of 2013 since mitigation measures will be implemented to reduce dust fall out. Dust control regulations were published under Government Notice R827 in Government Gazette 36974 of 1 November 2013.	-	-
SOCIAL			
National Heritage Resources Act (25 of 1999)	The project will be registered with South African Heritage Resource Agency (SAHRA) as well as the Eastern Cape Provincial Heritage Resources Authority (ECPHRA). A desktop heritage assessment must be undertaken to determine if heritage features occur on site and what level impact assessment (if any) maybe required. In the event that archaeological or historically significant sites would be destroyed, damaged, excavated, altered or defaced by the proposed project activity, the relevant permit will be granted before the project can continue.	-	-
Occupational Health and Safety Act (85 of 1993)	The developer must be mindful of the principles and broad liability and implications contained in the Operational Health and Safety Act and mitigate any potential impacts.	-	-
PLANNING			
National Road Traffic Act (No. 93 of 1996)	All the requirements stipulated in the NRTA will need to be complied with during the construction and operational phases of the proposed project.	-	-

5.2 The Constitution (Act No. 108 of 1996)

This is the supreme law of the land. As a result, all laws, including those pertaining to the proposed project, must conform to the Constitution. The Bill of Rights - Chapter 2 of the Constitution, includes an environmental right (Section 24) according to which, "*everyone has the right –*

(a) To an environment that is not harmful to their health or well-being; and

(b) To have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that–

(i) prevent pollution and ecological degradation.
(ii) promote conservation; and
(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

Relevance to the proposed project
The proponent has an obligation to ensure that the proposed project will: • Not result in pollution and ecological degradation; and • Be ecologically sustainable, while demonstrating economic and social development.

5.3 Local Government Municipal Systems Act (Act No. 32 of 2000)

The Municipal Systems Act is part of a series of legislation which aims to empower local government to fulfil its Constitutional objects. In 1998 the government issued a Local Government White Paper, which outlined a policy framework for local government. Later that year government passed the Municipal Demarcation Act, which enabled the re-demarcation of municipal boundaries; and the Municipal Structures Act, which defined the structures of local government. The Municipal Systems Act will complement these pieces of legislation, by regulating key municipal organisational, planning, participatory and service delivery systems. National government has also prepared the Municipal Financial Management Bill, which regulates municipal financial matters. Together, these pieces of legislation provide a framework for a democratic, accountable and developmental local government system, as envisaged by the Constitution.

The Local Government Municipal Systems Act (MSA) of 2000 Chapter 1; Interpretation; defines: "local community" or '"community", in relation to a municipality means that body of persons comprising (a) the residents of the municipality; (b) the ratepayers of the municipality, (c) any civic organisations and non-governmental private sector or labour organisations or bodies which are involved in local affairs within the municipality: and (d) visitors or other people residing outside the municipality who, because of their presence in the municipality make use of services or facilities provided by the municipality, and includes, more specifically, the poor and other disadvantaged sections of such body of persons.

MSA Chapter 4; Mechanisms, processes and procedures for community participation; section 17. (3) states: 'When establishing mechanisms, processes and procedures in terms of subsection (2) the municipality must take into account the special needs of (a) people who cannot read or write; (b) people with disabilities (c) women: and (d) other disadvantaged groups'.

Relevance to the proposed project
This project should provide proportionate and appropriate opportunity for all Interested and Affected Parties (I&APs as defined by NEMA) an opportunity to be informed of the details of the project and provided a mechanism in which they are able to provide feedback. This is included under the 2014 EIA Regulations (as amended) and referred to as the public participation process where I&APs can register their details and be involved in public meetings.

5.4 National Environmental Management Act (Act No. 107 of 1998, as amended)

The objective of the National Environmental Management Act (NEMA) is "*provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote cooperative governance and procedures for co-ordinating environmental functions exercised by organs of state; to provide for certain aspects of the administration and enforcement of other environmental management laws; and to provide for matters connected therewith*."

NEMA provides the basis for environmental governance in South Africa by establishing principles and institutions for decision-making on matters affecting the environment. A key aspect of NEMA is that it provides a set of environmental management principles that apply throughout South Africa to the actions of all organs of state that may significantly affect the environment. Section 2 of NEMA contains principles relevant to the proposed project, and likely to be utilised in the process of decision making by DEDEAT (Table 5.2).

Table 5.2: NEMA Environmental Management Principles.

(2)	*Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.*
(3)	*Development must be socially, environmentally and economically sustainable.*
(4)(a)	*Sustainable development requires the consideration of all relevant factors including the following:* *i. That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;* *ii. That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;* *iii. That waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner.*
(4)(e)	*Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.*
(4)(i)	*The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment.*
(4)(j)	*The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected.*
(4)(p)	*The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.*
(4)(r)	*Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.*

As these principles are utilised as a guideline by the competent authority in ensuring the protection of the environment, the proposed project should, where possible, be in accordance with these principles. Where this is not possible, deviation from these principles would have to be very strongly motivated. NEMA introduces the duty of care concept, which is based on the policy of strict liability. This duty of care extends to the prevention, control and rehabilitation of significant pollution and environmental degradation. It also dictates a duty of care to address emergency incidents of pollution. A failure to perform this duty of care may lead to criminal prosecution, and may lead to the prosecution of managers or directors of companies for the conduct of the legal persons.

In addition NEMA introduced a framework for environmental impact assessments, which aims to avoid detrimental environmental impacts through the regulation of specific activities that cannot commence without prior environmental authorisation. Authorisation in terms of these Regulations, the 2014 EIA Regulations (GN R. 982, as amended by GN R. 326 in 2017), either requires a Basic Assessment or a Full Scoping and Environmental Impact Assessment report (S&EIR), depending on the type of activity. These assessments specify mitigation and management guidelines to minimise negative environmental impacts and optimise positive impacts.

Relevance to the proposed project

An application for Environmental Authorisation (as triggered by the 2014 EIA Regulations (as amended)) will be required. In terms of Section 28, every person who causes, has caused, or may cause significant pollution or degradation of the environment, must take reasonable measures to prevent pollution or rectify the damage caused. The undertaking of various specialist studies, in order to identify potential impacts on the environment and to recommend mitigation measures to minimise these impacts, complies with Section 28 of NEMA. The applicant must apply the NEMA principles, the fair decision-making and conflict management procedures that are provided for in NEMA. The developer must apply the principles of Integrated Environmental Management and consider, investigate and assess the potential impact of existing and planned activities on the environment, socio-economic conditions and the cultural heritage.

Three lists of activities, provided in the EIA Regulations published on 4 December 2014 as Government Notice Numbers R.983, R.984, and R.985 (as amended by R.327, R.325 and R.324 respectively), define which process would be required to assess impacts associated with a particular development. The impacts of the project may be subject to a Basic Assessment (BA) process, which applies to activities with limited environmental impacts (GN R.983 and R.984, as amended), or may be subject to a more rigorous, two-tiered approach comprising of an S&EIR, required to assess activities with potentially more significant environmental impacts (GN R.985, as amended). The listed activities triggered by the proposed project include activities from each of the three listing notices (Table 5.3).

Table 5.3: NEMA Listed Activities triggered by the proposed project.

Listing Notice	Activity Number	Description	Relevance
Listing Notice 1 – GN R 983 (GN R 327) (Basic Assessment)	15	The development of structures in the coastal public property where the development footprint is bigger than 50 square metres, excluding — (iv) activities listed in activity 14 in Listing Notice 2 of 2014, in which case that activity applies.	This notice is unlikely to be relevant as Activity 14 in Listing Notice 2 is deemed applicable.

Listing Notice	Activity Number	Description	Relevance
	17	Development – (iii) Within the littoral active zone; (iv) In front of a development setback; or (v) If no development setback exists, within a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater. In respect of – (c) Embankments; (d) Rock revetments or stabilising structures including stabilizing walls; or (e) Infrastructure or structures with a development footprint of 50 square metres or more.	The positioning of the stub groynes, which are likely to be greater than $50m^3$ will occur within the littoral active zone and within 100m of the HMW of the sea.
	18	The planting of vegetation or placing of any material on dunes or exposed sand surfaces of more than 10 square metres, within the littoral active zone, for the purposes of preventing free movement of sand, erosion, accretion.	Sand material of more than $10m^3$ will be placed on the beach (within the littoral active zone) in order to prevent beach erosion.
	19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.	Dredging and excavation of over $10m^3$ of material may take place within the Kromme River.
	19 A	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from – (i) The seashore; (ii) The littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is greater.	Dredging and excavation of over $10m^3$ of material will take place within the Kromme River estuary and depositing of sand of more than $10m^3$ will take place along the seashore.
	27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation	The proposed development may require the clearance of indigenous vegetation, especially at the mouth of the Sand River.

Listing Notice	Activity Number	Description	Relevance
	48	The expansion of – (i) Infrastructure or structures where the physical footprint is expanded by 100 square metres or more; where such expansion occurs – (a) Within a watercourse; (b) In front of a development setback; or (c) If no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	The existing revetment, which is located in front of a development setback, will be expanded along the spit.
	52	The expansion of structures in the coastal public property where the development footprint will be increased by more than 50 square metres.	
	54	The expansion of facilities – (i) In the sea; (ii) In an estuary; (iii) Within the littoral active zone; (iv) In front of a development setback; or (v) If no development setback exists, within a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater. In respect of – (c) Embankments; (d) Rock revetments or stabilising structures including stabilising walls; or (e) Infrastructure or structures where the development footprint is expanded by 50 square metres or more	Unlikely, but included at this stage in the event that any existing infrastructure is expanded as part of the required process.
	55	Expansion— (i) in the sea; (ii) in an estuary; (iii) within the littoral active zone; (iv) in front of a development setback; or (v) if no development setback exists, within a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater; in respect of — (c) inter- and sub-tidal structures for entrapment of sand.	
	65	The expansion and related operation of — (ii) any other structure or infrastructure; on or along the sea bed, where the expansion will constitute an increased development footprint.	

Listing Notice	Activity Number	Description	Relevance
	67	Phased activities for all activities— (i) listed in this Notice, which commenced on or after the effective date of this Notice or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices.	The various phases of beach nourishment and implementation of revetments and other structures along the St Francis Bay beach has been ongoing since 1996 and will continue to be conducted in phases.
Listing Notice 2 - GN R 984 (GN R 325) (Full Scoping & EIR)	14	The development and related operation of—(iii) any other structure or infrastructure — on, below or along the sea bed.	Stub groynes will be developed along the sea bed.
	23	The reclamation of an island or parts of the sea.	Part of the sea will be reclaimed by the proposed development.
	26	Development – (i) In the sea; (ii) In an estuary; (iii) Within the littoral active zone; (iv) In front of a development setback; or (v) If no development setback exists, within a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater. In respect of – (c) Inter- and sub-tidal structure for entrapment of sand.	The positioning of the stub groynes, for the entrapment of sand will, occur within the littoral active zone and within 100m of the HMW of the sea, as will the revetment structures.
Listing Notice 3 – GN R 985 (GN R 324) (Basic Assessment)	12	The clearance of an area of 300 square metres or more of indigenous vegetation In a. Eastern Cape ii. Within critical biodiversity areas identified in bioregional plans; iii. Within the littoral active zone or 100 metres inland from the high water mark of the sea, whichever distance is the greater, iv. Outside urban areas, within 100 metres inland from an estuarine functional zone.	The proposed development, which is located within both a terrestrial and aquatic CBA, within 100m of the HMW and within 100m of the Kromme River estuary:

Listing Notice	Activity Number	Description	Relevance
	14	The development of—ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs— (a) within a watercourse; (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse In a. Eastern Cape i. Outside urban areas: (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (ii) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined; or (jj) In an estuarine functional zone, excluding areas falling behind the development setback line.	- May require the clearance of indigenous vegetation, and - Will have a physical footprint of more than $10m^2$
	26	Phased activities for all activities— i. listed in this Notice and as it applies to a specific geographical area, which commenced on or after the effective date of this Notice; or ii. similarly listed in any of the previous NEMA notices, and as it applies to a specific geographical area, which commenced on or after the effective date of such previous NEMA Notices— where any phase of the activity was below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.	The various phases of beach nourishment and implementation of revetments and other structures along the St Francis Bay beach has been ongoing since 1996 and will continue to be conducted in phases.

Relevance to the proposed project

Based on the listed activities identified in Listing Notice 2 of GN R 325 (2014 EIA Regulations, as amended on 7 April 2017), the proposed project will be subject to an S&EIR process. In order to comply with NEMA, the impacts associated with the activities listed above will need to be identified and assessed during this process and will include the necessary specialist reports required. The Competent Authority (CA) for this project is identified as the Member of the Executive Council (MEC) of the Eastern Cape Department of Economic Development, Environment Affairs and Tourism (DEDEAT).

5.5 National Environment Management: Biodiversity Act (Act No. 10 of 2004)

The National Environment Management: Biodiversity Act (NEMBA) provides for the management and conservation of South Africa's biodiversity and the protection of species and ecosystems that warrant national protection.

The objectives of NEMBA are:

(a) within the framework of the National Environmental Management Act, to provide for—

(i) the management and conservation of biological diversity within the Republic and of the components of such biological diversity;

(ii) the use of indigenous biological resources in a sustainable manner; and

(iii) the fair and equitable sharing among stakeholders of benefits arising from bioprospecting involving indigenous biological resources;

(b) to give effect to ratified international agreements relating to biodiversity which are binding on the Republic;

(c) to provide for co-operative governance in biodiversity management and conservation; and

(d) to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

The Act provides for the management and conservation of South Africa's biodiversity within the framework of NEMA (Table 5.4). In terms of the Biodiversity Act, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (including The Endangered and Threatened Ecosystem Regulations, Government Notice R. 1002 dated 9th December 2011);
- Application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all developments within the area are in line with ecological sustainable development and protection of biodiversity;
- Limit further loss of biodiversity and conserve endangered ecosystems.

Table 5.4: Management and conservation of biodiversity within the framework of NEMA.

Chapter 4	• Provides for the protection of species that are threatened or in need of national protection to ensure their survival in the wild; • To give effect to the Republic's obligations under international agreements regulating international trade in specimens of endangered species; and • Ensure that the commercial utilization of biodiversity is managed in an ecologically sustainable way.
Chapter 5 (Part 2) Section 73	A person who is the owner of land on which a listed invasive species occurs must: a) Notify any relevant competent authority, in writing, of the listed invasive species occurring on that land; b) Take steps to control and eradicate the listed invasive species and to prevent it from spreading; and c) Take all required steps to prevent or minimise harm to biodiversity.
Chapter 5 (Part 2) Section 75	• Control and eradication of a listed invasive species must be carried out by means or methods that are appropriate for the species concerned and the environment in which it occurs. • Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment. • The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth

	of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

NEMBA's permit system is further regulated in the NEMBA Threatened or Protected Species Regulations Government Notice R. 152 of 2007. The NEMBA Alien and Invasive Species List (Government Notice R 599 of 2014) defines Alien and Invasive species that are regulated by the NEMBA Alien and Invasive Species Regulations (Government Notice 98 of 2014).

Relevance to the proposed project

The proponent must:
- Not cause a threat to any endangered ecosystems and must protect and promote biodiversity;
- Assess the impacts of the proposed project on endangered ecosystems;
- Not remove or damage any protected species without a permit;
- Ensure that the site is cleared of alien vegetation using appropriate means;
- Implement an invasive species monitoring, control and eradication plan for land/activities under their control should be developed, as part of their environmental plans in accordance with Section 11 of NEMA.

5.6 Conservation of Agricultural Resources Act (Act No. 43 of 1983)

The Conservation of Agricultural Resources Act (CARA) aims to control over-utilisation of the natural agricultural resources to promote the conservation of soil, water sources and vegetation through the combat of weeds and invader plants. Regulations 15 and 16 under this Act, which relate problem plants, were amended in March 2001. The Act provides a list of declared weeds and invader plants as well as indicators of bush encroachment. In terms of weeds and invader plants:
- A land user shall control any category 1 plants that occur on any land or inland water surface;
- No person shall, except for the purposes of a biological control reserve:
  - Establish, plant, maintain, multiply or propagate weeds and invader plants;
  - Import or sell propagating material of category weeds and invader plants; and
  - Acquire propagating material of weeds and invader plants.

These lists include:
- Combating of category 1 plants (Section 15A) according to CARA (Act No 43 of 1983); and
- Combating of category 2 plants (Section 15B) according to CARA (Act No 43 of 1983)

Relevance to the proposed project

- An invasive species monitoring, control and eradication plan for land/activities under the control of the proponent should be developed as part of the Environmental Management Programme (EMPr) in accordance with CARA.

5.7 National Environmental Management: Waste Act (Act No. 59 of 2008)

The National Environmental Management: Waste Management Act (NEMWA) gives legal effect to the Government's policies and principles relating to waste management in South Africa, as reflected in the National Waste Management Strategy (NWMS).

The objects of the Act are "*to protect health, well-being and the environment by providing reasonable measures for—*

- *minimising the consumption of natural resources;*
- *avoiding and minimising the generation of waste;*
- *reducing, re-using, recycling and recovering waste;*
- *treating and safely disposing of waste as a last resort;*
- *preventing pollution and ecological degradation;*
- *securing ecologically sustainable development while promoting justifiable economic and social development;*
- *promoting and ensuring the effective delivery of waste services;*
- *remediating land where contamination presents, or may present, a significant risk of harm to health or the environment; and*
- *achieving integrated waste management reporting and planning.*"

Chapter 4 of this Act deals with the general duty in respect to waste management and emphasises that, "*a holder of waste must, within the holder's power, take all reasonable measures to:- avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated; reduce, re-use, recycle and recover waste; where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner; manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts; prevent any employee or any person under his or her supervision from contravening this Act; and prevent the waste from being used for an unauthorised purpose*".

Chapter 4, Part 3 of this Act deals with reduction re-use and recovery of waste, Part 4 deals with waste management activities, Part 5 covers storage collection and transportation of waste, Part 6 deals with treatment, processing and disposal of wastes, Part 7 covers industry waste management plans and Part 8 deals with contaminated land. Chapter 5 covers all issues regarding the licensing of waste management activities.

Relevance to the proposed project
• All reasonable measures must be taken to avoid the generation of waste and, where such generation cannot be avoided, minimise the toxicity and amounts of waste that are generated; reduce, re-use, recycle and recover waste; where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner; • Manage the waste in such a manner that it does not endanger human health or the environment or cause a nuisance through noise, odour or visual impacts; • Prevent any employee or any person from contravening this Act and prevent the waste from being used for an unauthorised purpose; • All waste must be disposed of at a registered waste disposal facility.

5.8 National Water Act (Act No. 36 of 1998)

The National Water Act (NWA) provides for fundamental reform of the law relating to water resources in South Africa.

The purpose of the Act is "*to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors–*

(a) meeting the basic human needs of present and future generations;
(b) promoting equitable access to water;

(c) redressing the results of past racial and gender discrimination;
(d) promoting the efficient, sustainable and beneficial use of water in the public interest;
(e) facilitating social and economic development;
(f) providing for growing demand for water use;
(g) protecting aquatic and associated ecosystems and their biological diversity;
(h) reducing and preventing pollution and degradation of water resources;
(i) meeting international obligations;
(j) promoting dam safety;
(k) managing floods and droughts."

Section 21 of the NWA describes activities defined as a water use under the Act. These activities may only be undertaken subject to the application for, and issue of, a Water Use License (WUL) or general authorisation (GA). Water use activities include—

(a) taking water from a water resource;
(b) storing water;
(c) impeding or diverting the flow of water in a watercourse;
(d) engaging in a stream flow reduction activity contemplated in section 36;
(e) engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);
(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
(g) disposing of waste in a manner which may detrimentally impact on a water resource;
(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
(i) altering the bed, banks, course or characteristics of a watercourse;
(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
(k) using water for recreational purposes."

Relevance to the proposed project

- Infrastructure constructed within the 100m regulatory area of a river or drainage line or within the 500m regulatory area a wetland, will require a water use authorisation (WUA). This will be discussed with the Department of Water and Sanitation (DWS) and reported on in the EIR;
- According to Section 19(1) of the NWA, "*an owner of land, a person in control of land or a person who occupies or uses the land on which—*
  (a) Any activity or process is or was performed or undertaken; or
  (b) Any other situation exists, which causes, has caused or is likely to cause pollution of a water resource, must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring."
- Appropriate measures must be taken to prevent the pollution of water courses and other water resources and riparian zones must be protected.

5.9 National Environmental Management: Integrated Coastal Management (ICM) Act (Act No. 24 of 2008)

According to Section 2 of the NEM: ICMA, the objects of this Act are:

- *To determine the coastal zone of the Republic;*

- *To provide, within the framework of the National Environmental Management Act, for the co-ordinated and integrated management of the coastal zone by all spheres of government in accordance with the principles of co-operative governance;*
- *To preserve, protect, extend and enhance the status of coastal public property as being held in trust by the State on behalf of all South Africans, including future generations;*
- *To secure equitable access to the opportunities and benefits of coastal public property; and*
- *To give effect to the Republic's obligations in terms of international law regarding coastal management and the marine environment.*

Section 13 of the NEM: ICMA states that any natural person in the Republic:

- Has a right of reasonable access to coastal public property; and
- Is entitled to use and enjoy coastal public property.

Coastal Public Property is defined by the Act as coastal waters, land submerged by coastal waters, any island in coastal waters, the seashore, any admiralty reserve owned by the state, any other state land declared as coastal public property and any natural resources. The ICM Act unequivocally vests ownership of coastal public property in the citizens of South Africa. Coastal public property cannot be transferred, sold, attached or acquired by prescription, nor can the rights over it be acquired by prescription. It is the duty of the State as trustee to ensure that coastal public property is used, managed, protected, conserved and enhanced in the interests of the whole community, as opposed to only a few individuals or groups.

Chapter 2; Part 3; Responsibilities of municipalities with regard to coastal access land; Section 20 (h) which states: 'describe or otherwise indicate all coastal access land in any municipal coastal management programme and in any municipal spatial development framework prepared in terms of the Municipal Systems Act'.

Chapter 6; Part 3; 48 (2) Municipal coastal management programmes; Preparation and adoption of municipal coastal management programmes; Before adopting a programme contemplated in subsection (1)(a): 'a municipality, must invite members of the public to submit written representations on or objections to the programme in accordance with the procedure contemplated in Chapter 4 of the Municipal Systems Act'.

Chapter 6; Part 4; Co-ordination and alignment of plans and coastal management programmes states:

Alignment of plans and coastal management programmes;
Section 51. An environmental implementation or environmental management plan in terms of Chapter 3 of the National Environmental Management Act, an integrated development plan in terms of the Municipal Systems Act and a provincial or municipal land development plan must (a) be aligned with the national coastal management programme and any applicable provincial coastal management programme; (b) contain those provisions of the national coastal management programme and any applicable provincial coastal management programme that specifically applies to it; and (c) give effect to the national coastal management programme and any applicable provincial coastal management programme.

Ensuring consistency between coastal management programmes and other statutory plans;
Section 52 (4). Each municipality in the coastal zone must ensure that its integrated development plan (including its spatial development framework) is consistent with other statutory plans adopted by either a national or a provincial organ of state.

Section 65(1) (subject to sections 67 and 95) states that no person may occupy any part of, or site on, or construct or erect any building, road, barrier or structure on or in, coastal public property except under and in accordance with a coastal lease awarded by the Minister in terms of this Chapter. This is relevant to the proposed project as the entire project occurs within what is defined as coastal public property.

Relevance to the proposed project

- The use of vehicles in a coastal protection zone and the reclamation of land, as well as the dredging of the Kromme Estuary, may require a permit (coastal lease) from the Coastal Conservation and Strategies Directorate of the DEA, Oceans and Coast Branch (DEA Oceans and Coasts).
- The DEA Oceans and Coasts have confirmed that once the EA application has been submitted to DEDEAT, all correspondence must be submitted to DEA Oceans and Coasts. Confirmation if the applicant will need to apply for reclamation of land, coastal lease and off-road vehicle (ORV) permits will be provided once the background information documentation (with supporting documents) has been provided to the DEA Oceans and Coasts.
- In line with the requirements of Section 48 to 50 of the National Environmental Management: Integrated Coastal Management Act 24 of 2008 (ICMA), the Sarah Baartman District Municipality (SBDM) has developed a Coastal Management Programme (CMPr) to guide integrated management of the coastal zone within the District Municipality's jurisdiction. The draft report was released on the 30th October for public review and response.
- The EIR must assess the potential risks and impacts that the natural environment will have on the proposed project in terms of storm surges, sea level rise and other coastal processes which occur in the area.

5.10 National Environmental Management: Air Quality Act (Act No. 39 of 2004, as amended)

The National Environmental Management: Air Quality Act (NEMAQA) is the principal legislation regulating air quality in South Africa. Its purpose is:

- *to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development;*
- *to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government;*
- *for specific air quality measures; and for matters incidental thereto.*

The objects of the Act are to:

(a) *to protect the environment by providing reasonable measures for—*
  - (i) *the protection and enhancement of the quality of air in the Republic;*
  - (ii) *the prevention of air pollution and ecological degradation; and*
  - (iii) *securing ecologically sustainable development while promoting justifiable economic and social development; and*

(b) *generally to give effect to section 24(b) of the Constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and wellbeing of people.*

The Air Quality Act empowers the Minister to establish a national framework for achieving the objects of this Act. The said national framework will bind all organs of state. The said national framework will inter alia have to establish national standards for municipalities to monitor ambient air quality and point, non-point and mobile emissions.

Relevance to the proposed project
• The proposed project does not require an Air Emissions Licence according to the NEMAQA; • The "best practicable means" must be implemented for the abatement of dust during construction and operation.

5.11 National Heritage Resources Act (Act No. 25 of 1999)

The protection of archaeological and paleontological resources is the responsibility of a provincial heritage resources authority and all archaeological objects, paleontological material and meteorites are the property of the State. "*Any person who discovers archaeological or paleontological objects or material or a meteorite in the course of development must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority*".

Relevance to the proposed project
• No person may alter or demolish any structure or part of a structure, which is older than 60 years or disturb any archaeological or paleontological site or grave older than 60 years without a permit issued by the relevant provincial heritage resources authority; • No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter or deface archaeological or historically significant sites; • The South African Heritage Resources Agency (SAHRA) and the Eastern Cape Provincial Heritage Resources Authority (ECPHRA) must be informed of the project.

5.12 Occupational Health and Safety Act (Act No. 85 of 1993)

The objective of the Occupational Health and Safety Act (OHSA) is to provide for the health and safety of persons at work. In addition, the Act requires that, "*as far as reasonably practicable, employers must ensure that their activities do not expose non-employees to health hazards*". The importance of the Act lies in its numerous regulations, many of which will be relevant to the proposed project (Table 5.5). These cover, among other issues, noise and lighting.

Table 5.5: Health and safety of persons at work according to the Occupational Health and Safety Act.

8: GENERAL DUTIES OF THE EMPLOYERS TO THEIR EMPLOYEES	
(1)	Every employer shall provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of his employees.
(2)	Without derogating from the generality of an employer's duties under subsection (1), the matters to which those duties refer include in particular- a) The provision and maintenance of systems of work, plant and machinery that, as far as is reasonably practicable, are safe and without risks to health; b) Taking such steps as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard to the safety or health of employees, before resorting to personal protective equipment; c) Establishing, as far as is reasonably practicable, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported and any plant or machinery which is used in his business, and he shall, as far as is reasonably practicable, further establish what precautionary measures should be taken with respect to such work, article,

	substance, plant or machinery in order to protect the health and safety of persons, and he shall provide the necessary means to apply such precautionary measures; d) Providing such information, instructions, training and supervision as may be necessary to ensure, as far as is reasonably practicable, the health and safety at work of his employees; e) As far as is reasonably practicable, not permitting any employee to do any work or to produce, process, use, handle, store or transport any article or substance or to operate any plant or machinery, unless the precautionary measures contemplated in paragraphs (b) and (d), or any other precautionary measures which may be prescribed, have been taken; f) Taking all necessary measures to ensure that tire requirements of this Act are complied with by every person in his employment or on premises under his control where plant or machinery is used; g) Enforcing such measures as may be necessary in the interest of health and safety; h) Ensuring that work is performed and that plant or machinery is used under the general supervision of a person trained to understand the hazards associated with it and who have the authority to ensure that precautionary measures taken by the employer are implemented; and authority as contemplated in Section 37 (1) (b).
14: GENERAL DUTIES OF EMPLOYEES AT WORK Every employee shall at work:-	
(a)	Take reasonable care for the health and safety of himself and of other persons who may be affected by his acts or omissions;
(b)	As regards any duty or requirement imposed on his employer or any other person by this Act, cooperate with such employer or person to enable that duty or requirement to be performed or complied with;
(c)	Carry out any lawful order given to him, and obey the health and safety rules and procedures laid down by his employer or by anyone authorized thereto by his employer, in the interest of health or safety;
(d)	If any situation which is unsafe or unhealthy comes to his attention, as soon as practicable report such situation to his employer or to the health and safety representative for his workplace or section thereof, as the case may be, who shall report it to the employer; and
(e)	If he is involved in any incident which may affect his health or which has caused an injury to himself, report such incident to his employer or to anyone authorized thereto by the employer, or to his health and safety representative, as soon as practicable but not later than the end of the particular shift during which the incident occurred, unless the circumstances were such that the reporting of the incident was not possible, in which case he shall report the incident as soon as practicable thereafter.
15: DUTY NOT TO INTERFERE WITH, DAMAGE OR MISUSE THINGS [S. 15 substituted by S. 3 of Act No. 181 of 1993.]	
	No person shall intentionally or recklessly interfere with, damage or misuse anything which is provided in the interest of health or safety.

Relevance to the proposed project

- The proponent must be aware of the principles and broad liability and implications contained in the OHSA and mitigate any potential impacts.

5.13 National Road Traffic Act (Act No. 93 of 1996)

The National Road Traffic Act (NRTA) provides for all road traffic matters and is applied uniformly throughout South Africa. The Act enforces the necessity of registering and licensing motor vehicles. It also stipulates requirements regarding fitness of drivers and vehicles as well as making provision for the transportation of dangerous goods.

Relevance to the proposed project

- All the requirements stipulated in the NRTA will need to be complied with during the construction and operational phases of the proposed project;
- The proposed project will likely require the use of the R330 provincial road as well as a number of other roads located within St Francis Bay.

5.14 Other Relevant Legislation

Other legislation that may be relevant to the proposed project includes:

- The Environment Conservation Act No 73 of 1989 (ECA) Noise Control Regulations, which specifically provide for regulations to be made with regard to the control of noise, vibration and shock, including prevention, acceptable levels, powers of local authorities and related matters;
- Provincial Nature and Environmental Conservation Ordinance (No. 19 of 1974), which lists species of special concern which require permits for removal. Schedules 1 to 4 list protected and endangered plant and animal species;
- Spatial Planning and Land Use Management Act (SPLUMA) (Act 16 of 2013 – came into force on 1 July 2015) aims to provide inclusive, developmental, equitable and efficient spatial planning at the different spheres of the government. This act repeals national laws on the Removal of Restrictions Act, Physical Planning Act, Less Formal Township Planning Act and Development Facilitation Act;
- Sarah Baartman District Municipality and Kouga Local Municipality By-Laws;

In addition to the above, the following spatial tools from the South African National Biodiversity Institute (SANBI) need to be taken into consideration:

- The South African Vegetation Map (Mucina and Rutherford);
- The Subtropical Thicket Ecosystem Programme (STEP);
- The Eastern Cape Biodiversity Conservation Plan (ECBCP); and
- The National Freshwater Ecosystem Priority Areas (NFEPA) project.

6 DESCRIPTION OF THE AFFECTED ENVIRONMENT

6.1 Climate

St Francis Bay is characterised by a warm, temperate climate, with average temperatures ranging between 18.5 °C in July to 24 °C in February. The coldest temperatures are experienced during July, where average temperatures may drop to a low of 8.2 °C. The warmest months include January and February (Figure 6.1). Rainfall in St Francis occurs throughout the year, averaging around 525 mm per annum. The highest rainfall occurs during August, averaging around 62 mm, while the lowest rainfall occurs during January (26 mm).

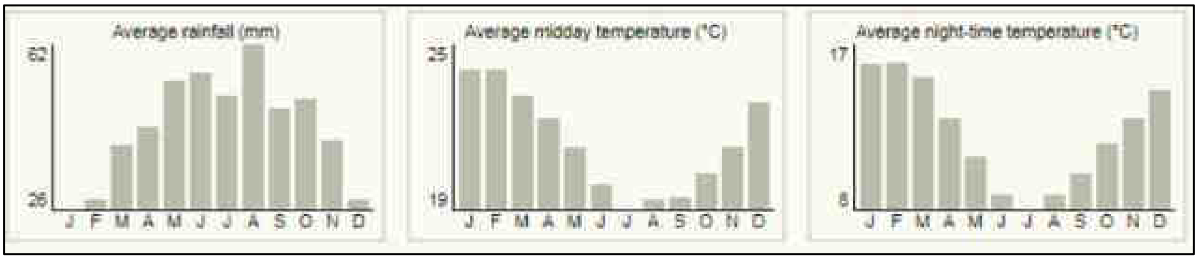


Figure 6.1 Average rainfall, midday temperatures and night time temperatures for St Francis Bay (SA Explorer, 2017).

6.2 Geology and Topography

St Francis Bay is characterised by relatively flat terrain (Figure 6.2), descending slightly towards the Kromme and Sand River channels that traverse the broader area. A deviation from the norm is evident along the coastal zone, where an elevation profile from a point inland in the west to the intertidal zone in the east, displays a steep decline from 7 m at the mean high water spring (MHWS) mark to 1 m just below the mean low water spring (MLWS) (Figure 6.3).

The underlying geology of the broader St Francis Bay area falls within the Cape Super Group, more specifically represented by the upper portions of the Table Mountain Group and the Bokkeveld Group (both subdivisions of the Cape Super Group) (Figure 6.4). Recent Cenozoic Aeolian deposits belonging to the Algoa Group largely mask the strata of the underlying geology in the surrounding area. The sediments of the Algoa Group have been accumulating for approximately 41 million years and represent a series of marine transgressions and regressions of the Agulhas Sea, which opened as a consequence of the early rifting between Africa and South America. The Schelm Hoek Formation, representing the most recent accumulation of aeolian deposits within the Algoa Group, is characterised by unconsolidated, calcareous sands interspersed by locally developed paleosols and Late Stone Age middens. The dune fields of the Schelm Hoek Formation can reach a thickness of 100 m.

The Table Mountain Group is characterised by quarzitic sandstones that were deposited along the coastal plains of the Agulhas Sea approximately 510-400 million years ago. It constitutes the first of three subdivisions of the Cape Super Group. The Table Mountain Group is unconformably overlain by the fine-grained sandstone and mudrock units of the Bokkeveld Group. The five coarsening-upward cycles, together with the abundance of marine invertebrate fossils, suggest the sediments of this group were deposited along the continental slopes of the Agulhas Sea Basin approximately 400 million years ago. The Ceres Subgroup constitutes the lower strata of the Bokkeveld Group. The underlying geology of the St Francis Bay area is especially important because of the abundance of the marine fossils which provides insight to early Agulhas Sea life. According to SOTER (2005), the soils within the St Francis Bay area are classified as Gleyic Arenosols (or Gelysols) - soils formed under waterlogged conditions, usually in low lying areas with shallow groundwater.

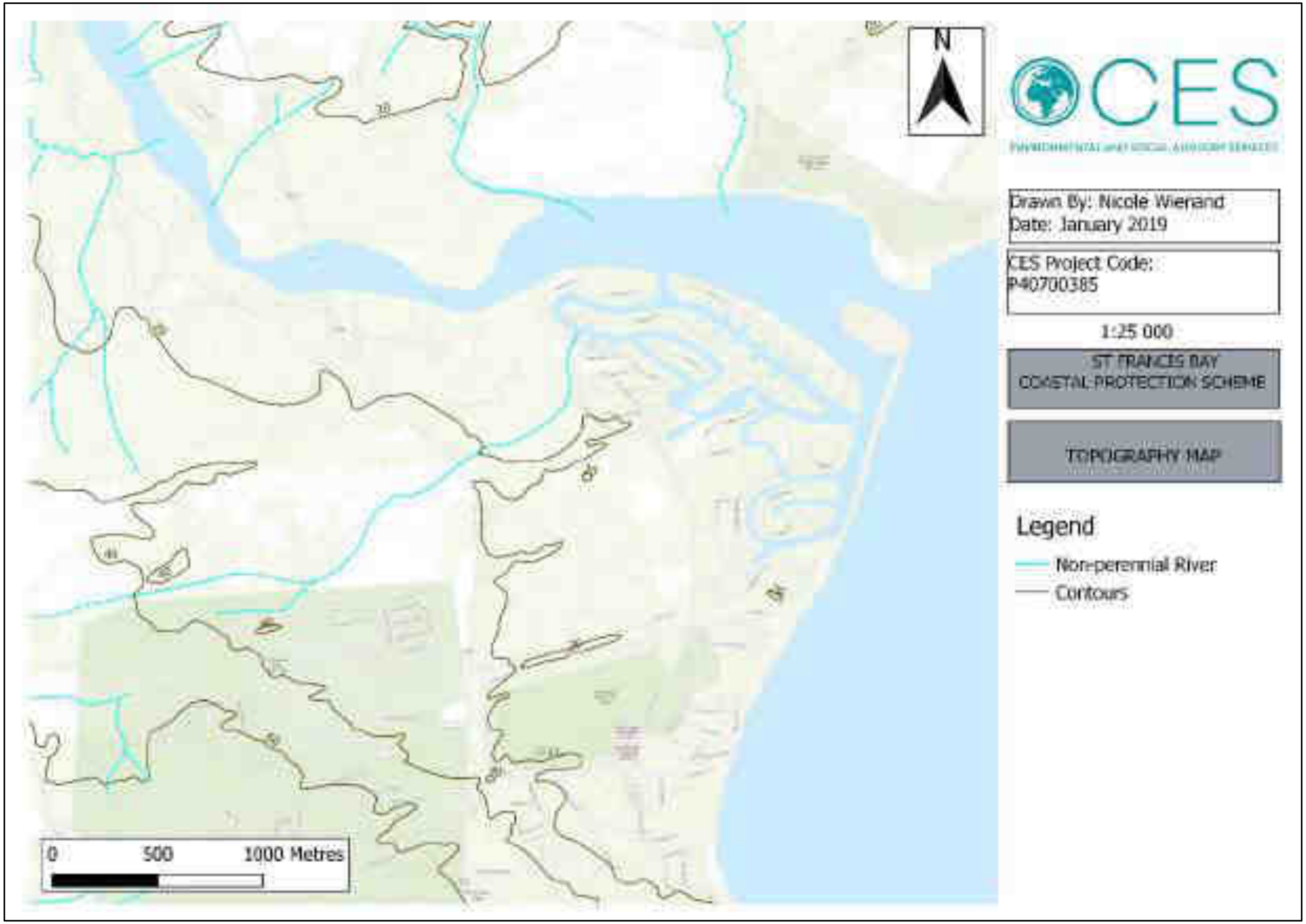


Figure 6.2: Topography of St Francis Bay

Figure 6.3: East-West elevation profile from a point inland in the west, to the intertidal zone in the east

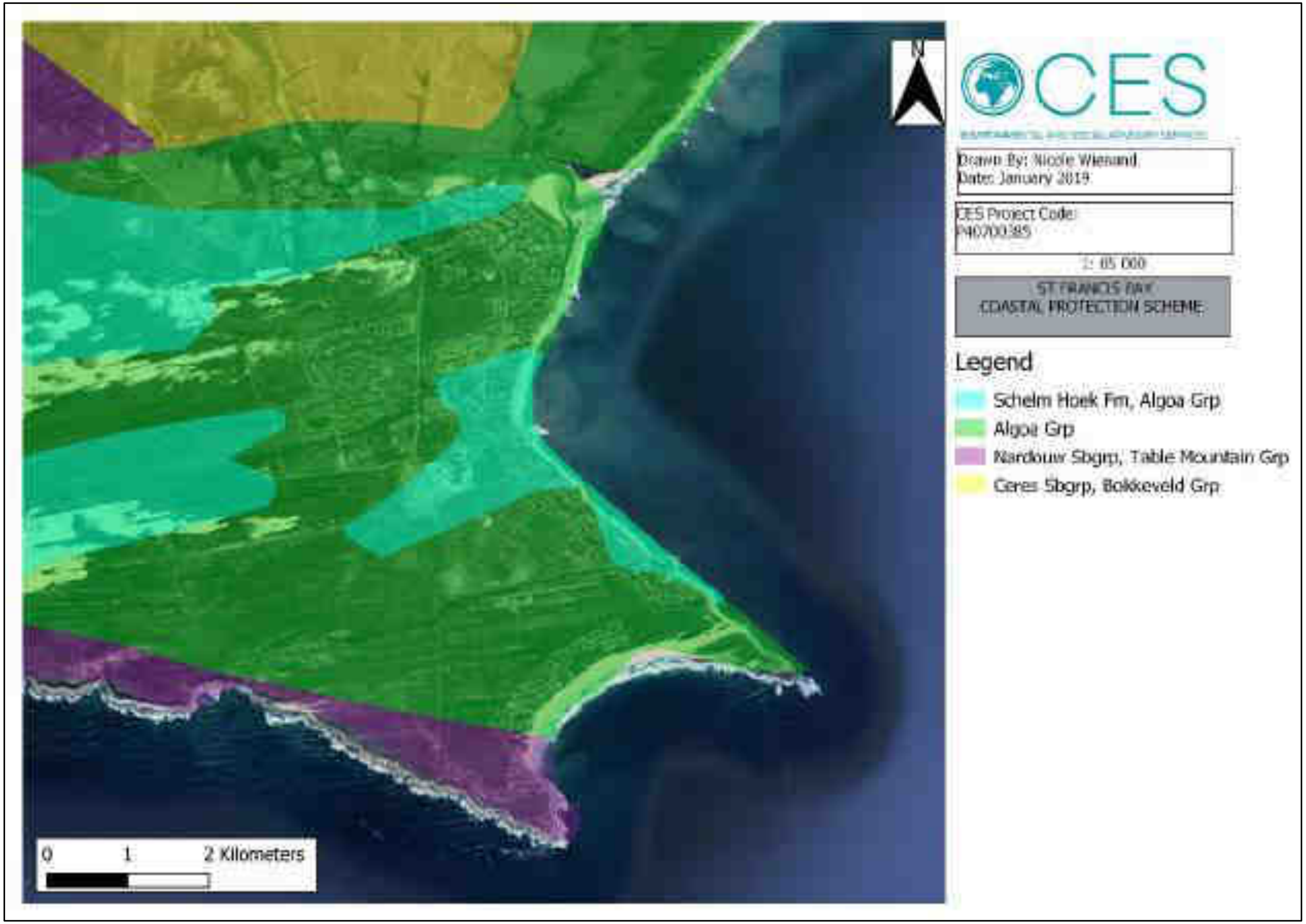


Figure 6.4: Geology of St Francis Bay

6.3 Land Use

According to the Kouga Municipality Spatial Development Framework (2015), the project site is classified as 'open space' and is located both within and outside the urban edge of St Francis Bay (Figure 6.5). The project will also be located within areas defined by the NEM ICM as coastal public property (i.e. the St Francis Bay beach as well as the Kromme River estuary).

6.4 Vegetation

The South African Vegetation Map (SA VEGMAP) of 2018 is an important resource for biodiversity monitoring and conservation management in South Africa. Under the custodianship of the South African National Biodiversity Institute (SAMBI) the SA VEGMAP (2018) was updated in order to provide floristically based vegetation units of South Africa, Lesotho and Swaziland at a greater level of detail than had been available before.

The map provides a detailed description of each of South Africa's unique vegetation types along with a comprehensive list of the important species associated with each, including endemic and biologically important species. According to the SA VEGMAP (2018) spatial dataset, the vegetation of the proposed project area consists of (Figure 6.6):

- Cape Seashore Vegetation;
- St Francis Dune Thicket;
- Elands Forest Thicket;
- Sunday's Mesic Thicket; and
- Albany Alluvial Vegetation.

These vegetation types are discussed briefly below.

<u>Cape Seashore Vegetation</u>

Cape Seashore Vegetation typically occurs on recently deposited coastal sandy sediments forming dunes and beaches, along the Eastern and Western Cape Provinces of South Africa. It stretches along the temperate coasts of the Atlantic and Indian Ocean, from Olifants River mouth to Cape Agulhas in the south west; and from Cape Agulhas to East London in the south. This vegetation type is characteristic of beaches, coastal dunes, dune slacks and coastal cliffs. It ranges from open grassy and herbaceous vegetation to dwarf-shrubby vegetation, often dominated by a single pioneer species. The age of the substrate and natural disturbance regime (moving dunes), coupled with the distance from the upper tidal mark and the exposure of the dune slope (leeward verses seaward), influences the composition of the plant communities present (Mucina et al., 2006).

Cape Seashore Vegetation is classified as Least Concern (Skowno et al., 2019), with a conservation target of 20%. Almost half of the area is statutorily conserved in formal protected areas, including National Parks and Nature Reserves, while a considerable portion is protected in a number of private conservation areas. Only 1.7% of this vegetation type has been transformed, mainly as a consequence of urban development (Mucina et al., 2006).

St Francis Dune Thicket

St Francis Dune Thicket occurs on flat to moderately undulating coastal dunes from Tsitsikama River Mouth to Sundays River Mouth within the Eastern Cape Province. It is characterised by a mosaic of low (1-3 m) thicket and asteraceous fynbos. The thicket component is dominated by small bush clumps, consisting of small trees and woody shrubs, which are best developed in fire-protected dune slacks, while the fynbos component occurs on dune slopes and crests. The fynbos component becomes less prominent towards the eastern distribution of this vegetation type. The geology underlying this vegetation type is mainly restricted to the Schelm Hoek Formation (Grobler et al., 2018).

St Francis Dune Thicket is classified as poorly protected, with a Conservation Target of 19%.

Elands Forest Thicket

This vegetation type occurs in between St Franics Bay and Uitenhage and is associated with moderate slopes around the Elands River, Seekoei River, and Kromme River. It consists of medium-sized to tall (3 - 5 m) thicket with a canopy composed of trees (e.g. *Olea europaea subsp. cuspidata*, *Pittosporum viridiflorum*) and emergent succulent trees like *Euphorbia tetragona*. Elands Forest Thicket was historically encompassed by fire-prone shrublands (renosterveld and grassy fynbos), and the periodic fires experienced here likely prevented the establishment of true forest vegetation (Vlok & Euston-Brown 2002).

The vegetation is classified as poorly protected, with a Conservation Target of 19%.

<u>Sundays Mesic Thicket</u>

Sundays Mesic Thicket occurs at the southern foot of the Zuurberg Mountains from Skurweberg near Kirkwood in the west to Nuweposkop near Paterson in the east. Smaller areas occur along the south-eastern slopes of the Groot Winterhoek and Elandsberg Mountains around Uitenhage, in incised valleys around Addo Heights, and in the lower reaches of river valleys and adjacent coastal forelands from the Gamtoos River south-eastward to Kromme River Mouth. It is characterised by medium-sized to tall (3 - 5 m) thicket dominated by small trees and woody shrubs, with *Cussonia spicata* and *Euphorbia triangularis* emergent above the canopy.

The vegetation is classified as well protected, with a Conservation Target of 19%.

<u>Albany Alluvial Vegetation</u>

This vegetation type occurs between East London and Cape St Francis on wide floodplains (usually close to the coast where the topography becomes flatter) of large rivers such as the Sundays, Zwartkops, Coega, Gamtoos, Baviaanskloof and Great Fish River. This alluvial ecosystem is embedded within the Albany Thicket Biome.

Two major types of vegetation pattern are observed in these zones, namely riverine thicket and thornveld (*Acacia natalitia*). The riverine thicket tends to occur in the narrow floodplain zones in regions close to the coast or further inland, whereas the thornveld occurs on the wide floodplains further inland. At least two endemic plant species occur in the ecosystem. Approximately 6% of the ecosystem is protected in the Greater Addo Elephant National Park, Baviaanskloof Wilderness Area, Loerie Dam, Springs, Swartkops Valley and Yellowwoods Nature Reserves and the Double Drift Reserve Complex. A further 2% is found in eight private conservation areas.

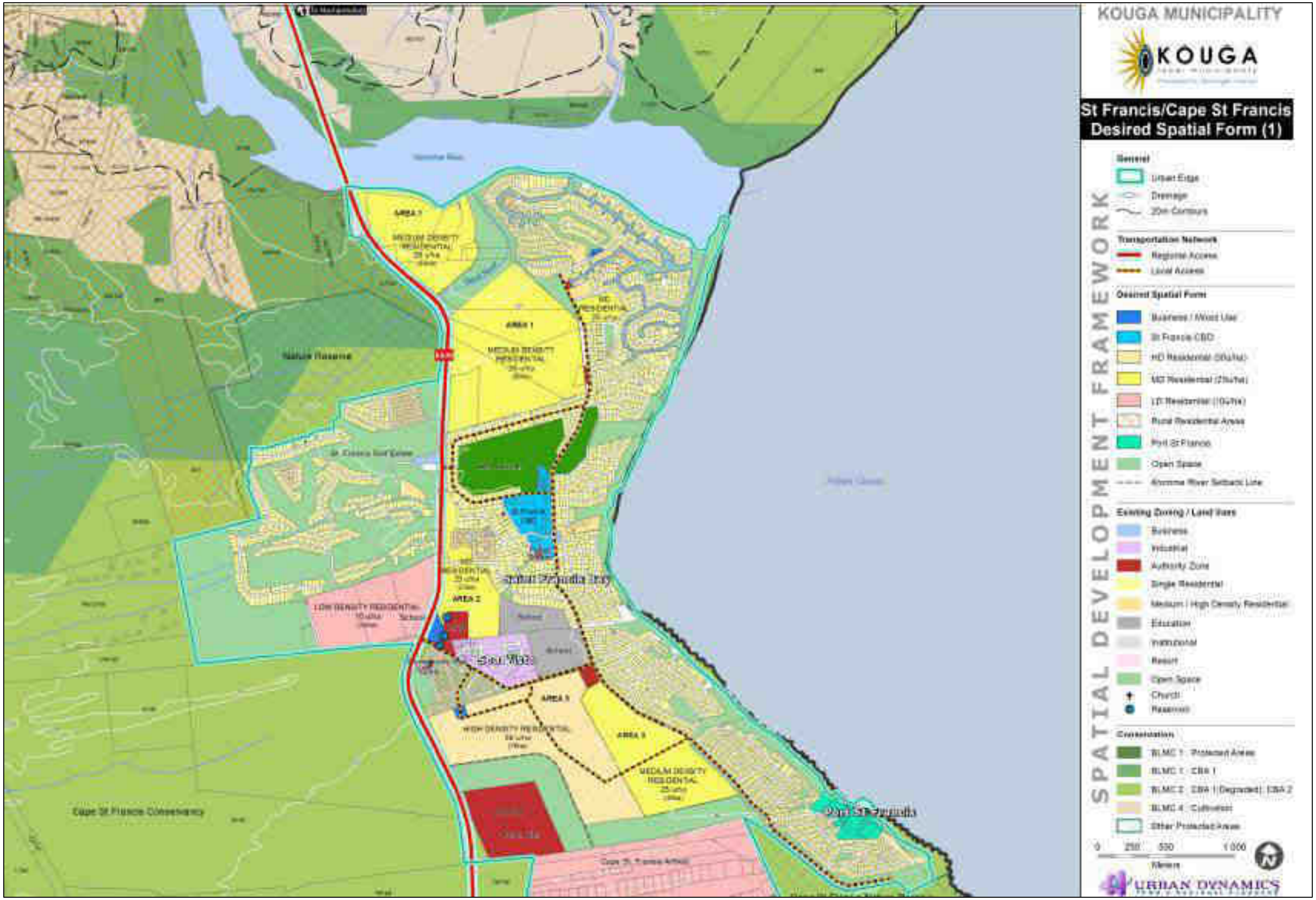


Figure 6.5: Land use at the project site and surround St Francis Bay area (Kouga Municipality Spatial Development Framework, 2015).

6.5 Protected Areas

The application area does not fall within any formally protected areas or within any delineated National Protected Areas Expansion Strategy (NPAES) Focus Areas (Figure 6.7). The closest National Park to the application area is the Tsitsikama National Park (62 km west of the application site) and the Addo Elephant National Park (103 km north east of the application site). The closest protected areas are the Kromme River Mouth Private Nature Reserve (380 m North); the Rebelsrus Private Nature Reserve (6.3 km south west); and lastly the Erma Booysen Florareservaat Local Authority Nature reserve and Seal Bay Local Authority Nature Reserve (both located approximately 3 km south of the application site). In addition, the Kromme Estuary is identified as an ‘estuarine’ wetland as defined by the National Freshwater Ecosystem Priority Areas (NFEPA). The NFEPA database also defines a number of smaller artificial and natural wetlands which are located around the estuary (Figure 6.8).

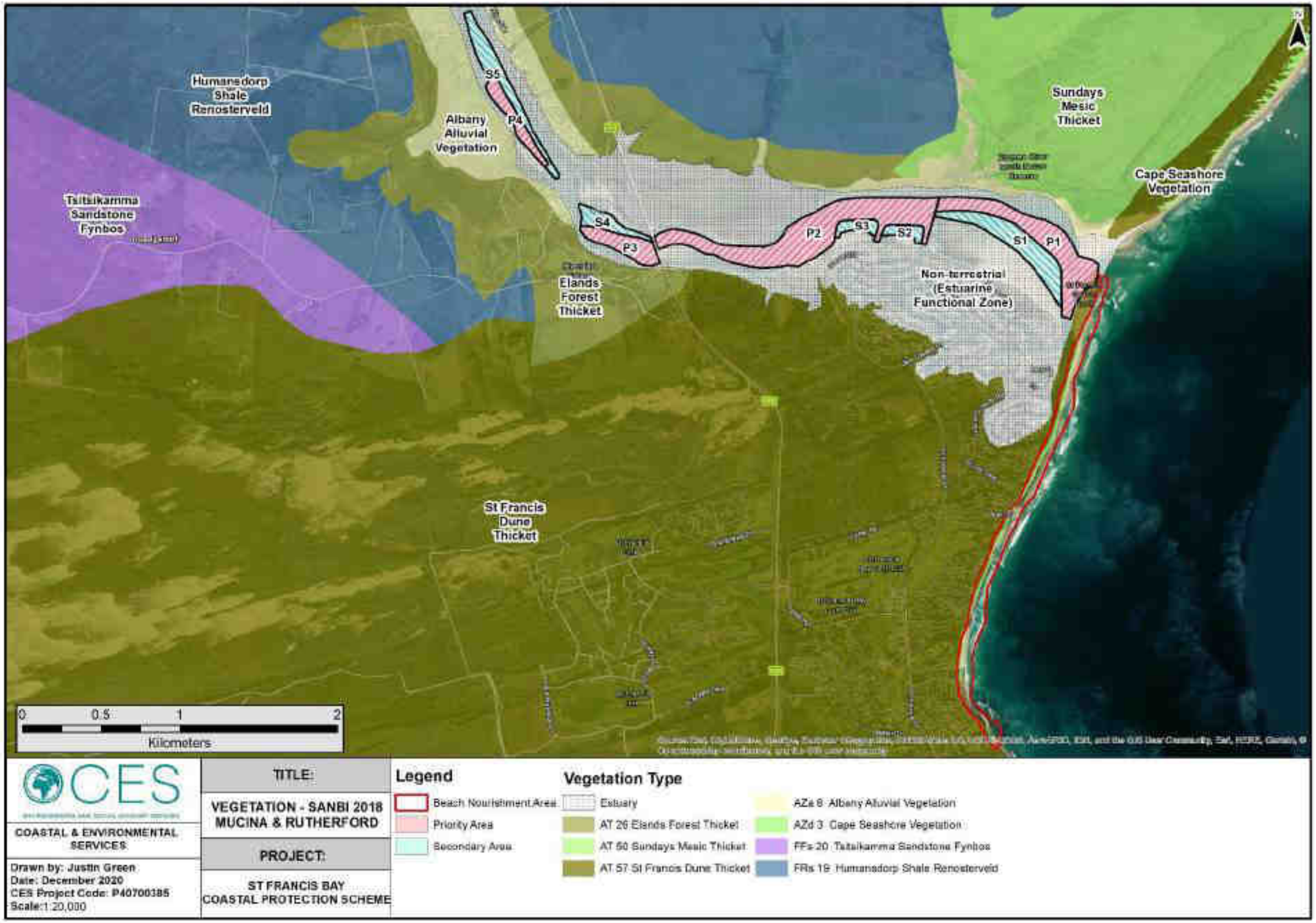


Figure 6.6: SANBI Vegetation map

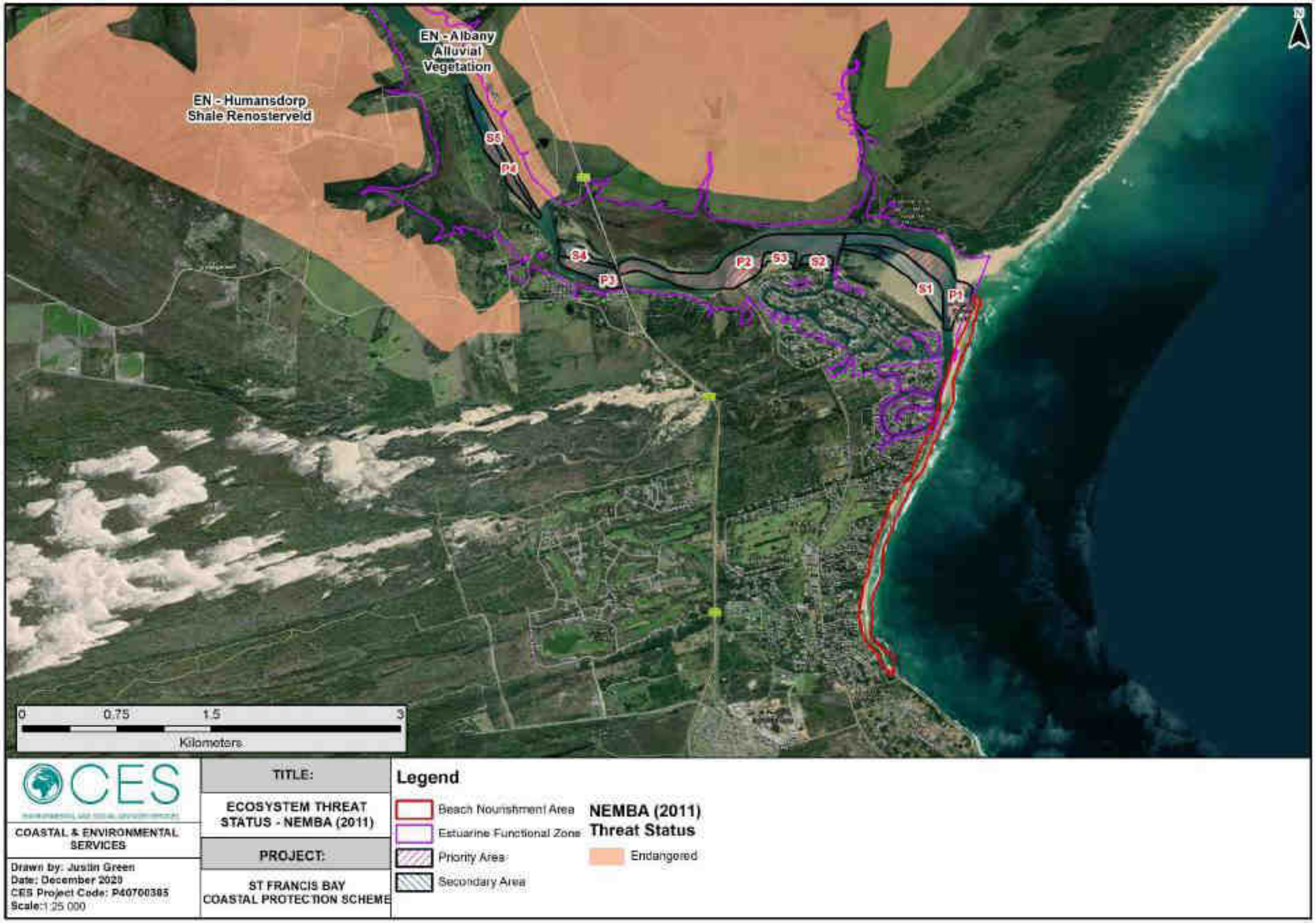


Figure 6.7: NEMBA threatened ecosystems in the broader St Francis Bay area.

6.6 Threatened Ecosystems

The National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA) published a national list of ecosystems that are threatened and in need of protection (GN. 1002 of 2011).The application site is not located in any threatened ecosystems as legislated by NEMBA and the nearest threatened ecosystem is the Humansdorp Shale Renosterveld (classified as endangered) located approximately 1.3 km north-west (refer to Figure 6.7).

The Eastern Cape Biodiversity Conservation Plan (ECBCP, 2019) replaces the ECBCP (2007) in its entirety and provides a map of important biodiversity areas, outside of the Protected Areas network, which must be used to inform land use and resource-use planning and decision making.

The aim of the ECBCP (2019) was to map biodiversity priority areas through a systematic conservation planning process. The main outputs of the ECBCP include Protected Areas (PA), Critical Biodiversity Areas (CBA), Ecological Support Areas (ESA), Other Natural Areas (ONA) and No Natural Habitat Remaining (NNR) for both terrestrial and aquatic ecosystems.

According to the ECBCP the application site falls within a terrestrial and aquatic CBA1 (Figure 6.9 and 6.10).

Table 6.1: Description of the CBA designations.

CBA area	Desired State	Management requirements
CBA1	Natural	Maintain in a natural state (or near-natural state if this is the current condition of the site) that secures the retention of biodiversity pattern and ecological processes: For areas classified as CBA1, the following objectives must apply: Ecosystem and species must remain intact and undisturbed; Since these areas demonstrate high irreplaceability, if disturbed or lost, biodiversity targets will not be met; Important: these biodiversity features are at, or beyond, their limits of acceptable change. If land use activities are unavoidable in these areas, and depending on expert opinion of the condition of the site, a Biodiversity Offset must be designed and implemented.

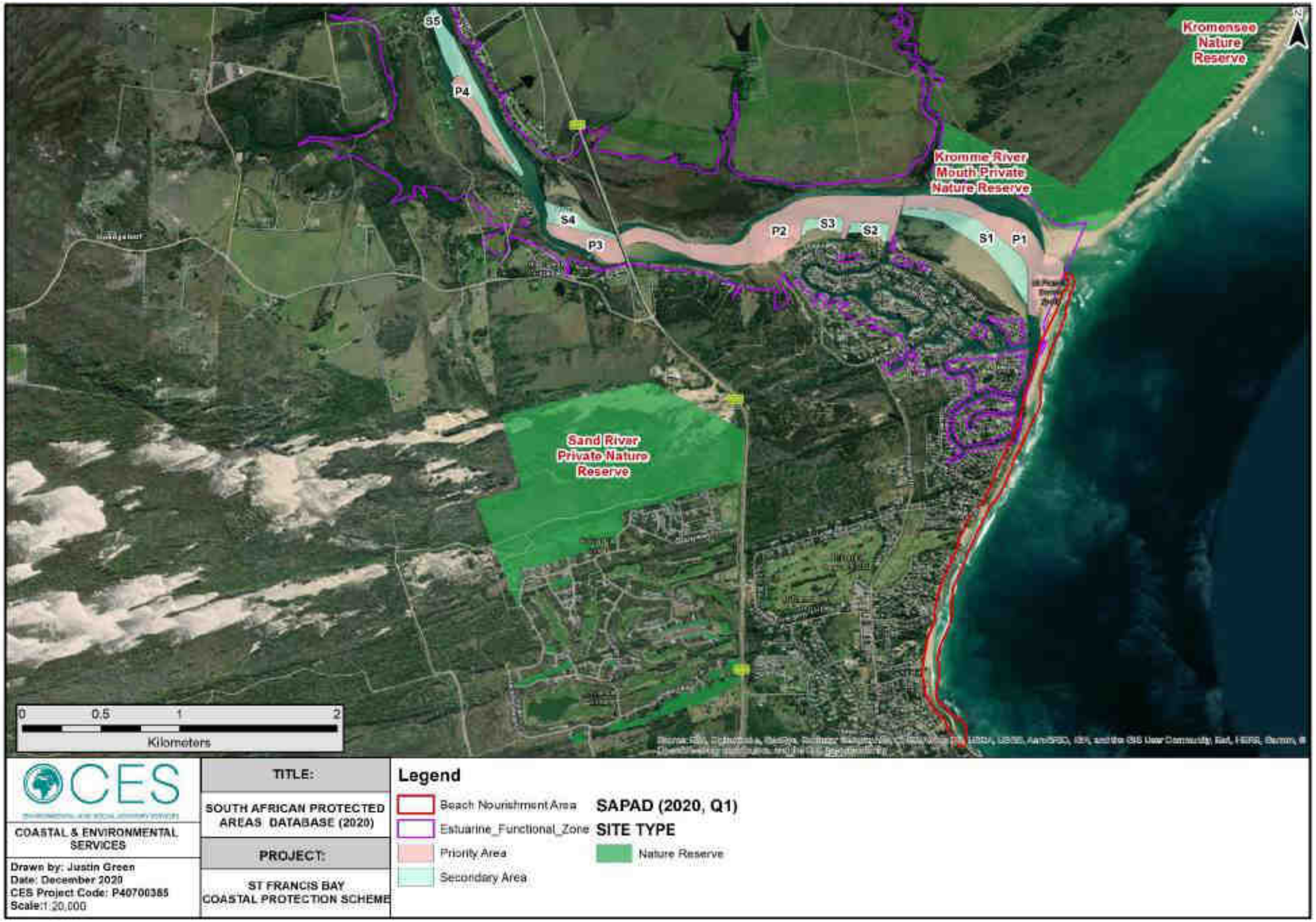


Figure 6.8: Surrounding protected areas and their distances to the estuary and beach study sites.

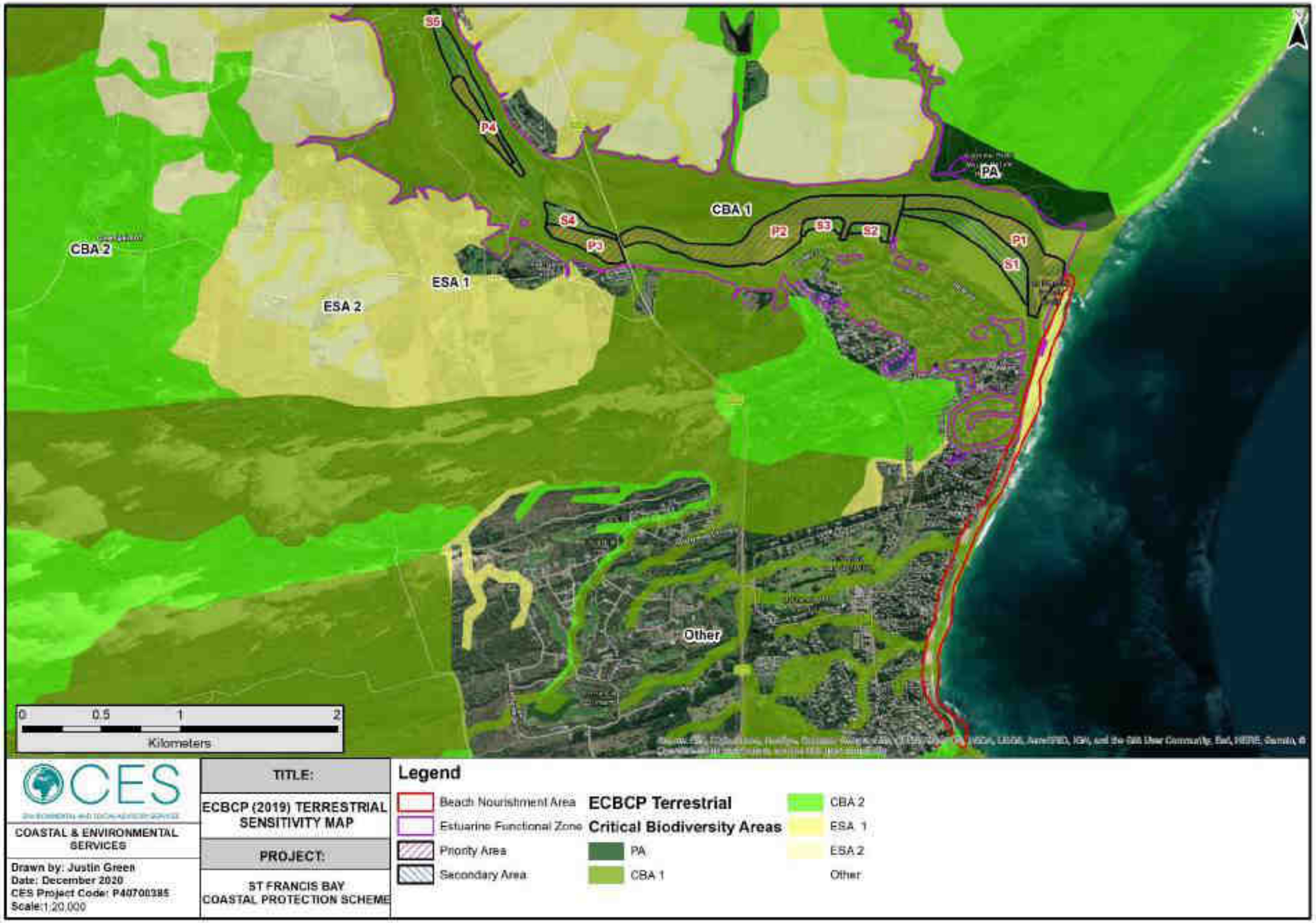


Figure 6.9: Critical Biodiversity Areas of St Francis Bay

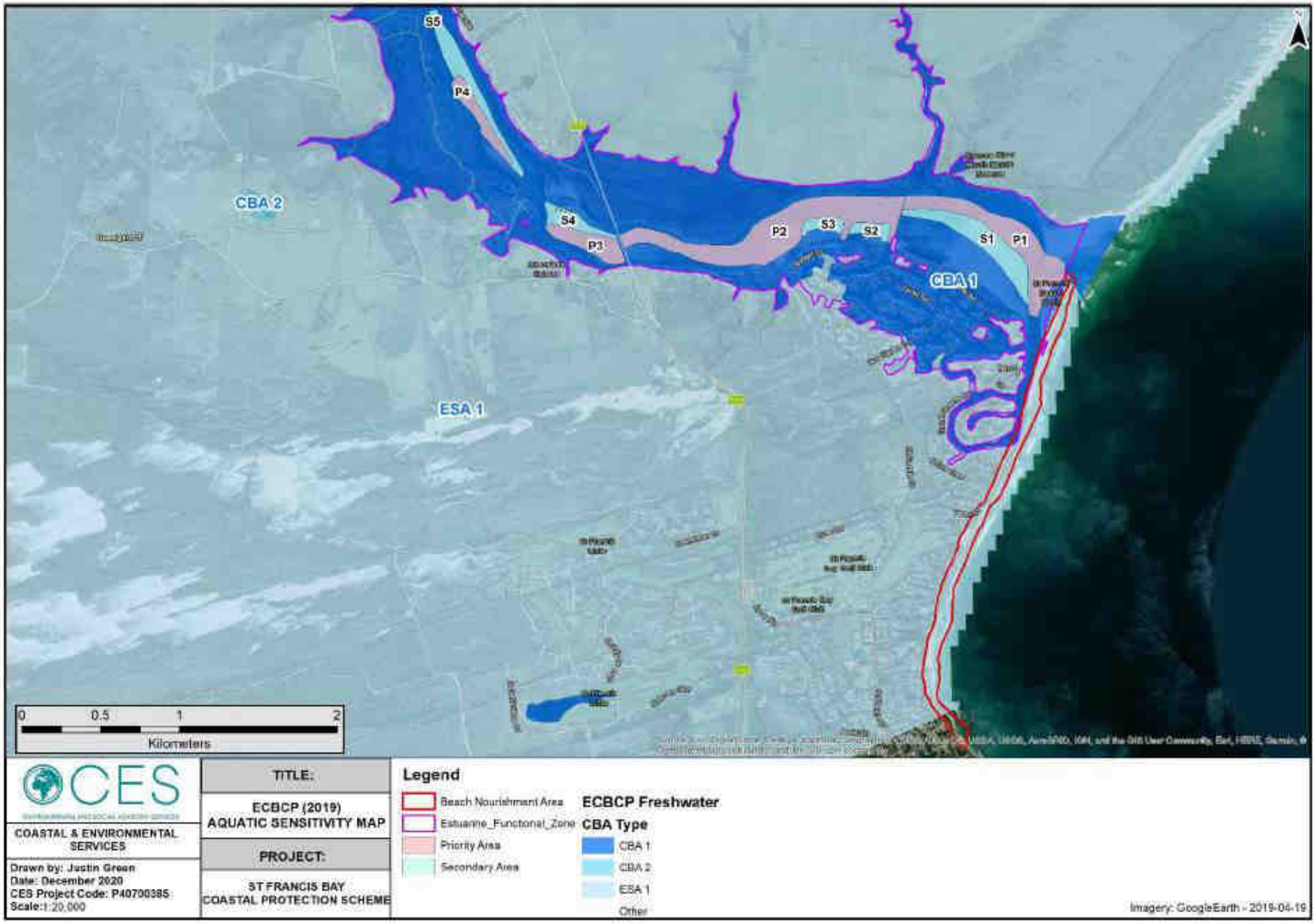


Figure 6.10: Critical Aquatic Biodiversity Areas of St Francis Bay

6.7 Physical marine environment and hydrodynamic conditions

The south-east coast of South Africa is characterised by a particularly dynamic marine environment. The south-east coast of South Africa is a region with relatively high-energy shores, dominated by waves from the south-westerly quarter. The relatively exposed nature of St Francis Bay, together with the complex interaction between coastal and estuarine processes, has resulted in the drastic removal of sediment and the consequent beach erosion observed over the last two decades. Waves along this stretch of coast typically approach from the west-southwest, as a consequence of the prevailing wind, reaching maximum heights of up to 12 m. Variation in wave frequency and intensity is observed during cold fronts which occur on average every three to five days during winter months. The dominant winds approach from the west to south-west, however easterly winds are a common occurrence. Sea surface water temperatures are generally warm, ranging from 22-25°C in February to 18-20°C degrees in August. Deviations from the norm are observed during periods of sporadic upwelling, when sea surface water temperatures may drop to a low of 8°C. Tides are classified as semidiurnal, with the maximum tidal range rarely exceeding 2 m.

The south east orientation of St Francis Bay results in significantly lower and more variable wave energy regimes than the exposed southern oriented coastlines of South Africa (Figure 6.11). This is principally due to this beach being sheltered from the persistent waves and swells generated by west and southwest winds. The predominant south westerly waves, which occur approximately 80% of the time, must angle themselves around the Cape St Francis headland in order to enter the bay, which results in waves that approach the beach at an angle and drive alongshore currents to the east along much of this coast. These wave-driven currents also transport sand in an easterly direction, and in the absence of a sand supply, result in net erosion. Easterly wave events are often generated relatively locally, resulting in short period high waves (known as steep waves) that result in direct erosion of sand off the beach face and into deeper water. Thus, sediment is 'zigzagged' up the coast, away from St Francis Bay. This combination of wave events and the lack of a constant sand supply must be addressed in order to provide long-term coastal protection, and reinstate the wide sandy beach that first attracted people to the area (ASR Ltd, 2006).

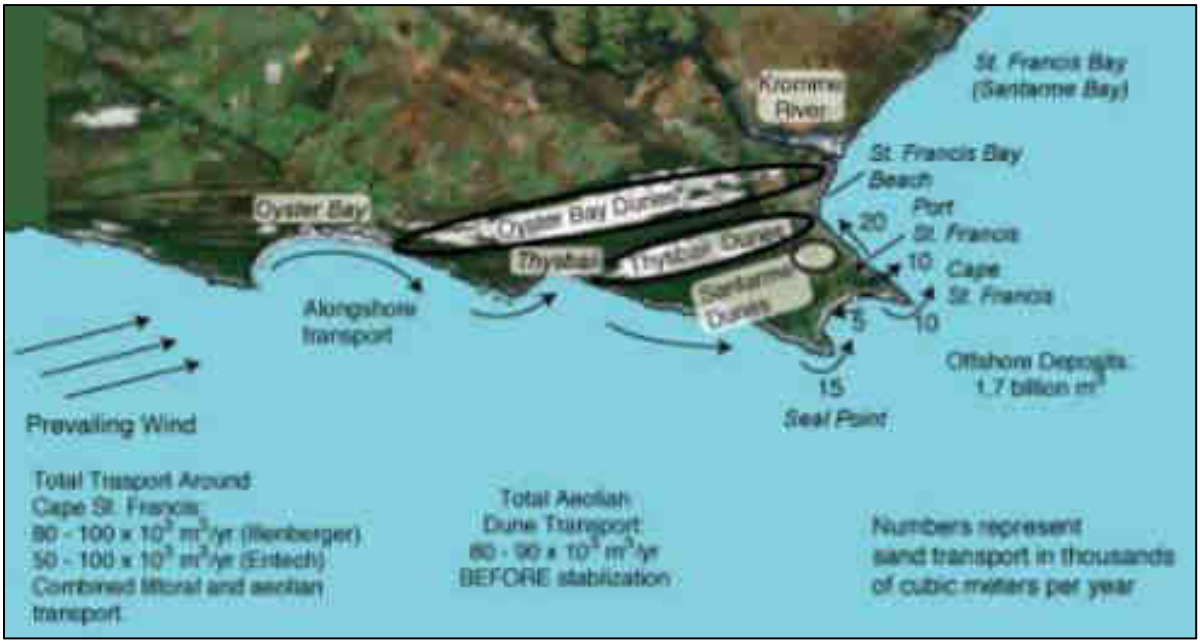


Figure 6.11: Sediment movement around St Francis Bay area (from ASR Ltd, 2006).

Estimates for the total amount of sediment moving around Cape St. Francis from west to east vary between 50 and 100 thousand cubic meters per year. Illenberger (2001) estimates a range of 80 – 100,000 m^3 per year while the Entech (2002) report gives a wider range of 50 – 100,000 m^3 per year. Of this total amount, the transport is divided between wave driven littoral transport along the coast and around the headland, and wind driven (aeolian) transport across Cape St Francis through the headland bypass dune systems. It is believed that the largest fraction of the total sediment transport across the region is through aeolian processes moving sand through the dune fields (ASR Ltd, 2006).

The net shoreline retreat along the St Francis Bay beach has been approximately 30 m to 50 m over the past 30 years. This is a shoreline retreat of between 1m and 1,5m per annum, and is regarded as very significant. This has resulted from increased sediment-carrying capacity within the lower reaches of the Kromme Estuary, resulting in less sediment available to accumulate on the St Francis Bay beach. The increased sedimentation potential of the lower reaches of the river is a direct result of the construction of several dams further upstream, which act as sediment traps.

In 2020, Advisian revised the numerical wave and shoreline modelling to assess the proposed changes to the overall groyne layout of the St. Francis Bay coastal protection scheme (please refer to Appendix F for more information). The model was updated using updated bathymetric and topographic data and as a result, more accurate nearshore wave climates were established to assess the shoreline evolution along the project site due to the construction of the coastal protection scheme.

The wave climate in St Francis Bay is considered relatively mild since most of the offshore swell wave energy is substantially reduced in wave height due to the shelter offered by Cape St. Francis, as well as refraction and diffraction effects (Figure 6.13). However, local strong winds can generate strong short-period waves throughout St Francis Bay, which enhances the harshness of the coastal environment (Figure 6.12) (Advisian, 2020).

The reductions in wave heights in the nearshore are due to the combined effects of offshore shoals, refraction, diffraction, bed friction losses and wave breaking.

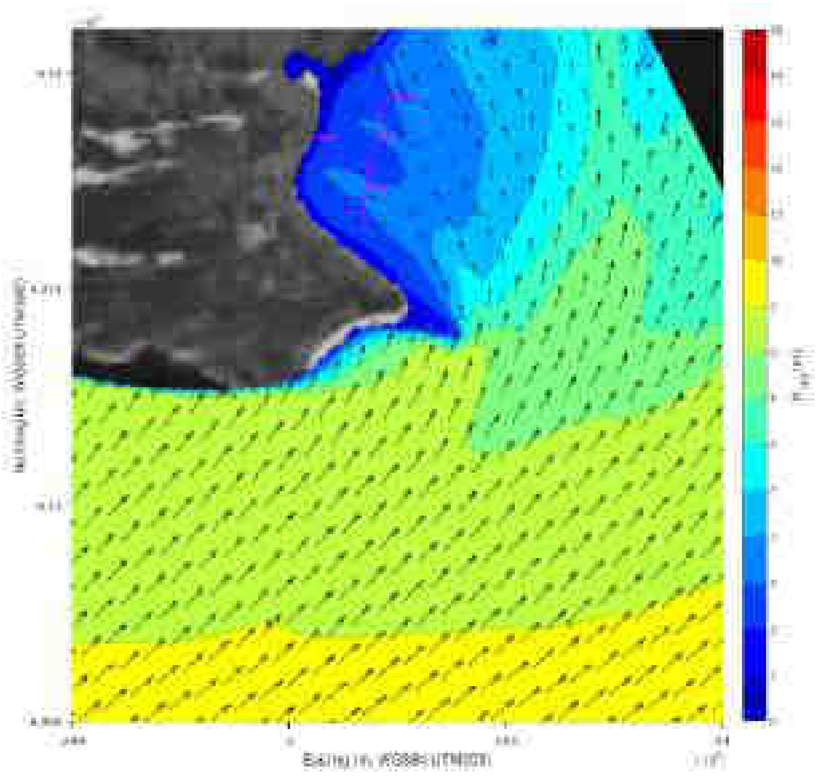


Figure 6.12 Extreme wave condition and direction illustrating sheltering effects of Cape St Francis. Arrows show the direction of the waves

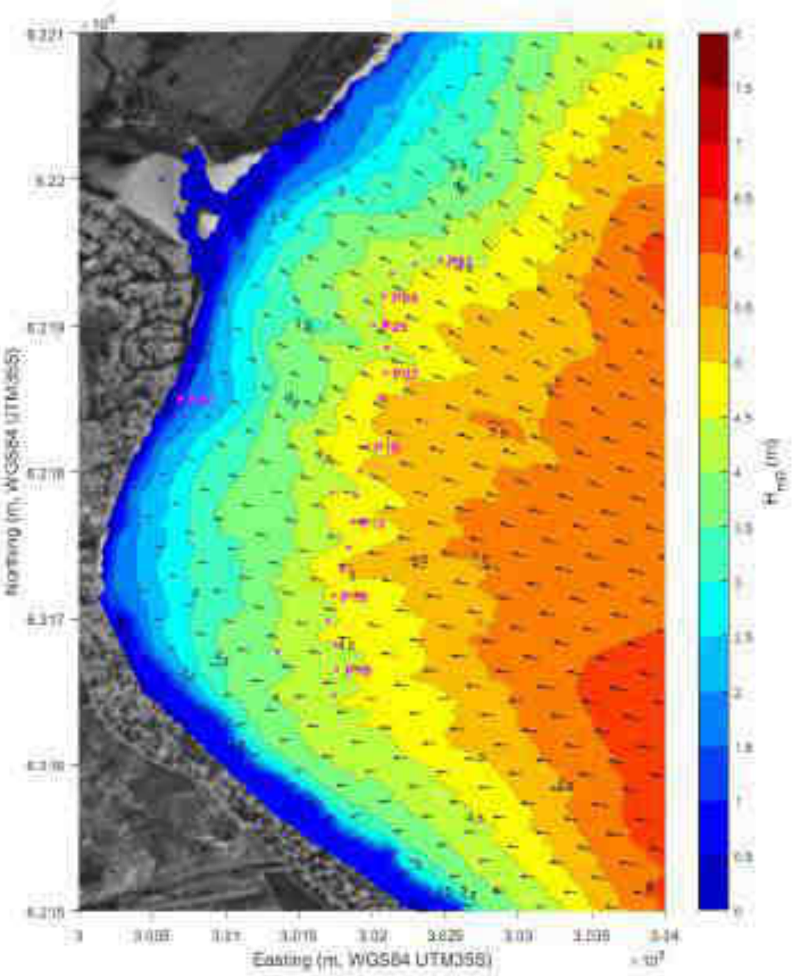


Figure 6.13 Simulated wave condition and direction for the strongest easterly wind and swell conditions. Arrows show the direction of the waves

The sediment transport along the coast is defined by the angle of incidence of the dominant wave direction and the energy in the waves. In order to validate the modelling the shoreline evolution was run for a 45 year modelling period (1975 – 2020) and compared to the current situation (Figure 6.14). The model for St Francis reproduces the historical shoreline changes due to the reduction of available sand supply (damming of the Kromme river and stabilization of Santereme dunes) over the past decades, and the effect of the constructed rock revetments sufficiently well to allow its application in the assessment of the proposed coastal protection scheme.

Figure 6.15 illustrates the long-term shoreline evolution (with and without nourishment) in response to the installation of the groynes. The model shows that the construction of the long-term coastal protection scheme will have an impact on the northern coast in terms of creating an erosional environment. However, this effect is considered relatively limited as the length of the groynes do not extend sufficiently far offshore to fully block the entire littoral drift.

In addition, the existing and future imported sand will still travel towards this northern beach area due to longshore processes, as long as maintenance nourishment of at least 6,000 m^3/year for each of the embayments south of the spit, and at least 10,000 m^3/year for the remaining embayment at the spit takes place on a regular basis.

The proposed groyne scheme in combination with beach maintenance will provide a continuous supply of sediment of approx. 28,000m^3 per year that will be transported towards the northern coastline when the complete solution is implemented. This is considered to be more beneficial to the northern coastline than the current situation (no-go scenario). Allowing the St Frances Beach to erode to the extent where negligible sediment transport can occur would result in the northern beaches experiencing accelerated erosion.

Figure 6.14 provides the shoreline evolution of St. Francis Bay beach for the 45-year modelling period considered (1975 – 2020)

Figure 6.15 Long term shoreline planform, with the groynes installed, with and without nourishment (2020 – 2045)

6.8 Marine ecology

St Francis Bay is within the warm temperate Agulhas Bioregion, one of four inshore bioregions spanning the coast of South Africa (Porter, S. Hutchings, K and B.M. Clark. 2012). This bioregion extends from the Mbashe River in the Eastern Cape west to Cape Point. It is considered an important area of mixing where warm Agulhas Current water mixes with cool Benguela Current water. The continental shelf also extends considerably further offshore relative to the east and west of this bioregion (Porter, S. Hutchings, K and B.M. Clark. 2012).

These characteristics of the coast play an important role in providing habitat for many organisms and contribute to the maintenance of important fisheries (Wallace et al. 1984). The wide oceanic shelf provides and a range of habitats and the temperature mixing also plays a large role in accounting for the highest number of endemic fish species along the South African coast (Wallace et al. 1984).

Three main substrate types comprise the St Francis Bay off-shore area, with the dominant type being sand, and low-profile scoured reef and elevated reefs (e.g. the Umzumawethu reef) in the shallower off-shore areas.

Subtidal trawl and dredge surveys conducted mainly over soft bottom habitats from Mossel Bay to Cape Padrone recorded high diversities of polychaetes (56 species of bristleworms), followed by gastropods (53 species of snails) , ophiuroids (9 species of brittlestar) and mysids (4 species of shrimps) (Wallace et al. 1984). Wallace et al. (1984) also conducted inshore ichthyofauna surveys using otter-nets, blanket nets, try nets, scoop-nets and dredges in an effort to gain an understanding of the fish community composition the same survey in St Francis Bay and these catches are summarised in Table 6.2.

Table 6.2 Proportion that each species (%) caught in inshore trawls contributes according to the frequency of that species relative to that of the total catch in St Francis Bay.

Species Name	Common Name	Habitat	Percentage of Catch
Myliobatus Aquila	Eagle ray	Shallow water to 95m	0.9
Squalus megalops	Spiny dogfish	Shore down to 500m, usually claose to bottom, juveniles pelagic over continental shelf	1.65
Argyrosomus inodorus	Silver kob	Important nursery areas are sandy and muddy substrata of the nearshore, shandy reef edges and estuaries	4.13
Galeichthys feliceps	White sea-catfish	Sheltered reefs or muddy bottom down to 100m	16.45
Merluccius capensis	Hake	In water between 50-400m deep. Closer to the surface at night	6.38
Pomadasys olivaceum	Piggy grunter	Juveniles and adults in coastal waters. Often over offshore reefs and soft substrate banks	30.08
Pagellus natalensis	Red tjor tjor	Deep water species brought closer inshore by upwelled water over sandy bottoms	6.65
Pterogymnus laniarius	Panga	Adults over rocky reefs 20-230m deep	5.75
Pomatomus saltatrix	Shad	Predatory over sandy bottoms and reef edges	17.31
Trachurus trachurus	Maasbanker	Pelagic, surface to 400m	5.75

Wallace et al. (1984) findings for the soft bottom species were corroborated through the National Biodiversity Assessment (2011) results, where the majority of the coastal and nearshore habitats for the study area were considered to be sandy substrate (Figure 6.16).

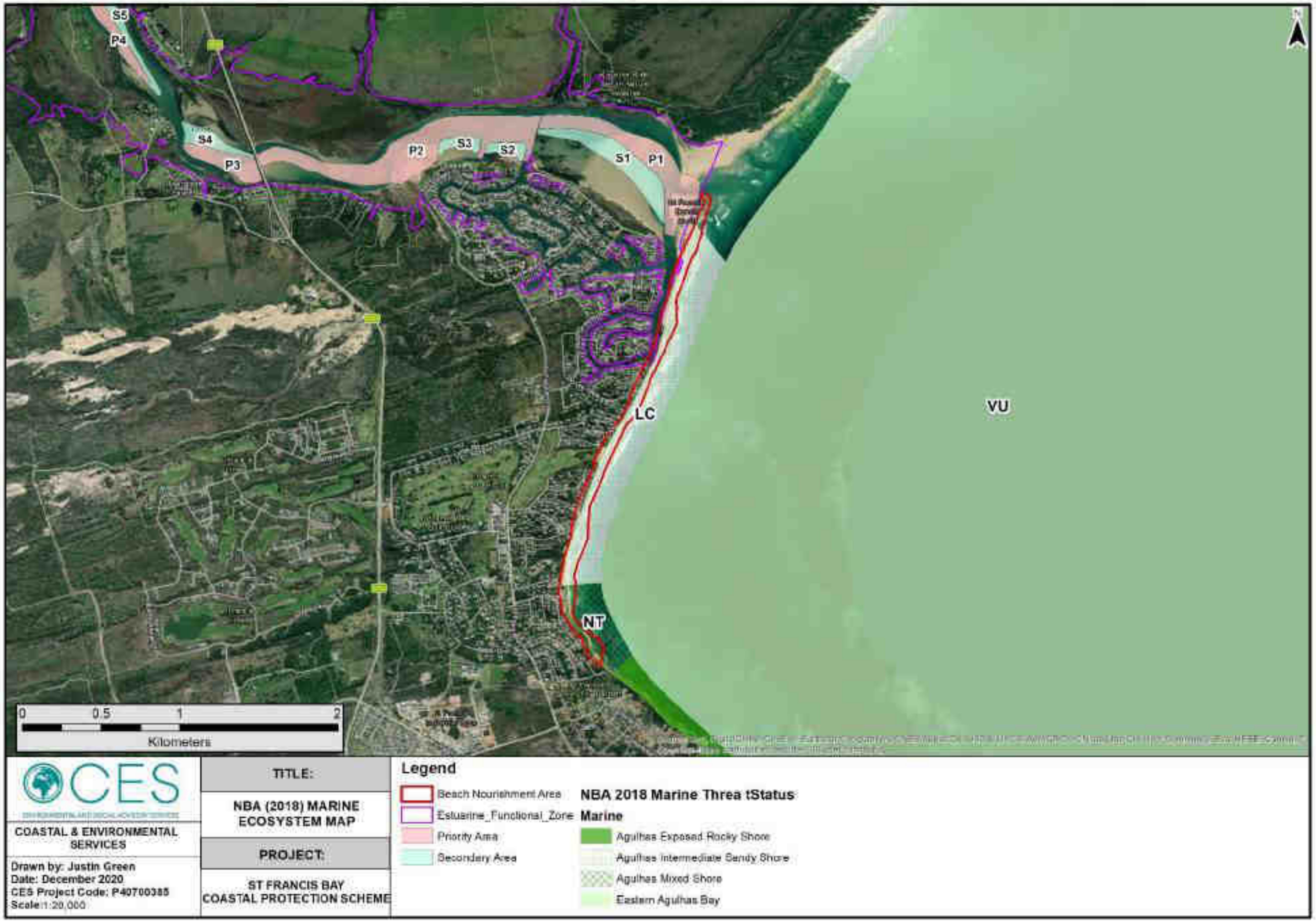


Figure 6.16 Marine Benthic substrate characteristics (NBA, 2011, 2018).

There are two prominent reefs located off-shore the St Francis Bay beach, namely the Umzumawethu reef and the Anne Avenue reef (Plate 6.1). According to ASR (2006), the Umzumawethu reef is only approximately 1 m above the height of the adjacent sea bed. It is, however, relatively large in extent and is therefore a significant control point for the St Francis Bay Beach, resulting in the 'dog-leg' (curving) shape between the Kromme Entrance and the reef.

Plate 6.1. Approximate position of the Umzumawethu reef

The first survey of the bathymetry of the St Francis Bay off-shore area was undertaken in December 2005. Due to the influence of the reefs on the shape of St Francis Bay Beach (as described above) high resolution bathymetry survey of the Umzumawethu and Anne Ave reefs was undertaken and combined to the existing survey data. Additional data digitized from the nautical chart for the area, acquired from ASR, and beach profiles were also incorporated into the bathymetric data. During spot dives conducted by ASR, a number of small low scoured reefs were identified where populations of red algae (Figure 6.17) dominate, particularly *Plocamium corallorhiza, P. Cornutum, Pterosiphonia cloiophylla, Hypnea spicifera, Chondrococcus hornemannii, Gigartina paxillata, Laurencia flexuosa* and articulated corallines *Amphiroa bowerbankii, A. ephedraea, Arthrocardia duthiae, Cheilosporum cultratum, Corallina sp.* and *Jania sp*. (Porter, S. Hutchings, K and B.M. Clark. 2012). Brown algae are also an important component, particularly species of *Dictyota* and *Dictyopteris, Zonaria subarticulata, Ecklonia biruncinata* and *Iyengaria stellata*. Green algae such as C*aulerpa filiformis, C. racemosa, Bryopsis spp.* and *Codium spp.* play a subordinate role to intertidal community composition (Porter, S. Hutchings, K and B.M. Clark. 2012).

On intertidal and shallow subtidal reefs, grazers and filter feeders are the most abundant fauna. In particular, molluscs such as *Perna perna* and *Petella cochlear* and the ascidian *Pyura stolonifera* dominate the infratidal and shallow subtidal (Porter, S. Hutchings, K and B.M. Clark. 2012). Deeper reefs are dominated by a high diversity of filter feeders, particularly colonial ascidians, sponges, soft corals and bryozoans.

Figure 6.17 Photographs of the Umzumawethu reef taken during spot dives (ASR, 2006).

The relatively hard and stable reefs result in greater biodiversity and species abundance than the sandy substrates (Pratt, 1994) and directly related to the higher complexity and stability of hard substrate. This is reflected in the NBA (2018) threat status for both reef habitat and sandy substrate being classified as “vulnerable” and “least threatened” accordingly (Figure 6.18).

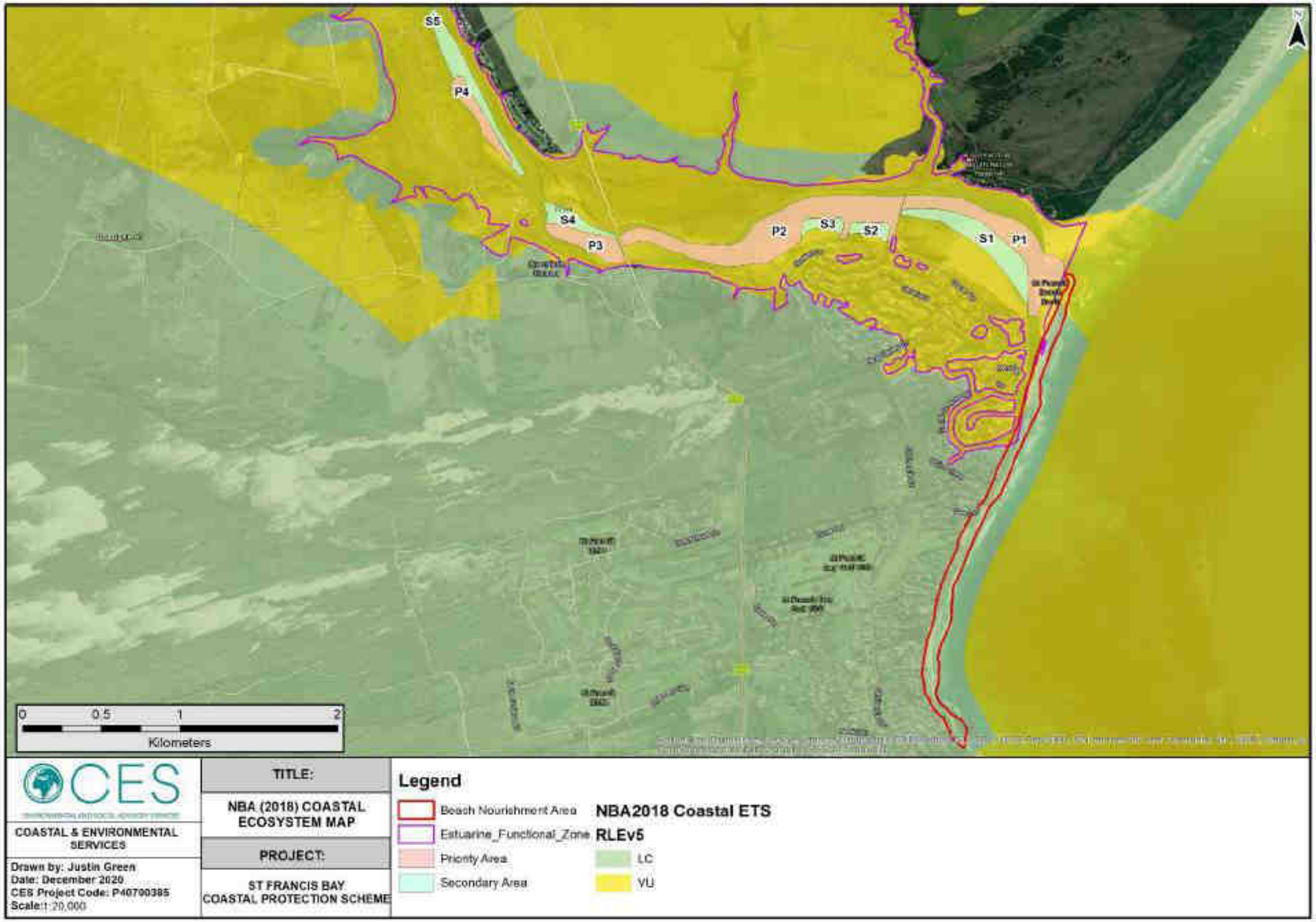


Figure 6.18 Ecosystem threat status for the coastal and inshore marine benthic habitat (NBA, 2011).

6.9 The Kromme River Estuary

The Kromme Estuary is a permanently open system and is located approximately 80 km west of Port Elizabeth on the south coast of South Africa. The system has a catchment of approximately 936 km^2 and consists of 1.73 km^2 of natural forest, 79.6 km^2 of fynbos, whilst the remainder consists mainly of private farms for livestock and grain cultivation (Baird *et al*., 1992). The Kromme Estuary is tidal for approximately 14 km (Bickerton and Pierce, 1988) (see Appendix J).

A sand spit of about half a kilometre long extends from the south bank of the estuary mouth and tends to push the mouth channel northwards. In the lower reaches of the estuary (up to about 5 km from the mouth) channel depths are around 1.5 m, characterised by a sandy bottom substrate. Further upstream, the estuary becomes deeper (3 to 5 m). In the upper reaches current velocities are usually lower than 0.3 $m.s^{-1}$, while current velocities of 1 $m.s^{-1}$ are common near the mouth. Extensive salt marshes cover the banks of the estuary in the middle and lower reaches, while the channel meanders between vegetated cliffs in the upper reaches. A marina has been developed on the south bank near the mouth (Coastal and Environmental Services, 2006). The mouth of the Kromme Estuary is flood tide dominated, resulting in the ingress of marine sediment in its lower reaches (Bickerton and Pierce, 1988). The main tributary is the Geelhoutboom River, which originates south of Humansdorp, and joins the Kromme Estuary about 8 km upstream of the mouth.

The Estuarine Health Index Score calculated for the Kromme Estuary based on its present status is 49, which translates to a Present Ecological Status of D (i.e. largely modified). However the Estuarine Importance Score is rated as “important‟. The Kromme Estuary has been targeted as a Desired Protected Area. The policy basis suggests that it should be restored to and maintained in the best possible state of health. However, it has been decided that based on current impacts, mostly caused by dams in the catchment, it is unlikely that this status would be realistically attained, and it is recommended that the estuary should be in an Ecological Reserve Category C (a moderately modified system where a loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged) (Coastal and Environmental Services, 2006).

6.9.1 *Physical Characteristics*

The flow pattern of the Kromme Estuary has been significantly modified by the construction of two large dams, i.e. the Churchill Dam (built in 1943) and the Mpofu Dam (built in 1983;) (Bickerton and Pierce, 1988; Bate and Adams, 2000). The dams in the catchment are considered to attenuate all floods with a return period of less than 1 in 30 years (Bickerton and Pierce, 1988) and have a combined storage capacity of *ca* 133 % of the mean annual run-off of the Kromme River catchment (Scharler and Baird, 2000). This results in high water column salinity throughout the year and the occasional occurrence of hypersaline conditions in the upper reaches.

Data collected during the past 30 years show that both the Sand and Geelhoutboom Rivers, the biggest tributaries of the Kromme Estuary, are not viable freshwater contributors to the system (Scharler *et al.,* 1997), due to numerous small agricultural dams within the respective catchments. Under natural conditions the Geelhoutboom tributary, on average, is estimated to have contributed less than 5 % of the freshwater inflow into the estuary throughout the year. Under current conditions this contribution is less than 1 % in mid- to late summer, but typically between 10 to 30 % during the remainder of the year (i.e. the peak contribution is during the early part of the wet season). Under current conditions, during dry years the Geelhoutboom tributary contribution is negligible in terms of freshwater inflow to the Kromme Estuary in the dry summer months, but typically 15 to 20 % during the remainder of the year. During wet years the freshwater contribution from the Geelhoutboom ranges between 5 to 10% during the rainy season in late winter to early spring to approximately 20 % during the dry months in mid to late summer. The contribution from the Sand River is considered to be negligible (Coastal and Environmental Services, 2006). Studies of various biological disciplines have often characterised the estuary as freshwater-starved (e.g. Marais, 1983; Hanekom and Baird, 1984; Emmerson and Erasmus, 1987; Adams *et al.,* 1992; Newman, 1993; Jerling and Wooldridge, 1994). Salinity values above 35 PSU dominate at the tidal head of the estuary, whereas lower salinity values (< 35 PSU) were only measured occasionally near the surface in the upper reaches of the estuary (Scharler *et al.,* 1997).

Reduction in freshwater flow also results in marine sediments moving upstream due to tidal flow. Since the construction of the Churchill and Mpofu dams on the Kromme River, the upstream migration of marine sand has increased (Reddering and Esterhuysen, 1983).

On the south bank of the estuary mouth is a sand spit that extends for approximately 650m, and this spit tends to push the mouth channel northwards. The beach in front of the sand spit system has eroded, and the toe of the foredune is cliffed, and a typical pioneer zone with incipient foredunes is absent. A foredune is entirely absent from the back-beach area due to the severe erosion that has taken place. Rock revetments have been placed immediately above the high-water mark to prevent further shoreline erosion. Aside from two small pocket beaches located at George road and Mary Crescent, where some foredune vegetation is present in the back-beach area behind the HWM, at high tide there is no beach, and wave run-up occurs across the length of the beach face, with the rock revetments dissipating the wave energy.

A more natural shoreline is found to the north of the estuary mouth. A relatively large transverse dune system to the north (150m wide, 500m long) defines the northern bank of the estuary. Behind this, and to the north-east is a well vegetated dune cordon of 300m wide, with a small foredune and vegetated transverse dunes. There appears to be very little erosion in these areas.

The mouth of the Sand River is located 2km upstream of the mouth, on the south bank of the river. The Sand River's contribution to the freshwater inflow into the Kromme system is negligible. The dominant flow within the Sand River is subterranean, but reduced flows both in the system as well as the Kromme has resulted in a substantial accumulation of sand along this 250m of river bank. The sand mass is approximately 180m wide and 300m long, and has become stabilised by pioneer dune and salt marsh vegetation. Further east the sand has not yet become vegetated, as it is still inundated at high tide. Over time, and with ongoing sand accumulation it is expected that this sand will also become stabilised with dune vegetation.

6.9.2 *Vegetation Structure*

Vegetation in the Kromme Estuary can be divided into four (4) distinct groups (Figure 6.19:

- *Submerged Macrophytes*: Dominated by *Zostera capensis;*
- *Intertidal Salt Marsh*: Dominated by salt marsh species such as *Sarcocornia decumbens, Triglochin striata, Triglochin bulbosa*, *Bassia diffusa, Sporobolus virginicus, Limonium linifoloium, Spartina maritima* and *Salicornia meyeriana;*
- *Supratidal Salt Marsh: Dominated by Sarcocornia pillansii; and*
- *Reeds and Sedges*: Dominated by *Phragmites australis*

Submerged Macrophytes

Freshwater impoundment reduces the frequency of floods and sedimentary disturbances (Whitfield and Bate, 2007). Den Hartog (1977) has shown that plants such as submerged macrophytes, cannot develop or colonize areas where the substrate is constantly being modified by water currents. Therefore, reduced freshwater input into an estuary favours submerged macrophyte growth and dominance, as there is a decrease in turbidity and water velocities resulting in a more stable sediment and salinity environment. The reduction of freshwater inflow into the Kromme Estuary over the past decade has led to an increase in Zostera capensis biomass and area distribution (Adams and Talbot, 1992; Wooldridge, 2007).

Bezuidenhout (2011), showed, that there has been a steady increase in the area covered by *Zostera capensis* since 1942 (10.8 ha), 1980 (13.7 ha), 1989 (21.7 ha) and in 2000 up to 30.98 ha. This three fold increase can be attributed to the following anthropogenic factors: reduced flows (which results in a lack of scouring and sedimentary disturbance, stable salinity and reduced turbidity), construction of the bridge, and reduction in sand input from the Sand River tributary.

Salt Marsh

Large intertidal salt marsh areas within the Kromme Estuary are important as only 18 % of South African estuaries are permanently open and these salt marshes are considered to be rare (Colloty, 2000). The largest section of salt marsh occurs on the seaward side of the road bridge on the northern bank approximately 2 km from the mouth (Figure 6.19). Small isolated salt marshes also occur further upstream on the west bank (4 km from the mouth) and on the east bank about 2 km from the head of the estuary. Salt marshes extend into the middle-upper reaches of the Geelhoutboom tributary. *Sarcocornia decumbens* was the dominant species in the intertidal zone. This species generally occupies the mid and upper levels of estuarine salt marshes (O‟ Callaghan, 1992). *Sarcocornia pillansii* was the dominant species in the supratidal zone. This species is dominant in most of the supratidal areas of warm and cold temperate South African estuaries (Adams *et al.,* 1999). There is some evidence of salt marsh erosion in the middle reaches of the estuary due to boat activity. In addition, lack of freshwater input into the Kromme Estuary has resulted in increased water column salinity that has caused salt accumulation in the intertidal marshes (Adams *et al.*, 1992), which has resulted in large areas of bare ground in the upper intertidal areas due to hypersaline. These bare patches were only colonized by the highly stress tolerant *Salicornia meyeriana.* When an increase in rainfall flushed some of the excess salt from these bare patches during winter there was a decrease in the cover of *Salicornia* and an increase in other salt marsh species.

Reeds and Sedges

According to Bezuidenhout (2011) a large area (7.2 ha) of *Phragmites australis* near the village of St. Francis Bay was lost as a result of development. Ignoring the loss of this inland reed bed, there was actually an increase of over 6 ha in the estuary itself. This increase in reedbed cover resulted from an increase in sedimentation due to decreased freshwater input (Adams and Talbot, 1992). Reed beds occur upstream of the road bridge on the south bank, and in small streams and tributaries feeding the estuary in the middle-upper reaches. Reeds can survive tidal inundation with saline water as long as their roots and rhizomes are located in brackish to fresh water (Adams and Bate, 1999). The upper reaches of the Kromme Estuary are rocky and extensive reed beds do not occur there naturally. However, reeds were probably more extensive in the Geelhoutboom tributary prior to the construction of farm dams when the water column salinity was lower (< 15 PSU).

Dune Vegetation

For most of its length the sand spit is well vegetated with typical pioneer woody species such as *Chrysanthemoides monolifera* (Bitou), but the most dominant species is the invasive Acacia, *Acacia cyclops* (Rooikrans). It is likely that this species was used to stabilise the sand spit, owing to its important function of protecting the seaward canal of the marina. It is only about 15m to 25m wide, and on average 6m high. The four breaches in 2020 have resulted in a reduction of dune habitat along the spit. This, together with the repair works have resulted in a disturbed foredune environment which now also contains rock material, reducing the ability for revegetation of the spit naturally.

The dune system at the Sand River has become well vegetated say with typical saltmarsh species closer to the river’s edge, giving way to dune slack species in the depressions. Further inland woody pioneer species such as *Metalasia muricate* and *Stoebe plumosa* are present. There is a clear successional gradient away from the water's edge, where the vegetation has become well established over time. In some locations the freshwater reed, *Phragmites australis* is present, indicating a source of freshwater close to the surface.

6.9.3 *Fauna*

The mouth of the estuary is permanently open and experiences regular tidal inflow and outflow, which is sufficient to maintain a tidal inlet. Consequently, the flood-tidal delta of the Kromme is well-developed and extends 4-5 km upstream of the mouth where it produces large intertidal sand flats, which are densely colonised by burrowing infauna (mainly *Callianassa* spp.). The open connection with the sea and strong tidal currents permit both active and passive migration of biotic elements and enable the maintenance of "typical" estuarine water level fluctuations, creating extensive sandy intertidal areas and salt marshes, which are important habitats for the estuarine biota (Harrison *et al.,* 1996a; Harrison *et al.,* 1996b).

The macrobenthic communities of estuarine substrate are divided into two main groups: suspension- and deposit feeders. The presence/absence of these types of species is strongly related to sediment type. The communities are dominated by crustaceans, *Cleistostoma edwardsii*, *C. algoense*, *Upogebia africana, Sesarma catenata* and *Uca urvillei* and the bivalve *Solen cylindraceus.* Other species include: *Glycera tridactyla*, *Tellina gilchristi* and *Macoma ordinaria*. The sediment of the estuary also contains bait species including: the sandprawn, *Callianassa kraussi*, the pencil bait, *Solen capensis* and the bloodworm, *Arenicola loveni*.

There is a significant lack of recent literature concerning the ichthyofaunal composition of the Kromme Estuary. However, according to Hanekom and Baird (1984), a total of 24 species have been recorded in this estuary (Table 6.3). Of these 24 species, 7 species occur throughout the estuary, namely *Cajjrogobius multifasciatus* (Smith), *GiJchristeUa aestuarius* (Gilchrist), *Gkmogobius giurus* (Hamilton-Buchanan), *Hepsetia breviceps* (Cuvier), *Liza dumerili* (Steindachner), *Liza richardsoni* (Smith) and *Rhabdosargus holubi* (Steindachner). The species *Monodactylus jalcijonnis* (Lacepede) and *Rhabdosargus holubi* occur predominantly in Zostera beds, while the species *Diplodus cervinus* (Valenciennes), *Lithognathus lithognathus* (Cuvier), *Spondyliosoma emarginatum* (Cuvier) *Gilchristella aestuarius*, *Liza dumerili, Liza richardsoni* and *Pomadasys olivaceum* usually dominate areas outside of Zostera beds. Species occurring in the highest abundance include *L. dumerili, G. giurus*, and *G. aestuarius.*

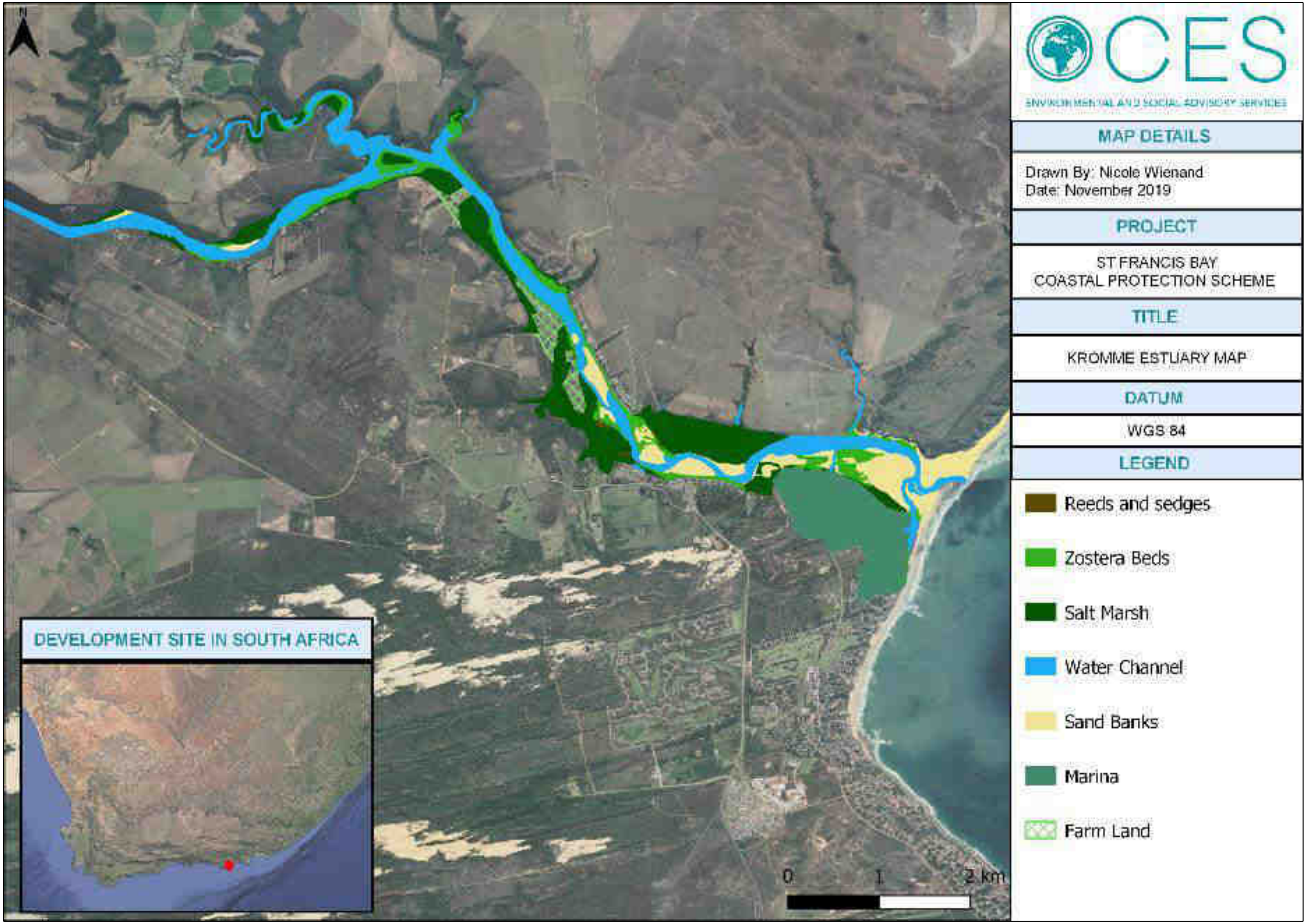


Figure 6.19: The Kromme Estuary Functional Zone and Habitat Map.

Table 6.3: Conservation Status of fish species recorded in the Kromme River Estuary

SPECIES	IUCN
Clinus superciliosus	Least Concern
Caffrogobius multifaciatus	-
Diplodus cervinus	Least Concern
Diplodus sargus	Least Concern
Gilchristella aestuarius	Least Concern
Glossogobius giurus	Least Concern
Hepsetia breviceps	Not Evaluated
Heteromycetes capensis	Not Evaluated
Lichia amia	Least Concern
Lithognathus lithognathus	Endangered
Chelon dumerili	Data Deficient
Chelon richardsonii	-
Chelon tricuspidens	-
Monodactylus falciformis	Least Concern
Mugil cephalus	Least Concern
Myxus capensis	Least Concern
Pomadasys commersonni	Not Evaluated
Pomadasys o/ivaceum	-
Psammogobius knysnaensis	-
Rhabdosargus holubi	Least Concern
Solea bleekeri	-
Spondyliosoma emarginatum	Least Concern
Syngnathus acus	Least Concern
Tachysurus jeliceps	•
Syngnathus watermeyeri	•

Although the Western Cape's endemic seahorse species *Hippocampus capensis*, commonly referred to as the Knysna Seahorse, historically occurred in the Kromme Estuary, sightings of this species has not been recorded for many years. This endangered species now only inhabits three estuarine systems along the South African coast, namely the Swartvlei Estuary, Keurbooms Estuary and the Knysna Estuary (Harding, 2017).

Important Bird and Biodiversity Areas (IBAs), as defined by BirdLife International, constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. IBAs are sites of global significance for bird conservation, identified nationally through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria. Essentially, these are the most important sites for conserving (https://www.birdlife.org.za/what-wedo/important-bird-and-biodiversity-areas/). Important Bird Areas (IBAs) as listed by BirdLife South Africa relative to St Francis Bay include the Tsitsikamma-Plettenberg Bay IBA in Koukamma LM, the Maitland-Gamtoos Coast IBA in the Kouga LM (Birdlife South Africa, 2019) (see Figure 6.20).

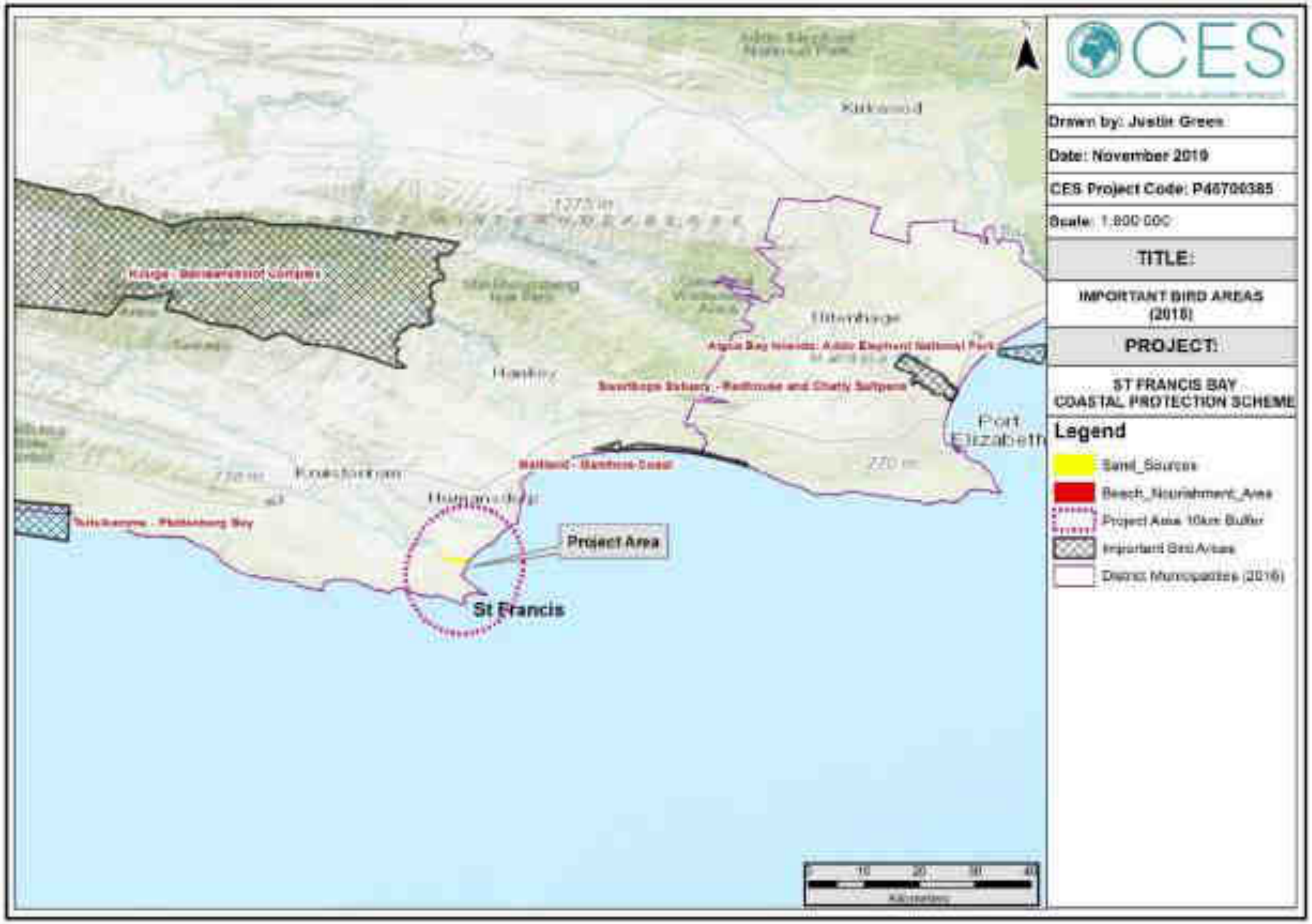


Figure 6.20. Important Bird Areas (IBA) in close proximity to the study site

According to South African Birding (2008), within just a few hours of bird watching, anywhere between 80 to 160 regularly occurring bird species can be spotted in and around the St Francis Bay area. Commonly spotted species include the African fish eagle (*Haliaeetus vocifer*); African Marsh-Harrier (*Circus ranivorus*); Osprey (*Pandion haliaetus*); Cape Gannet (Morus Capensis); African Black Oyster Catcher (*Haematopus moquini*); Goliath Heron (*Ardea goliath)*; African Spoonbill (*Platalea alba*); Black-winged Stilt (*Himantopus himantopus*); Blue Crane (*Anthropoides paradiseus*); Denham's Bustard (*Neotis denhami*), Olive Bush-Shrike *(Chlorophoneus olivaceus)*; Southern Tchagra *(Tchagra tchagra)*; Cape Longclaw (*Macronyx capensis)*, Cape Grassbird (*Sphenoeacus afer*), 5 species of kingfisher (family *Alcedinidae*); 3 species of sunbird (family *Nectariniidae*) and African Stonechat (*Saxicola torquatus*).

During low tide, when the sand banks within the estuary are exposed, it has been reported that large numbers of waterbirds feed and roost on the sand banks. Historically the presence in number of Swift Tern, Common Tern and Sandwich Tern have been of regional importance, but recent records are not available to confirm whether this is still the case. Bickerton and Pierce (1988) suggested that the Kromme has lower numbers of water fowl than expected compared to the Seekoei and Kabeljous estuaries.

The conservation status of the above listed species are listed in Table 6.4 below.

Table 6.4: Conservation Status of bird species recorded in the Kromme River Estuary

SPECIES	IUCN
Haliaeetus vocifer	Least Concern
Circus ranivorus	Least Concern
Pandion haliaetus	Least Concern
Morus Capensis	Vulnerable
Haematopus moquini	Near Threatened
Ardea goliath	Least Concern
Platalea alba	Least Concern
Himantopus	Least Concern
Anthropoides paradiseus	Vulnerable
Neotis denhami	Near Threatened
Chlorophoneus olivaceus	Least Concern
Tchagra	Least Concern
Macronyx capensis	Least Concern
Sphenoeacus afer	Least Concern
Saxicola torquatus	Least Concern

6.9.4 *Socio-Economic Value*

The open water of the Kromme Estuary is listed as 125 ha (Sowman and Fuggle, 1987). The Kromme Estuary supports many recreational activities including fishing, birding, bait collection, waterskiing, canoeing, boat cruisers, hiking and swimming (Adams, 2001). Tourism is viewed as an important income generator in the area (Davies, 2009 in Sale *et al.,* 2009). There is considerable concern that the recreational capacity of the Kromme River estuary is being exceeded. In 1992, the estimated increase of recreational activities on the river in peak holiday periods was ~400 %. Calculations were done using international safe space standards and it was determined that the carrying capacity of the river in terms of power boating and sailing activities is exceeded in peak holiday times. This implies that the river becomes unsafe for public use in these times (ARSC Kromme River Structure Plan, 1992).

St Francis Bay falls within the area known as the "Sunshine Coast", characterised by undeveloped coastal areas interspersed with small towns such as St Francis Bay. It can be expected that holiday makers, tourists and many permanent residents would be highly sensitive to negative changes in the visual environment. It is also expected that these groups of people would place a high premium on landscape quality.

Four distinct landscape types exist within the study area:

- A sandy beach;
- An eroded foredune ridge backed by residential development;
- A barrier dune fronting the Marina Glades ski canal; and
- The Kromme River Estuary.

The overall landscape quality is considered to be high. The sense of place depicted in the study area is in part a pattern that occurs at various sites along the coast, but the strong curve of the St Francis Bay beach, the sandy beach zone which is contained by the rocky shore to the south west and the Kromme River estuary inlet to the north, as well as uniform architectural character contribute to the uniqueness of the site.

Similarly the landscape of the Kromme River estuary is also considered to be high. Although the presence of boat traffic and large numbers of tourists may interupt the the character of the view. In addition to landscape the estuary is considered to be a quiet and serene area, especially during the quieter periods of the day and outside of the main tourist season.

6.9.5 *Cultural Heritage and Palaeontological Features*

In 2019 a heritage and archaeological assessment was carried out by Exigo. This work was completed as part of obtaining authorisation and permits for repair work to the rock revetments along the St Francis Bay beach. The survey which covered a stretch of beach between the spit and just south of the Neville Road car park was deemed to be sufficient in informing this project as it covers a similar area, and given the nature of the features unlikely that any unidentified would now be present. It is unlikely that the dredging component of this project would affect cultural heritage and palaeontological features since the material is likely to be won from areas within the estuary which would have historically been covered by water and/or disturbed by the estuary.

In general the St Francis Bay area is particularly rich in archaeological shell middens. Many of these have been identified over the years and were presented in the specialist study in 2006 and 2019 (see Exigo report in Appendix G). The archaeology of this area relates primarily to the Holocene (last 10 000 years) occupation by San hunter-gatherers and later by KhoeKhoen pastoralists. The archaeological term used to describe the remains from the period is Later Stone Age (LSA). As mentioned there are many coastal shell middens in the vicinity of St Francis Bay. In addition to the middens, a number of graves have also been found in recent years during the construction of new houses in the St Francis Bay area.

However, for the area applicable for this project and according to the previous study, no archaeological sites or material was found. No shell concentrations, stone, bone or pottery fragments were observed. It is possible that some sites may already have been lost due to the coastal erosion, while other may have been destroyed through previous coastal development.

In terms of Marine and Underwater Cultural Heritage (MUCH), a number of ships are known to have wrecked along the coastline of Cape St Francis and the Kromme River mouth - four vessels in particular are listed as being wrecked in St Francis Bay. Of note is the wrecking site of the Lady Head (1859) in an unspecified location in the mouth of the Kromme River (See Figure 5-4 in Appendix G). A Maritime and Underwater Cultural Heritage Impact Assessment (MUCHIA) was considered as a large part of the proposed development, and particularly sand sourcing and beach replenishment, are proposed to occur below the high-water mark. However, the MUCH Unit of SAHRA granted exemption from MUCHIA, being cognisant of the fact that target areas for dredging occur largely to the riverside delta of the Kromme River estuary and areas within the river system to the west. In addition, the beach infrastructure (i.e. groynes) are expected to be constructed on top of the existing beach sand level without the need for excavation. The revetment at the spit will be installed on a nourished beach level, which will be approximately 1 m higher than the existing beach level.

6.9.6 *Socio-Economic Profile*

The Kouga Local Municipality falls under the Sarah Baartman District Municipality (previously known as the Cacadu District Municipality). According to Statistics South Africa, the unemployment rate of the Kouga Local Municipality is approximately 21.5%. There are an estimated 38 412 economically active individuals (i.e. people who are employed or unemployed but actively seeking employment) living within the Kouga Local Municipality, of which 21.5% are unemployed. Of these 38 412 individuals, 19 634 are classified as 'youth' (age 15 to 34), with 26.7% of the youth population unemployed.

The total population of the Kouga Local Municipality is 98 558, with the youth (ages 15 to 34) accounting for 26.8% of this. The population growth rate from 2001 to 2011 equated to 3.22% per annum and the majority of the population (85.5%) are found within urban areas. Only 7.2% of people aged 20 years or older, have completed primary school. 38% of people have received some form of secondary education, 4.9% have completed matric and only 9.5% have some form of higher education (Stats SA, 2011).

The tourism profile of the area includes a number of attractions that fall under various categories. St Francis Bay is world renowned for its waves, including the iconic Bruce's Beauties features in the 1966 film, 'The Endless Summer". Other wave attractions include Seal Point in Cape St Francis and Super Tubes in Jeffery's Bay, just around the corner. The Kromme River is famous for its skiing, canoeing, stand-up paddle (SUP) boarding, and fishing. Due to the diverse range of activities on offer, St Francis Bay is a popular holiday destination with its series of canals, upmarket restaurants, beaches, golf courses, and uniform white and thatched roof homes. Other activities on offer include bird and whale watching, kite surfing, jet-skiing and hiking (Kouga Integrated Development Plan, 2015).

7 IDENTIFICATION OF POTENTIAL IMPACTS

According to Appendix 3, Section 3 (1), of the of the 2014 EIA Regulations (as amended), "*an environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include—*

(v) a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including:

(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts—

(aa) can be reversed;

(bb) may cause irreplaceable loss of resources; and

(cc) can be avoided, managed or mitigated;

(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;

(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;

(viii) the possible mitigation measures that could be applied and level of residual risk;

(ix) the outcome of the site selection matrix;

(vi) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including—

i. a description of all environmental issues and risks that were identified during the environmental impact assessment process; and

ii. an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;

(vii) an assessment of each identified potentially significant impact and risk, including—

i. cumulative impacts;

ii. the nature, significance and consequences of the impact and risk;

iii. the extent and duration of the impact and risk;

iv. the probability of the impact and risk occurring;

v. the degree to which the impact and risk can be reversed;

vi. the degree to which the impact and risk may cause irreplaceable loss of resources; and

vii. the degree to which the impact and risk can be mitigated.

7.1 Issues Identification Matrix

The CES rating scale has been updated to meet the requirements outlined in Appendix 2 of the EIA Regulations (2014, as amended). This methodology takes into consideration the following criteria, and includes the new criteria for assessing post mitigation significance, by incorporating the principles of reversibility and irreplaceability:

- Nature of impact
- Type of impact
- Duration
- Extent
- Probability
- Severity or benefits

Nature of impact

Negative or positive impact on the environment.

Type of impact

Direct, indirect and/or cumulative effect of impact on the environment.

Duration, extent, probability and severity scales

These four factors need to be considered when assessing the significance of impacts (Table 7.1a, 7.1b), namely:

- *Relationship of the impact to temporal scales* - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
- *Relationship of the impact to spatial scales* - the spatial scale defines the physical extent of the impact.
- *The likelihood of the impact occurring* - the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts could occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance. In this case likelihood equates to some extent with risk. If the impact is definite, then there is a high risk that it will occur. However, likelihood and risk are not to be confused, and for certain impacts (e.g. risk of a vehicle accident) a risk assessment will be required.
- *The severity of the impact* - the severity/beneficial scale is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party. The severity of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it, and how effective the mitigation might be. The word ‘mitigation’ means not just ‘compensation’, but includes concepts of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.

Reversibility and Mitigation

The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. Both the practical feasibility of the measure, the potential cost and effectiveness is taken into consideration when determining the appropriate degree of difficulty.

Table 7.1a: Evaluation Criteria for Duration, extent, probability.

Duration (Temporal Scale)		***Score***
Short term	*Less than 5 years*	*1*
Medium term	*Between 5-20 years*	*2*
Long term	*Between 20 and 40 years (a generation) and from a human perspective also permanent*	*3*
Permanent	*Over 40 years and resulting in a permanent and lasting change that will always be there*	*4*
Extent (Spatial Scale)		
Localised	*At localised scale and a few hectares in extent*	*1*
Study Area	*The proposed site and its immediate environs*	*2*
Regional	*District and Provincial level*	*3*
National	*Country*	*3*
International	*Internationally*	*4*
Probability (Likelihood)		
Unlikely	*The likelihood of these impacts occurring is slight*	*1*
May Occur	*The likelihood of these impacts occurring is possible*	*2*
Probable	*The likelihood of these impacts occurring is probable*	*3*
Definite	*The likelihood is that this impact will definitely occur*	*4*

Table 7.1b: Evaluation Criteria for impact severity.

Impact Severity *(The severity of negative impacts, or how beneficial positive impacts would be on a particular affected system or affected party)*		***Score***
Very severe	**Very beneficial**	**4**
An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.	
Severe	**Beneficial**	**3**
Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.	A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.	
Moderately severe	**Moderately beneficial**	**2**
Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated. For example constructing the sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.	
Slight	**Slightly beneficial**	**1**
Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.	
No effect	**Don't know/Can't know**	
The system(s) or party(ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.	

** In certain cases it may not be possible to determine the severity of an impact thus it may be determined: Don't know/Can't know*

Significance

The scores for the three criteria in Table 7.1a are added to obtain a composite score. They must then be considered against the severity rating to determine the overall significance of an activity. This is because the severity of the impact is far more important than the other three criteria. The overall significance is then obtained by reading off the matrix presented in Table 7.2. The overall significance is either negative or positive (Criterion 1) and direct, indirect or cumulative (Criterion 2).

Table 7.2: Matrix used to determine the overall significance of the impact based on the likelihood and effect of the impact

SEVERITY		COMPOSITE DURATION, EXTENT & PROBABILITY SCORE									
		3	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	Slight	3	4	5	6	7	8	9	10	11	12
	Mod severe	3	4	5	6	7	8	9	10	11	12
	Severe	3	4	5	6	7	8	9	10	11	12
	Very severe	3	4	5	6	7	8	9	10	11	12

The environmental significance scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of especially a social nature need to reflect the values of the affected society.
It is clear that an impact that has a slight severity could be of MODERATE significance because it is permanent (4), has a regional affect (3) and is definite. This elevates it from a LOW to a MODERATE rating. Conversely, a moderately severe impact could be rated as LOW since it is short term (1), localised (1) and only probable (3). An impact rated as severe could be of VERY HIGH significance because it is permanent (4), of national importance (3) and is definite (4).

The Significance Rating Scale is defined in Table 7.3 below.

Table 7.3: Description of Impacts Level Significance Ratings.

OVERALL SIGNIFICANCE *(The combination of all the above criteria as an overall significance)*	
VERY HIGH NEGATIVE	**VERY BENEFICIAL**
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects. *Example: The loss of a species would be viewed by informed society as being of VERY HIGH significance.* *Example: The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.*	
HIGH NEGATIVE	**BENEFICIAL**
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long-term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light. *Example: The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated.* *Example: The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.*	
MODERATE NEGATIVE	**SOME BENEFITS**
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial. *Example: The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.*	
LOW NEGATIVE	**FEW BENEFITS**
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect. *Example: The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels.* *Example: The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.*	
NO SIGNIFICANCE	
There are no primary or secondary effects at all that are important to scientists or the public. *Example: A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.*	
DON'T KNOW	
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information. *Example: The effect of a particular development on people's psychological perspective of the environment.*	

Once mitigation measure are proposed, the following criteria (Table 7.4) are then used to determine the overall post mitigation significance of the impact:

- Reversibility: The degree to which an environment can be returned to its original/partially original state.

- Irreplaceable loss: The degree of loss which an impact may cause.
- Mitigation potential: The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. The four categories used are listed and explained in Table 7.4 below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

Table 7.4: Description of Impacts Level Significance Ratings.

Reversibility	
Reversible	*The activity will lead to an impact that can be reversed provided appropriate mitigation measures are implemented.*
Irreversible	*The activity will lead to an impact that is permanent regardless of the implementation of mitigation measures.*
Irreplaceable loss	
Resource will not be lost	*The resource will not be lost/destroyed provided mitigation measures are implemented.*
Resource will be partly lost	*The resource will be partially destroyed even though mitigation measures are implemented.*
Resource will be lost	*The resource will be lost despite the implementation of mitigation measures.*
Mitigation potential	
Easily achievable	*The impact can be easily, effectively and cost effectively mitigated/reversed.*
Achievable	*The impact can be effectively mitigated/reversed without much difficulty or cost.*
Difficult	*The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs.*
Very Difficult	*The impact could be mitigated/reversed but it would be very difficult to ensure effectiveness, technically very challenging and financially very costly.*

7.2 Detailed Impact Assessment

A detailed impact assessment of all the construction and operational impacts identified is provided in Table 7.5 below.

Table 7.5: Construction and Operation Impacts and Key Mitigation Measures

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
Estuarine Physical Characteristics	Construction and Operation	Preferred Alternative	Removal of large volumes of sediment from the Kromme Estuary has the potential to change the physical (hydrodynamics) and sedimentary processes within the estuarine system. The dredging of the river will increase the tidal prism, and the area around the river mouth will allow the water to drain out more effectively. This in turn lowers the low-water level (with respect to MSL) resulting in the exposure of previously submerged sandbanks within the estuary. The sandbanks exposed under existing conditions is calculated at 52 ha. Following the dredging activity (assuming the full extraction volume) the exposed sandbanks exposed equate to 51 ha. However, it is assumed that this low water level will be a variable phenomenon in any case given the dynamic nature of the river mouth which will govern this low tide level. This may lead to exposure of shallow non-dredged areas within the estuary during low tides.	Long Term	Study Area	Probable	Slight	Difficult	**LOW –**	• Maintain the current main sand bank adjacent to Area S1 to act as a sand sink (i.e. a place for sand to accumulate); • Avoid sensitive areas identified in the Estuarine Report; and • At the completion of the initial phases (i.e. Phase 1 and Phase 2), monitor the flow and sedimentation rates of the system to assess the changes, if any, to the hydrodynamics. Use this data to inform the subsequent phases of sand sourcing.	**LOW –**
	Construction and Operation	Preferred Alternative	The removal of sand from the intertidal areas, together with the subsequent changes to the hydrodynamics of the Kromme Estuary and mouth, could result in the realignment of the main estuarine channel. While the modification of the course of the main channel is not planned, the dredging activity could result in it changing its current orientation or 'straight-lining' its path	Long Term	Study Area	Probable	Slight	Very Difficult	**LOW-**		**LOW-**

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
			resulting in potential impacts to habitats (dunes) and features (property, infrastructure) along the banks. Recent hydrodynamic modelling showed that current velocities are unlikely to change significantly as a result of the dredging, other than at the mouth. These modified velocities are expected to be temporary and while there might be some movement of the mouth it is unlikely to be a dramatic shift. Similarly, the only realignment of the channel is likely to occur under high flow conditions and not necessarily as a result of the dredging.								
	Operation	Preferred Alternative	Erosion of the Kromme riverbanks and beach spit. Advisian's (2020) modelling indicates that none of the dredging scenarios they tested led to any substantial changes in current velocities within the estuary under normal and/or flood conditions. They concluded that the currents outside the main channel (i.e. near to the banks) and in particular on the northern bank are low (up to 0.2m/s) and that the dredging would not lead to any significant change. This suggests that erosion of the banks of the river, as a result of the dredging, is unlikely. Any increase in current velocities have the ability to transport sediment. With current velocities increasing in the mouth under certain conditions, the integrity of the northern end of the spit could be put at risk through erosion. The project is anticipating nourishing the spit area	Long Term	Study Area	May Occur	Slight	Very Difficult	**LOW-**		**LOW-**

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
			which is also protected by revetments and future groyne infrastructure. While material is expected to be shifted in the area, ongoing maintenance of sand material on the spit is planned as part of this project.								
	Operation	Preferred Alternative	The increase in boat traffic as a result of the ability of the estuary to be used on more states of the tide may result in an increased risk of erosion of the banks of the estuary.	Long Term	Study Area	Definite	Moderately severe	Achievable	**MODERATE-**	• Reduce speed (i.e. no wake zones) of vessels in sensitive areas of the estuary • Impose stricter control of boat traffic during peak tourist season	**LOW-**
	-	No-go Alternative	The presence of the upstream dams limiting the flushing effect and leading to increase siltation	Long Term	Study Area	Definite	Severe	Difficult	**HIGH-**	-	**HIGH-**
	-	No-go Alternative	The combination of reduced freshwater flow and the permanently open river mouth results in an increase in salinity of the water column as well as intertidal and supratidal sediments.	Long Term	Estuary	Definite	Severe	Difficult	**HIGH-**	-	**HIGH-**
	-	No-go Alternative	The deterioration of water quality is mainly related to nutrient status and possible fluctuating temperature and oxygen levels downstream of dams. The estuary is highly regulated by the Churchill and Impofu dams, with no or little environmental releases being made to maintain riverine and estuarine function	Long Term	Study Area	Definite	May Occur	Difficult	**LOW-**	-	**LOW-**
Surface water Pollution (i.e. from machinery)	Construction	All Alternatives	There will be disturbance of beach sand during the sand sourcing and ongoing operations, and during the construction of the hard infrastructure required for coastal protection. Substances such as oil and diesel may enter the Kromme River and/or the ocean, if spillages are not effectively managed and/or prevented.	Short Term	Study Area	May Occur	Moderately severe	Achievable	**MODERATE –**	• Construction vehicles and equipment should be maintained and daily checks should be done for leaks; • Spill kits and drip trays must be readily available and utilised during refuelling. This includes spill kits and equipment to contain, manage and remediate any spillages in aquatic/marine environments. • Refuelling procedures for aquatic based craft must be included in a method statement;	**LOW –**

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
										• No storage of fuel or chemicals close to the shore or estuary must be permitted.; • It is recommended that ready mixed cement is used if necessary. No cement mixing close to the shore or estuary must be permitted; • Servicing of machinery and vehicles must occur off site unless this is done in a bunded area.	
Estuarine Ecology	Construction and Operation	Preferred Alternative	During both construction and operation it is likely that there will be suspended sediment (turbidity) in the water column as a result of the dredging activity. Suspended sediment is directly related to the size of the particles where smaller particles remain suspended for longer than particles that are larger. Given that smaller particles remain in suspension for longer it is likely that those particles will be transported further from the source location. Suspended sediment in itself is not necessarily a problem. Estuaries by their nature are systems that have high turbidity from time to time (i.e. flooding events). Similarly, the habitats and species within the estuary are adapted to periods of inundation or periods of high turbidity. Where it might result in an adverse impact is where excessive amounts of finer material settle in areas that limit the ability of the species in those areas to flourish, resulting in a decline in populations. These impacts are presented	Long Term	Study Area	Possible	Moderately Severe	Difficult	**MODERATE-**	• Limit extraction of material to areas where sediment particle size is what is required for the beach nourishment. These larger grain sizes are less likely to become suspended in the water column. • Sensitive habitats will be identified and avoided where possible.	**LOW-**
Estuarine Ecology – Flora	Construction	Preferred Alternative	The methodology of extracting the sediment may result in the direct physical loss of estuarine floral species	Medium Term	Study Area	Definite	Moderately severe	Very Difficult	**MODERATE -**	• Where possible, sediment should be taken from areas where there is low abundance of estuarine vegetation.	**LOW-**

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
										• Associated equipment will be placed in areas of low sensitivity only.	
	Construction and Operation	Preferred Alternative	The estuarine functional zone (EFZ) includes the lateral boundaries of an estuary up to the 5 m contour, with the downstream boundary taken as the estuary mouth and the upstream boundary taken as the limits of tidal variation or salinity penetration, whichever penetrates furthest. Protection/rehabilitation of the estuarine functional zone is considered essential for protection of estuarine biodiversity and associated ecological processes. The proposed project is likely to impact on the estuarine functional zone both directly and indirectly: • The loss of habitat (direct removal of *Zostera capensis*, sandbanks and benthic habitat) • Increases in turbidity (direct impact) which may result in further loss of habitat as a result of smothering (indirect impact). • Altering the nutrient dynamics of the system as a result of releasing trapped nutrient from sediments. Previous authors who have studied water quality in the Kromme have concluded that due to the influence and constant flushing of the system through the tidal cycle, water quality is generally good.	Medium Term	Study Area	Definite	Moderate	Difficult	**MODERATE-**	• Only the correct size material (course) will be dredged for beach nourishment allowing; • Do not remove or disturb salt marsh habitat; • Sensitive Zostera habitats will be avoided where possible; and • Only the required volume of sediment will be dredged.	**MODERATE-**
	-	No-go Alternative	The estuary is considered to have a mouth status of permanently open which facilitates regular	Long Term	Estuary	Definite	Severe	Very Difficult	**HIGH-**		

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
			interaction with marine waters. This, in tandem with the reduced freshwater input results in the estuary being dominated by mostly marine habitats. This situation has resulted in hypersaline conditions in certain areas of saltmarsh, resulting in a species composition more representative of species more tolerant to elevated salinity levels (i.e. Salicornia sp.)								
	-	No-go Alternative	The areas of saltmarsh habitat within the Kromme Estuary have diminished over time. It is anticipated that this is due to development on the floodplain along with evidence of salt marsh erosion in the middle reaches of the estuary due to boat activity as well as waves caused by easterly and westerly winds. In addition, lack of freshwater input into the Kromme Estuary has resulted in increased water column salinity that has caused salt accumulation in the intertidal marshes (Adams et al., 1992), which has resulted in large areas of bare ground in the upper intertidal areas due to hypersaline conditions.	Long Term	Estuary	Probable	Moderate	Difficult	**MODERATE-_**		
	-	No-go Alternative	The reduction of freshwater leading to a reduction of flushing of the estuary has led to an increase in submerged macrophytes	Long Term	Estuary	Definite	Moderately Beneficial	Difficult	**MODERATE+**		
Estuarine Ecology – Fauna	Construction	Preferred Alternative	The extraction of sediment from sand banks, which provide habitat for faunal communities (e.g. sand prawns) will result in the loss of this habitat.	Long Term	Study Area	Definite	Moderately severe	Achievable	**MODERATE -**	• Limit dredging in habitats where high biodiversity / abundance of benthic species exist • Do not remove or disturb salt marsh habitat	**LOW -**

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
	Construction and operation	Preferred Alternative	Similarly to the impacts on the vegetation communities, faunal communities will be affected directly by the project as well as indirectly. Direct losses are expected for species associated with the sandbanks and channels. Important species in this habitat include sand prawn (*Callianassa kraussi*), pencil bait *Solen capensis* and bloodworm *Arenicola loveni*. Direct physical loss would be attributed to the removal of material directly by dredging. Given the type of material required for the project the habitat lost would be that associated with a sandy benthic substrate. This would be a habitat colonised by species adapted to coarse grained sediment - mostly molluscs, crustaceans and polychaetes.	Medium Term	Study Area	Definite	Moderately severe	Difficult	**MODERATE-**	• Only the correct size material (course) will be dredged for beach nourishment; • Only the required volume of sediment will be dredged; • Associated equipment will be placed in areas of low sensitivity only; and • Monitoring of sensitive habitats in close proximity to dredging activities must be implemented during both the construction and operational phases of the project	**LOW-**
	Construction	Preferred Alternative	The presence of excavators / dredgers working in the intertidal areas may result in disturbance to wading bird species. While wading species would be temporarily displaced the works would not take place in all intertidal area allowing foraging in other parts of the estuary. Some species may be drawn to the dredger as it would be disturbing the sediment and facilitate foraging.	Short Term	Study Area	Probable	Slight	Achievable	**LOW-**	• Avoid working in areas where bird species may nest. Especially during the breeding season. • Restrict activity to discreet sections of the sand banks and channel. • Encourage owners of dogs to keep their dogs on leashes while on the sandbanks to ensure those water birds using the sandbank are not disturbed unnecessarily.	**LOW-**
	-	No-go Alternative	The distribution of submerged macrophytes and the increase in sandbank habitat has resulted in an increase in faunal abundance and diversity of species suitable to these types of habitat, such as *Callianassa* spp.	Long Term	Study Area	Definite	Moderately Beneficial	Difficult	**MODERATE+**		
	-	No-go Alternative	The shift in the system to that of a marine	Long Term	Study Area	Definite	Moderately severe	Difficult	**HIGH-**		

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			dominated one is likely to result in the loss of some species. One such species that has been lost from the system is the seahorse (*Hippocampus* sp.)								
Dune Ecology	Construction	Preferred Alternative	Loss of dune vegetation on the vegetated sand bank at the delta of the Sand River Mouth.	Long Term	Study Area	Probable	Moderately severe	Difficult	**MODERATE-**	It is not possible to mitigate this impact	**MODERATE-**
	Construction	Preferred Alternative	The construction of the groynes, as well as activities associated with beach nourishment will require access over the foredunes in selected areas, and damage to the foredunes and the loss of some vegetation is inevitable. However, the breaching of the sand spit has already resulted in substantial loss of vegetation, which reduces the severity of this impact.	Short Term	Study Area	Probable	Slight	Difficult	**LOW-**	• Enforce all provisions contained in the Construction EMP • Do not allow any laydown areas within the sensitive foredune area. • Limit access across the foredunes to four access points in total, where each groyne will be located. The access point where the sand spit starts (possibly at the Aldabara Road parking area) will need to serve the first two groynes. The second two will require access from Peter Crescent and at George road; and the final one at the Ralph Road parking area. These parking areas must also be used as laydown areas. • Limit pedestrian access to these same points. • Disallow workers from accessing the foredune areas.	**LOW-**
	Construction	Preferred Alternative	During the construction phase ecological impacts on the beach and nearshore areas are likely to be moderately significant, and will be difficult to mitigate. However, the beach and nearshore ecosystems are resilient to natural perturbations.	Short Term	Study Area	Probable	Moderate	Difficult	**MODERATE-**	• Enforce all provisions contained in the Construction EMP • Implement all mitigation measures mentioned above. • Do not allow any laydown areas within the sensitive foredune area.	**MODERATE-**
	Operation	Preferred Alternative	The construction of groynes, coupled with sand nourishment will increase the width of the beach and introduce additional substrate. Historically, there was a significant beach with significant volumes of sand. These former habitats would be restored.	Short Term	Study Area	Definite	Moderately Beneficial	Difficult	**MODERATE+**	• None Required	**MODERATE+**

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	-	No-go Alternative	In 2020 the spit breached four times, resulting in property and marina infrastructure being exposed directly to the waves and storm surges. This also resulted in damage to property in the marinas and loss of dunes systems and dune vegetation.	Long Term	Study Area	Definite	Severe	Difficult	HIGH-	Emergency repair work, involving the placement of sand material from other areas along the beach and the construction of revetments along parts of the frontage to provide additional protection was undertaken. However, this did not mitigate the ecological impacts.	HIGH-
	-	No-go Alternative	The reduction of sediment into St Francis Bay has resulted in significant erosion, to the point that in 2020 the spit breached and the beaches have all but disappeared. It has been established that the longshore drift, which transports sediment, is in a northerly direction. With no further introduction of sediment (i.e. very little remaining on the beaches) into the system it is expected that erosion will continue and possibly accelerate along the beaches to the north	Long Term	Study Area	Probable	Moderate severe	Difficult	MODERATE-		
Marine Ecology – Flora	Construction	Preferred Alternative	The placement of sand and / or rock material on or near the nearshore reef structures will result in localised smothering, leading to a loss of individuals and habitat. This is particularly relevant for algal species since they are unable to move from these areas. It should be noted that these reefs would have been covered in sediment in the past.	Long Term	Study Area	Probable	Moderately severe	Difficult	MODERATE-	• Design and orientate groyne structures to avoid smothering the nearshore reefs as far as possible.	LOW-
	Construction	Preferred Alternative	The development of groyne structures of rock material may provide additional hard substrate for benthic species.	Long Term	Study Area	May occur	Moderately Beneficial	Difficult	MODERATE+	• None required	MODERATE+
Marine Ecology – Fauna	Construction	Preferred Alternative	The placement of sand and / or rock material on or near the nearshore reef structures may result in localised smothering leading to a limited loss of individuals and habitat. However, the development of groyne structures of rock material is anticipated to provide	Long Term	Study Area	May occur	Moderately Beneficial	Difficult	MODERATE+	• None required	MODERATE+

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
			additional hard substrate for benthic species.								
Marine Hydrodynamics	Operation	Preferred Alternative	Development of the groynes will alter the hydrodynamic regime through the refraction of waves and altering of local currents. This impact is expected to be limited to the area immediately north of the northern-most groyne. The design of the beach nourishment is to nourish this area as part of the maintenance activity. Similarly, the short groyne does not extend sufficiently into the marine environment to have an effect on the northern bank.	Permanent	Study Area	May Occur	Moderate	Difficult	**MODERATE-**	• Ensure that the adaptive management plan is developed to recognise and mitigate for any accelerated erosion.	**LOW-**
			Development of the groynes will restrict the longshore drift that transports sediment to the north. However, even with the restriction at least 50% of the material will pass through the scheme and the beach nourishment and maintenance introduces a new source of sediment which is able to be transported to the north. Please refer to Section 6.7 in this report and Appendix F for more information and detail.	Permanent	Study Area	May Occur	Moderate	Difficult	**MODERATE-**	• Place sand material immediately north of the northern most groyne to act as sacrificial material. • Maintain nourishment of at least 6,000 m^3/year for each of the embayments south of the spit and 10,000 m^3/year for the remaining embayment at the spit on a regular basis.	**LOW-**
Local Amenity – estuary	Construction	Preferred Alternative	The presence of excavators / dredger may result in some areas of the estuary having restricted access for public safety	Medium Term	Study Area	Possible	Slight	Achievable	**LOW-**	• Reduce, where possible, the extraction of material during times of peak tourist activity • Ensure that signage is clear and areas are made safe during excavation / dredging • Ensure that newly excavated / dredged areas are safe for use	**LOW-**
	Construction	Preferred Alternative	The removal of sand banks and specifically the fauna within the sandbanks may result in reduced areas available for bait digging – a popular activity in the Kromme Estuary.	Short Term	Study Area	Possible	Slight	Difficult	**LOW-**	• Reduce dredging activity in popular bait digging areas (i.e. sand bank near the mouth of the estuary) during peak tourist season • Ensure areas of the sandbanks are available to bait diggers during construction • Dredging from the channels initially will ensure that sand bank habitat is maintained for a longer period; and	**LOW-**

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										• Inform bait diggers of construction schedule to allow digging in areas that are due to be dredged.	
	Operation	Preferred Alternative	The extraction of sediment from the navigation channels in the estuary will allow vessels access during all tidal cycles. This will improve safety and increase the recreational use of the estuary	Medium Term	Study Area	Probable	Beneficial	Achievable	**MODERATE+**	• Enforcement of the management of boating activities and restrictions in place (i.e. no wake zones, etc); • Identification and publication of buffer areas/safety zones around dredging equipment; • Development of a dredging programme that takes navigation and peak times into account; • Development and publication of water safety procedures and enforcement to ensure safety to all users of the estuary. • Clear channel marking where necessary; and • Ensure boating activity areas are clearly demarcated.	**MODERATE +**
	Operation	Preferred Alternative	The Kromme Estuary supports many recreational activities. As a result, tourism is viewed as an important income generator in the area.	Medium Term	Study Area	Probable	Beneficial	Difficult	**MODERATE+**	-	**HIGH+**
	-	No-go Alternative	Estuaries are valuable national assets that provide essential ecosystem services.	Long Term	Study Area	Definite	Beneficial	Achievable	**HIGH+**	-	**HIGH+**
Local Amenity – beach	Construction	Preferred Alternative	The presence of construction vehicles accessing the beach for the construction of the groynes, delivery of material and reworking of the sediment for nourishment may result in restricted access to certain parts of the beach (and carparks)	Short Term	Study Area	Definite	Moderately severe	Achievable	**MODERATE-**	• Reduce, where possible, the placement of material during times of peak tourist activity; • Ensure that signage is clear, and areas are made safe during placement / levelling of the beach; and • Ensure that newly nourished areas are safe for use.	**LOW-**
	Operation	Preferred Alternative	The construction of groynes, coupled with sand nourishment will increase the width of the beach, and this result in a significant improvement to the recreational amenities in a coastal town where the focus is on sea, beach and river activities. There is also likely to be resultant economic benefits.	Long Term	Study Area	Probable	Very beneficial	Achievable	**VERY HIGH+**	• Ensure that, where possible, groynes are designed and orientated to provide potential surf breaks.	**VERY HIGH +**

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			The orientation and location of the groynes have been updated as a result of engagement with the surfing community. The original orientation and groyne locations were deemed to be intrusive to existing surfing areas. The presence of groyne structures may result in additional breaks which surfers could exploit.								
Visual Impact	Construction and operation (estuary)	Preferred Alternative	Visually, the presence of vessels on the estuary are unlikely to be considered to be out of the ordinary. However, should the preferred method be via excavator then this may not fit with the current expectation of "normal" activity on the estuary. The presences of pumps and pipes may also not be considered to be "normal". However, their visibility is expected to be of low significance and will likely only be visible to those in close proximity to dredging activities.	Short Term	Study Area	Probable	Moderately severe	Achievable	**MODERATE-**	• Only absolutely necessary equipment required for the dredging to be at the work site. All other equipment to be stored in an area less intrusive; and • Pumps and pipe placement should take visual disturbance into account for placement during the works.	**LOW-**
	Operation (groynes)	Preferred Alternative	The establishment of revetment structures and the presence of groynes.	Permanent	Study Area	May occur	Moderately severe	Difficult	**MODERATE -**	• Where possible ensure the design of the groynes does not impede the open seascapes view • Where possible ensure the design of the groynes are compatible and blend in.	**LOW-**
Loss of Archaeological Resources	Construction	Preferred Alternative	Dredging activities could damage or destroy potentially significant archaeological or cultural heritage sites, should such sites occur within the river. The study did not identify archaeological sites or features in the project area but the project is situated in the larger archaeological coastal sensitivity zone of St Francis where shell middens and other archaeological sites/materials are found. As such, care should be taken not to destroy previously undetected heritage remains.	Short Term	Study Area	Slight	Moderately severe	Achievable	**LOW –**	• Should any archaeological or cultural sites or objects be located during the construction of the proposed project, it should immediately be reported to the the National Heritage Council and the ECPHRA.); • All construction site staff should be briefed to immediately report any sites or objects of heritage significance located during the construction phase. In the event of finding what appears to be an archaeological site or a cultural and/or historic site or object, work within that area should be stopped until a qualified archaeologist or	**LOW +**

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
			Should these sites be correctly identified and excavated by a trained professional, it could contribute to a better understanding of the cultural heritage of the area.							historian can examine the item or find.	
Loss of Cultural Heritage Resources (built environment)	Construction	Preferred Alternative	A large number of Contemporary Period structures and buildings occur in the project along the St Francis beach but these buildings are not significant in terms of the historical built environment per se. Impact on old buildings, structures or features as not anticipated.	Short Term	Study Area	Slight	No impact	Achievable	**NO SIGNIFICANCE**		**NO SIGNIFICANCE**
Loss of Cultural Landscape	Construction	Preferred Alternative	The larger area comprises a rich cultural horizon and the natural landscape surrounding the proposed project encompasses vast coastlines and river valleys, typical of the Eastern Cape coast. The cultural landscape holds Herder, Iron Age remains and a Colonial Period frontier which embraces a regional history, represented in a number of significant archaeological sites. However, the proposed project is unlikely to result in a significant impact on the general cultural landscape of this area.	Short Term	Study Area	Unlikely	Slight	Difficult	**LOW-**		**LOW-**
Loss of Graves / Human Burial sites	Construction	Preferred Alternative	No burial sites were located in the study area. It should be noted that graves and cemeteries often occur within settlements or around homesteads in the rural areas of the Eastern Cape, and they are also randomly scattered around archaeological and historical settlements. The probability of informal human burials encountered during development should thus not be excluded.	Short Term	Study Area	Unlikely	Severe	Very Difficult	**MODERATE-**	• If any human bones are found during the course of Construction work then they should be reported to an Archaeologist and work in the immediate vicinity should cease until the appropriate actions have been carried out by the archaeologist. • Where human remains are part of a burial they would need to be exhumed under a permit from SAHRA (for pre-colonial burials as well as burials later than about AD 1500). • Should any unmarked human burials/remains be	**LOW-**

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
										found during the course of construction, work in the immediate vicinity should cease and the find must immediately be reported to the archaeologist, or the South African Heritage Resources Agency (SAHRA). • Under no circumstances may burials be disturbed or removed until such time as necessary statutory procedures required for grave relocation have been met.	
Loss of Marine Archaeological and/or Cultural Heritage Resources (relevant to dredging, nourishment and groyne infrastructure)	Construction and Operation	Preferred Alternative	In terms of Marine and Underwater Cultural Heritage (MUCH), the dredging, beach nourishment and construction of the groynes pose a risk to maritime features in the area. The risk of damage or complete removal from the site is possible given the scale and nature of the activities. However, the target areas for dredging occur largely to the riverside delta of the Kromme River estuary and areas within the river system to the west. In addition, the beach infrastructure (i.e. groynes) are expected to be constructed on top of the existing beach sand and level without the need for excavation. The revetment at the spit will be installed on a nourished beach level, which will be approximately 1 m higher than the existing beach level. Therefore, no intersection with submerged items and artefacts are anticipated.	Short Term	Study Area	Possible	Slight	Achievable	LOW-	• A 50 m buffer around the river mouth should be implemented. This buffer includes the beach and coastal dune strips around the river mouth which could potentially hold the washed-up remains of wreckage, artefacts as well as possible survivor camp remnants. • The exclusion of a portion of dredging target area P1 which falls within this proposed buffer zone is recommended. The extent of this proposed exclusion area is approximately 1.1ha. • Bi-weekly monitoring and reporting to SAHRA MUCH Unit by an informed and trained Environmental Control Office (ECO) of the dredging of target areas P1 and S1 and the placing of the groyne and revetment • A suitably qualified MUCH specialist should be appointed during initial stages of the development in order to provide training to the assigned project ECO	LOW-
Solid Waste Pollution (relevant to all project aspects)	Construction and Operation	Preferred Alternative	The construction phase of the activity will produce construction waste in the form of building rubble, excavated soil as well as general waste (e.g. litter from workers on site).	Short Term	Study Area	May occur	Slight	Easily Achievable	LOW –	• Construction material should be reused or recycled where possible; • Waste that cannot be reused or recycled should be disposed of in the correct manner at the nearest registered waste disposal site;	LOW –

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			During the operational phase, the ongoing maintenance activities may also produce solid waste. The incorrect management of this waste will have a negative impact on the environment as it can cause unnecessary pollution and also have a detrimental effect on the aesthetics of the proposed site.							• Any hazardous materials (e.g. paint, fuel, oil) must be disposed of immediately and in the correct manner; • General good house-keeping should be practiced on site; • If rubble is stored on site it should be stored on designated portions of land. Designated areas for storage of rubble should be set aside at the onset of construction; • Litter must be controlled during construction e.g. adequate bins must be made available on site at all times; • Construction materials stored as part of the project must be secured (i.e. plastics must be covered to prevent being blown off site). Skips must be regularly emptied and must be covered;	
Dust Pollution (implementation of coastal protection infrastructure)	Construction	Preferred Alternative	The construction of the rock revetments and stub groynes increases the potential for dust within the coastal area. During the construction phase of the activity, materials will be moved to and from the project site and this could result in dust pollution not only from the materials, but also from the construction vehicles which will be operating on site. The effects of dust will be exacerbated during high wind conditions.	Short Term	Study Area	Probable	Slight	Easily Achievable	**LOW –**	• Construction should preferably cease during period of high winds; • Exposed surfaces should be wet down where required to avoid dust emissions; • Vehicles transporting material such as sand should remain at a speed limit of 30km/h and, if required, cover their loads with a tarpaulin to avoid dust emissions.	**LOW –**
Traffic (relevant to sand sourcing should the option of truck transportation be implemented) and vehicle movements related to groyne and revetment construction and material transportation	Construction	Preferred Alternative	During construction, there will be an increase in the number of vehicles using the roads in and around St Francis Bay, including heavy construction vehicles. This may result in damage to the road as well as increased potential for road accidents. The construction vehicles could also impede traffic at certain sections of St Francis Bay if not adequately managed and controlled. As a result of the proposed project, there is likely to be an increase in the use of the roads within the adjacent area (e.g. the R330 and St	Short Term	Study Area	Probable	Moderately severe	Achievable	**MODERATE –**	• Appropriate warning signs must be erected, in accordance with the requirements of the District Road Engineer; • Vehicles must be roadworthy and serviced and must abide by the standard traffic laws; • Any Abnormal Loads must be approved with the traffic authorities and must comply with any conditions imposed by the authorities; • The contractor must employ flag staff if deemed necessary in order to prevent accidents;	**LOW –**

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
			Francis Bay internal roads).							• Speed limits on site must not exceed 30km/h and the speed limits along the public roads must be adhered to at all times; • Manage the travelling times of the delivery trucks so as to allow them to depart and arrive at spaced out time intervals, thus reducing the intensity of traffic and avoiding the formation of convoys of heavy vehicles.	
Noise Disturbance (relevant to all project aspects)	Construction	Preferred Alternative	It can be expected that there will be an increase in noise levels during the site preparation and construction phase of the project. The increase in noise will be associated with the operation of construction vehicles, dredging and other equipment and labourers. The noise level associated with the dredging and nourishment activity is expected to be approx. 80 dB at source. Depending on the size of the booster pumps, noise levels are expected to be 92 dB at source, reducing down to 60 dB at 500 m (ICF Jones and Stokes, 2008). To provide context normal conversation is about 60 dB, a lawn mower is about 90 dB, and a loud concert is about 120 dB.	Medium Term	Study Area	Definite	Moderately severe	Easily Achievable	**MODERATE –**	• All construction vehicles and equipment to be properly serviced in order to meet the necessary noise level requirements; • Restriction of work to daylight hours; • Programming of works close to noise sensitive residential properties should considered to avoid holiday periods; • Restriction of any unnecessary noise e.g. portable radios, vehicle radios, whistles etc.; • Machinery should be fitted with the required mufflers to reduce noise to acceptable, and notice given to surrounding residents prior to the commencement of construction; • Adhering to the municipal by-laws regarding noise.	**LOW –**
Employment Creation and Economic Benefits (relevant to all project aspects)	Construction	Preferred Alternative	The construction phase of the proposed project is expected to create approximately thirty (30) temporary jobs.	Short Term	Study Area	Probable	Moderate Beneficial	N/A	**MODERATE +**	• As far as possible, local labour should be used during construction; • Purchase materials locally, where possible, in order to support the local communities.	**MODERATE +**
Protection of Coastal Public Property (relevant to all project aspects)	Operation	Preferred Alternative	The construction of groynes, coupled with sand nourishment will increase the width of the beach and will stabilise the shoreline and protect the foredunes from wave attack from storm surges, and reduce the current undercutting and collapse of the foredune ridge. It will also protect	Long Term	Study Area	Definite	Very Beneficial	N/A	**VERY HIGH +**	• None applicable	**VERY HIGH +**

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
			associated social infrastructure. Especially since the spit breached on four occasions during 2020.								
Public health and safety	Operation	Preferred Alternative	Groyne structure will not be designed to be used by the public (i.e. walking, climbing). Groyne structures tend to create rip currents in proximity to the groynes themselves.	Long Term	Study Area	May occur	Moderately severe	Difficult	**MODERATE-**	• Ensure that appropriate and visible signage is erected warning the public of the dangers of climbing the structures and the rip currents. • Local life guards to ensure swimming areas are clearly demarcated.	**LOW-**

A detailed impact assessment of all the cumulative impacts identified is provided in Table 7.6 below.

Table 7.6: Cumulative Impacts and Key Mitigation Measures

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
Increased Estuary Bank Erosion	Operation	Preferred Alternative	The Kromme Estuary supports many recreational activities including fishing, birding, bait collection, waterskiing, canoeing, boat cruisers, hiking and swimming and as such tourism is viewed as an important income generator in the area. The banks of the estuary have been eroded in areas, particularly in the middle reaches of the estuary. This can mainly be attributed to boat activity as well as waves caused by easterly and westerly winds. While the evidence of erosion is upstream from the proposed dredging area, increasing the area available for boat activity in the lower reaches could lead to additional erosion in the lower and middle reaches of the estuary due to increased boats and duration of boating through more states of the tide. Although the wake generated by boats is potentially less than that which is generated by the easterly and westerly winds, it may contribute to further bank erosion.	Long Term	Study Area	Probable	Moderately Severe	Difficult	**MODERATE-**	• Enforcement of the management of boating activities and restrictions in place (i.e. no wake zones, etc); • Design dredging areas that leave the bank of the estuary intact as far as possible; • Clear channel marking where necessary; • Ensure boating activity areas are clearly demarcated; and • Maintenance of the sandbank adjacent to S1 may provide a buffer to the marina complex and to the spit revetment and groyne during a flood event, providing a more resilient estuarine system	**LOW-**

IMPACT	DEVELOPMENT PHASE	PROJECT ALTERNATIVE	CAUSE AND COMMENT	DURATION	EXTENT	PROBABILITY	SEVERITY	REVERSIBILITY AND MITIGATION	SIGNIFICANCE	MITIGATION MEASURES	RESIDUAL RISK
			The hydrodynamic changes to the estuary as a result of the dredging have been demonstrated as minor to negligible. The project has amended the sand sourcing to exclude parts of the sandbank near the marina to provide a buffer under flood conditions.								

8 PUBLIC PARTICIPATION PROCESS

8.1 Objectives of Public Participation

The Public Participation Process (PPP) aims to:

- Disclose activities planned by the project proponent and the EIA team;
- Identify issues and concerns from I&APs;
- Harness local expertise, needs and knowledge from the I&APs;
- Respond to grievances and enquiries from I&APs;
- Identify additional or new stakeholders and people affected by, or interested in, the proposed project;
- Gather perceptions and comments on the proposed terms of reference for the specialist assessments;
- Ensure that all issues raised by I&APs have been adequately addressed and/or assessed;
- Share the findings of the EIA and specialists' assessments, such as significant impacts, mitigation measures, management actions, and monitoring programmes; and
- Include any new concerns or comments that arise.

This information is used to:

- Identify underestimated or unanticipated impacts;
- Alert the project to possible communication breakdowns and emerging problems and concerns;
- Encourage the use of local resources and knowledge in the project;
- Identify development opportunities and community projects; and
- Ensure that all issues and concerns raised during Scoping are dealt with adequately in the EIA Process. This is achieved through the preparation of an IRT, also referred to as a Comments Report (CR).

8.2 Public Participation Process

There are four key steps in the PPP to ensure that I&APs are informed of the proposed project and afforded sufficient opportunity to raise comments and / or concerns. These include:

1. Identifying potential I&APs;
2. Notifying I&APs through:
   i. Site notices;
   ii. Written notice;
   iii. Advertisements;
   iv. Public meeting;
3. Making provision for I&APs to review and comment on all draft reports before they are finalised and submitted to the competent authority; and
4. Compiling a record of responses to any comments and concerns provided by the I&APs and including and addressing these concerns in final reports.

The information presented in this report includes the public participation from the previous application and for which the Final Scoping Report was accepted by the Department (25th October 2019).

For ease of reference and relevant to this section the previous Draft EIR is referred to as the DEIR 2020. This Draft EIR will be referred to as the DEIR 2021.

This DEIR 2021 has been updated following the refinement of the design and the updating the coastal and estuarine modelling. However, since much of the information remains similar the comments received on the DEIR 2020 have been considered and included in this document as necessary.

8.2.1 *Interested and Affected Parties Database*

I&APs and Key Stakeholders were identified during the Pre-Assessment Scoping Phase of the project. However, I&APs have continued to register throughout the process. The identification and engagement of I&APs and Key Stakeholders was continued into and through the Formal Scoping and EIR Phases. All I&AP information (including contact details), together with dates and details of consultations and a record of all issues raised, was recorded within a comprehensive database of I&APs. This database was updated on an on-going basis throughout the project and will act as a record of the communication and involvement process. Appendix B contains the information shared and comments raised following the submission of the Final Scoping Report. Should electronic communications for the Scoping and Pre-Scoping Phases be required please refer to the FSR. In addition to the information gathered during the Scoping Phase, the previous Draft EIR phase also resulted in a number of comments. These too have been included as part of this Draft EIR in order to ensure that all issues raised throughout the process have been recorded and addressed.

8.2.2 *Notification of Interested and Affected Parties*

Prior to the commencement of the formal EIA process, the proposed coastal protection scheme has been presented to the community at meetings held on the 20th of December 2017, the 3rd of January 2018, the 11th of January 2018 and the 20th of December 2018, as well as at a pre-application scoping process public meeting held on the 15th of April 2019 . Both the Advisian Preliminary Design Reports and the pre-application Scoping Report were made available on the SFPO NPC web-site.

I&APs were further notified through the following:

- Site notices;
- Written notice;
- Advertisements; and
- Public meeting.

<u>Site Notice</u>
Site notices were initially placed in two (2) locations on the 21st of December 2018: 1) At the intersection of Canal Rd and Shore Rd and 2) At the beach stairway located at the end of the Aldbara Run.

Site notices were later placed (pre-Scoping Phase) at the following locations on the 9th of April 2019: 1) At the Spar located along St Francis Dr; 2) Main beach located at the end of Nevil Rd; 3) At the beach parking area located at the end of Anne Ave; 4) At the intersection of Canal Rd and Shore Rd; 5) At the Small Boat Harbour located along La Digue Pl; 6) The Library; 7) The St Francis Links; and 8) The Kouga Local Municipality Municipal Offices. Similar notices were displayed during the formal Scoping Phase and EIR phase (See Appendix B).

<u>Written Notice</u>
Letters of notification and Background Information Documents were sent to all registered Stakeholders and I&APs at the commencement of the Pre-Assessment PPP. Additional notices were sent to all registered I&APs informing them of the availability of the Draft Scoping Report at the commencement of the mandatory formal thirty (30) day public review period, which ran from the 20th of August 2019 until the 18th of September 2019.

Notices were sent to all registered I&APs (18th December 2019) informing them of the availability of the Draft Environmental Impact Report and the commencement of the mandatory formal thirty (30) day public review period, which ran from the 19 December 2019 to the 5th February 2020. A second notice was issued on the 16th January 2020 informing I&APs of the availability of the Draft EIR and the comment period.

As part of this new application notices were sent to all registered I&APs informing them of the application to be submitted by the SFPO NPC (See Appendix B).

Advertisement

Newspaper advertisements were placed in the Herald on the 27th of March 2019, the Kouga Express on the 28th of March 2019, and the St Francis Chronicle on the 4th of April 2019, in order to notify the general public of the proposed project and the availability of the Draft Scoping Report for public review during the pre-application public participation process. During the formal public participation process on the Draft Scoping Report, advertisements were placed in the Herald on the 20th of August 2019, the Kouga Express on the 22nd of August 2019, and in the St Francis Chronicle on the 19th of August 2019.

The availability of the DEIR 2020 was advertised in the Herald on the 18th December 2019 and the Kouga Express on the 19th December 2019. A second advert was placed in the Herald on the 18th January 2020.

Public meeting

A pre-application public meeting was held on the 20th of December 2018 to introduce the proposed project to the affected community. An additional public meeting was held at the St Francis Links on the 15th of April 2019 during the pre-assessment review of the Draft Scoping Report. The details of these meetings were conveyed to the public in newspaper advertisements that were placed in the Kouga Express, the St Francis Chronicle, and the Herald, notifying the public about the availability of the Draft Scoping Report, as well as via email and SMS. During the formal public review period for the Draft Scoping Report, a public meeting was held at the St Francis Bowling Club Hall on the 27th of August 2019.

The first public meeting for the DEIR 2020 was held at the St Francis Bowling Club Hall on the 19th December 2019. A second meeting was held at the St Francis Links on the 29th January 2020.

Please refer to Appendix B for proof of public participation conducted.

This DEIR 2021 will be available for the mandatory 30 day commenting period and will be advertised in a similar manner to previous draft reports (i.e. via notices and a public meeting).

8.2.3 *Public Review of the Draft Reports*

The Draft Scoping Report was made available for a thirty (30) day pre-assessment public review period. All stakeholders and I&APs were notified of the availability of the DSR via newspaper advertisements, email and SMS. During the formal public review period, the Draft Scoping Report was made available from the 20th of August 2019 until the 18th of September 2019. I&APs were notified of the review period via the same means. The Scoping Report was approved by the Department on the 25th October 2019.

A DEIR 2020 was then made available for review between the 19th December 2019 – 5th February 2020 with two public meetings on the 19th December 2019 and the 29th January 2020. Following the closure of the PPP period it was decided that additional work would be carried out prior to the submission of the Final EIR. This additional work would take longer than what the EIA process would allow and therefore the application was allowed to lapse.

The availability of the DEIR 2021 will be advertised and all registered I&APs will be notified of the availability of the reports for public comment as well as the date for the public meeting.

8.2.4 *Issues and Responses Trail*

All issues, comments and concerns raised during the previous public participation opportunities have been compiled into an Issues & Response Trail (IRT). Additional comments received during DEIR 2020 phase have been included. Comments received as a result of the PPP on the DEIR 2021 will be compiled into an updated IRT and incorporated and submitted as part of the Final EIR (Appendix B).

A large number of comments questioned how the Kromme estuary may be impacted through the extraction of sand material. These were both environmental (i.e. habitat and species impacts) and social (i.e. reduction of sand bank amenity).

Additional key issues were:

1. *The inclusivity of the PPP process for all members of the community (specifically disabled and those in the informal settlements)*. A summary of the process for the original application can be referenced in this section (Section 8 of the EIR) below. A detailed account of the PPP to date and specifically to obtain comment from all possible IAPs follows:

   CES requested that the department (DEDEAT) consider that the PPP period for the DEIR 2020 be extended to cover the holiday period as many of the owners of the properties are not permanent residents. The primary purpose of extending the review period to 6 weeks and to hold it over the Christmas period as this is the time that many non-resident St Francis Bay homeowners are in the town for the holiday period. Confirmation was received from DEDEAT on the 9th December 2019.

   Notifications of PPP commencement (as mandated by the legislation) and public meeting on the 19th December:

   - Were placed around St Francis Bay (St Francis Bay Spar, Municipal Offices, Small Boat Harbour (outside and inside the office building), SFPO offices, St Francis Community Library, Bruces Ocean Museum and Sea Vista Community Library) on the 17th December 2019 along with notification during the SFPO AGM on the 17th December (204 Attendees);
   - Sent out via email (18th December 2019) to all registered I&AP’s;

- Sent out via email from the SFPO newsletter desk to all members on their data base on 18th December 2019; and
- Published in the press (Herald 18th December, Kouga Express 19th December), as prescribed in the legislation;

Hard copies of the report were made available in the Municipal Offices and SFPO offices on the 19th December 2019 and electronically from the CES website on the 19th December 2019.

The presentation on the 19th December 2019 summarised the information contained in the documentation. It covered the Project Description, Alternatives, Need for EIA, Baseline Environment (incl. Specialist Reports), IA methodology, Potential impacts of the scheme, Recommendations for mitigation and monitoring (EMP), Questions and information on where to send comments. The main difference between the EIR and Scoping Presentations were the inclusion of the specialist studies and the environmental impact ratings. The engineering design was the same as that presented in the Pre-Application meeting (Public Meeting held on 15th April 2019) and the Draft Scoping Report (Public Meeting held in August 2019). Thus, IAPs have had the period from (29th March 2019) to 5 February 2020, a period of ten months, to read and understand the technical aspects of the proposed scheme.

The documentation referred to above included:

- The Draft EIR (including Draft EMPr);
- The preliminary engineering design report (released on 29th March 2019 during the Pre-Application PPP);
- The Estuarine Specialist Report (available from 20th August 2019 as part of the documentation from the Draft Scoping phase);
- The Sand Sourcing Specialist Report (available from the 19th December 2019 as part of the Draft EIR); and
- The Archaeological Specialist Report (available from the 19th December 2019 as part of the Draft EIR).

CES together with the SFPO considered the request for a second meeting outside of the holiday period (29th January 2020) to include local residents who may have been away. This was well outside the holiday period to accommodate local residents. Thus, we have held meetings to include residents, holiday makers and non-resident homeowners.

Notifications of a 2nd meeting on the 29th January 2020:

- Were placed around St Francis Bay (St Francis Bay Spar, Municipal Offices, Small Boat Harbour (outside and inside the office building), SFPO offices, St Francis Community Library, Bruces Ocean Museum and Sea Vista Community Library);
- Were sent out via email (16th January 2020) to all registered I&AP's; and
- Published in the press (Herald 17th January) and local posters (including St Francis Bay Facebook pages).

The presentation was very similar to that presented on the 19th December 2019.

According to the register, the meeting on the 19th December was attended to by 22 people.

Previous meeting registers indicate that there were:
- 30 people present during the initial public meeting held in December 2018;

- 25 people present during the Pre-Application meeting held on the 15th April 2019;
- 19 people during the Draft Scoping PPP (August 2019); and
- 66 people in attendance on the 29th January 2020.

CES consider that there has been significant opportunity for interested and affected parties to be involved in the project and to provide comment:

- Non mandatory 30 day comment period for Pre-Application Phase (April 2019) including 1 public meeting;
- Mandatory 30 day comment period for Scoping Phase including 1 public meeting;
- Mandatory 30 day comment period for the DEIR 2020 extended by 18 days to accommodate holiday makers, including 2 public meetings; and
- As the department are aware, comments have been submitted outside of the formal commenting periods which we have accommodated in the IRT.

2. *The consideration of the design to accommodate the surfing community*. The oblique nature of the initial groyne design and the location of some of the groynes was questioned by local surfers who were concerned that the location of the groynes would interrupt and affect local surf breaks. The proponent and their engineers re-designed the groynes (as presented in the DEIR 2021) to accommodate the concerns. This was through the repositioning of the groynes to avoid known surf breaks and secondly to align the groynes perpendicular to the shoreline to facilitate the potential for additional surf breaks. The potential impact of the groynes to surfing has been mitigated during the design phase and therefore is not carried through as an impact in the DEIR 2021.

3. *Concern over the lack of specific ecological data collected to inform the EIA process*. The Kromme Estuary was well known to the specialists involved since Dr Chantel Bezuidenhout studied the Kromme as part of her PhD. She was able to describe the system based on previous experience, desktop literature review and analysis of aerial imagery.

4. *Alignment of the project with the national, district and local planning policies*. CES are familiar with Chapter 6 of the ICMA, having prepared a number of CMPs. This project, which will take place within Coastal Public Property, is not a programme but a specific intervention with goals aligned to the provisions of the ICMA. It is to improve access to the coastline, improve its recreational value; ensure that the coastline's coastal protection functions can continue; and assist in protecting natural and built assets from sea level rise. The project does align with the policy guidelines contained in the local CMP and the District level CMP.

   On page 163 the Kouga CMP talks to various development issues and risks and highlights the inappropriate location of developments close to the high water mark, and the resultant threats due to beach erosion. It then goes on to mention under the opportunities section on page 171 that the environmental assessment being undertaken on the coastal erosion and beach nourishment scheme in St Francis bay is an opportunity. Implicit in this statement is the fact that the Kouga CMP supports this initiative and sees it as consistent with the coastal management programme.

5. *Erosion of the bank of the estuary through increased vessel traffic.* The DEIR 2021 recognises that the increase in vessel activity would lead to the potential for an increase in erosion of the banks of the estuary and includes potential mitigation measures for consideration. The management of vessels (i.e. numbers) and the speed of vessels in sensitive areas requires a dedicated resource. In this case the Kromme Joint River Committee (KJRC) are custodians, on behalf of the Kouga Local Municipality (KLM) of the Kromme and Geelhout Rivers as vested by virtue of the MOA signed between the KLM and the KJRC NPC dated September, 2016. It is therefore the responsibility of the KJRC to manage boat licencing and traffic.

6. *Concerns regarding the engineering design and its suitability*. The engineering reports describe, in detail, the previous proposals for the protection of this frontage. They also describe the current physical conditions experienced within the coastal zone along this frontage and offer an explanation of how the erosion has occurred, its rate and the risks of not proceeding with an engineering solution. Based on a number of design requirements (cost, effectiveness, ability of the scheme to facilitate longshore drift, etc) Advisian presented the preferred solution. In 2020, Advisian refined the design of the groynes. The design changes included the change in location of the groynes (to avoid surfing locations) and the orientation of the groynes (perpendicular to the shoreline) to promote additional surfing breaks. These design changes were informed by updating the coastal model which was expanded to understand the potential impacts to the beaches to the north of the scheme. The model investigated:

    a. Whether the groynes would lead to an increase in the erosion to the beaches to the north; and
    b. Whether the groynes would further limit the longshore sediment transport.

    Appendix F of the DEIR 2021 contains the detailed engineering reports – summaries of which have been included in the DEIR 2021.

7. *The impacts to the Kromme Properties Shareblock*. These were received and responded to as part of the IRT. Significant concerns were raised on the delineation of the material sources and the potential impact it would have on the property owners infrastructure (jetties) and recreational areas (i.e. sandbanks). The material sourcing areas in the vicinity of the shareblock are considered a priority area since the main channel runs adjacent to these properties. The secondary sources of material in this area are limited. Recent modelling of the estuary using pre- and post- dredging scenarios shows that the changes to the current velocities will not change significantly in this area and therefore risks to infrastructure as a result of the dredging are limited. The increase in boat activity which could increase the erosional effect have been addressed above. Sandbank amenities have been assessed and an overall net loss of 1 ha of sandbank habitat / area is not considered to be significant as it equates to 2% of the total sandbank area.

8. *The validity of the information used to inform the impacts*. The information used in the development of this report was based on desktop resources, scientific literature and updated engineering output (i.e. design and modelling). Advisian based their latest coastal and estuarine modelling on updated topographical and bathymetric surveys of the bay, the beach and the estuary. The model of the estuary specifically investigated the hydrodynamic conditions in a pre-dredging scenario and compared them to the hydrodynamic conditions in a post dredging scenario. The findings were:

    a. Very little change in current velocities within the estuary;
    b. A noticable change in velocities at the mouth of the estuary immediately after dredging. These return to pre-dredge conditions when the sediment reaches equilibrium shortly after dredging; and

c. The changes to the tidal prism result in lower water levels (at low tide) than that under the current scenario;

The specialist reports have subsequently been updated and any assumptions used to assess the impacts have been listed and potential limitations of the work identified in the respective reports. The Kromme Estuary is a fairly well researched estuary and the habitats that exist within the Kromme are well defined in scientific literature. Therefore, a suitable amount of information was available to provide adequate assessments.

8.3 Summary of PPP

The following public participation (Table 8.1) has already been conducted as part of the S&EIR process as part of a previous application.

Table 8.1: Summary of the PPP carried out to date, as part of the previous application.

Phase	Requirement	Date
Inception Phase	Site notices	Placed on 21 December 2018 and 9 April 2019.
	Pre-Assessment Public Meetings	Held on 20 December 2018.
	Pre-Assessment consultation with DEDEAT	Held on the 18 April 2019 and 1 March 2019.
Scoping Phase (30 day Pre-Assessment PPP period)	Newspaper Adverts	Placed in the Herald on the 27th of March 2019, Kouga express on the 28th of March 2019 and the St Francis Chronicle on the 4th of April 2019.
	Notifications	Sent at the commencement of the PPP period on the 1st of April 2019.
	Commenting Period	29th of March 2019 until the 29th of April 2019.
	Public Meeting	Held on the 15th of April 2019.
Scoping Phase (Formal Mandatory 30 day PPP Period)	Newspaper Adverts	Placed in the Herald on the 20th of August 2019, Kouga Express on the 22nd of August 2019 and the St Francis Chronicle on the 19th of August 209.
	Notifications	Sent at the commencement of the PPP period on the 20th of August 2019.
	Commenting Period	20th of August 2019 until the 18th of September 2019.
	Public meeting	Held on the 27th of August 2019.
	Ongoing consultation meeting with DEDEAT	Held on the 29th of August 2019.
	Site visit by Department of Environmental Affairs – Oceans and Coasts	5th September 2019.
EIA Phase 2019/2020 (Formal Mandatory 30 day PPP Period)	Newspaper Adverts	Placed in the Herald on the 18th December 2019. Kouga Express 19th December 2019.
	Notifications	Sent at the commencement of the PPP period – 19th December 2019.
	Commenting Period	19th December 2019 – 5th February 2020.
	Public Meeting	19th December 2019
	Newspaper Adverts	Placed in the Herald 17th January 2020.
	Notifications	Sent out on the 16th January 2020.
	Public Meeting	29th January 2020

Table 8.2: Summary of the PPP carried out as part of the new application.

Phase	Requirement	Date
Scoping Phase	See Table 8.1 above	See Table 8.1 above

EIA Phase 2020/2021 (Formal Mandatory 30 day PPP Period)	Notifications	Notification sent to registered I&APs on the 14th December 2020 to inform them of the pending new application.
	Newspaper Adverts	TBC
	Commenting Period	TBC
	Public Meeting	TBC

It is the EAP's opinion that the PPP process has been inclusive and extensive. The process has generated and collected a number of comments from I&APs. These comments have been addressed through the provision of engineering reports, public meetings and clarification in the reports generated.

9 CONCLUSIONS AND RECOMMENDATIONS

According to Appendix 3, Section 3 (1), of the of the 2014 EIA Regulations (as amended), "*an environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include—*

(l) An environmental impact statement which contains:
- *(i) A summary of the key findings of the environmental impact assessment;*
- *(ii) A map at an appropriate scale which superimposes the proposed activity and its associated infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and*
- *(iii) A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.*

(n) The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;
(o) Any aspects which were conditional to the finding of the assessment either by the EAP or specialist which are to be included as condition of the authorisation;
(p) A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed
(q) A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.

In line with the above-mentioned legislative requirement, this Chapter of the EIR provides a summary of the findings of the proposed development and a comparative assessment of the positive and negative implications of the proposed project. In addition, this Chapter provides the EAP's opinion as to whether the activity should or should not be authorised as well as the reason(s) for the opinion.

9.1 Description of the proposed activity

The St Francis Property Owners Non Profit Company (SFPO NPC), on behalf of the Kouga Local Municipality (Kouga LM), has proposed the implementation of a coastal protection scheme for St Francis Bay beach, located within the Eastern Cape Province. The proposed project area is situated approximately 100 km west of Port Elizabeth, within the Kouga LM, seated within the Sarah Baartman District Municipality (SBDM).

The coastal protection scheme will include sand material sourcing from the Kromme River, beach nourishment of St Francis Bay beach and the development of coastal structures to retard the erosion of St Francis Bay beach. It is proposed that the preferred alternative included in this report is considered as the solution with which to proceed from an environmental point of view. That is:

1. Sand sourcing from the Kromme Estuary focussing on priority areas and secondary areas as required;
2. Beach nourishment along the full frontage, likely to be developed in phases; and
3. Construction of stub groynes as proposed that retain the nourished sediment but also facilitate the long shore sediment movement to ensure that the coast to the north of the scheme still receives sediment supply.

9.2 Conditions to be included in the Environmental Authorisation

The following conditions should be considered for inclusion in the Environmental Authorisation:

- The development of an adaptive management plan informing the maintenance dredging – prior to construction starting;
- The monitoring of the beach profiles to the north of the scheme – prior to construction starting;
- The monitoring of the estuarine channels and sandbanks (i.e. bathymetry) during construction phases;
- The completion of a vegetation assessment, specifically the *Zostera* and saltmarsh habitats – prior to construction starting. In this case the distribution and species composition is important;
- The appointment of an ECO for all construction phases of the project.

9.3 Assumptions, uncertainties and gaps

Assumptions

- Additional bathymetry and modelling may take place during and post construction of Phase 1.
- The sand sourcing study reported on compatibility and volume of material. During the procurement of a contractor the contractor may carry out additional and more specific testing of material.

Gaps

Only preliminary engineering input was provided in this phase of the project. It is general engineering practice that the detailed design phase of a project is only initiated once environmental authorisation for a project (based on what is submitted as preliminary design) is secured.

This has also provided the EIA process an opportunity to guide the Planning and Design proactively rather than reactively (e.g. surfing). Valuable comments have been received which will be incorporated into the detail design. The Environmental Management Programme (EMPr) should, therefore, be viewed as a dynamic evolving document that can be adapted and updated to specific needs and design conditions.

If the project is authorised by the Department of Economic Development, Environment and Tourism, SFPO NPC will be required to provide DEA with final layout plans. These plans should be informed by the EIA and any other post-authorization studies or surveys. The final layout requirement will further serve to demonstrate to how the relevant environmental standards and management specifications contained in the EMPr, as informed by the site-specific environmental context and potential impacts, as well as the relevant conditions of authorisation, has been incorporated in the detailed design process.

9.4 Need and desirability

Section 4 of the EIR describes the need and desirability of the project.

The project aligns with the planning and development objectives from municipal to national level in the following ways:

- "*to create a safe environment with diverse opportunities for economic growth and development*' as per the Kouga LM Integrated Development Plan (IDP) 2017-2022. The proposed project will assist in achieving this important objective by (a) decreasing the exposure of the beachfront and municipal infrastructure such as roads, access stairs and parking facilities to dynamic coastal processes, thereby increasing the safety and quality of the beachfront area; (b) decreasing the potential of shifting sand bars in the Kromme river, thereby increasing the navigation ability and safety of boaters; (c) increasing the width of the beaches, thereby promoting tourism and economic growth and development, and (d) preventing the loss of physical infrastructure in both the public and private sector by arresting the current rapid rate of beach erosion.

- At district level St Francis Bay has been recognised as an important tourist destination. This project is referred to in the draft Sarah Baartman District Municipality Coastal Management Programme as an opportunity to protect coastal infrastructure and particularly to maintain public access to the beach, car parks and ablutions.

- Assist with attaining the strategic objectives and actions set out in the Provincial Development Plan. It is also aligned with the Eastern Cape Vision 2030 Provincial Development Plan (2014) as it will contribute to employment creation and social development, tourism, coastal protection and maintenance of coastal infrastructure through preventing the loss and erosion of the St Francis Bay beaches and public and private land and amenities.

- Support the 2030 National Development Plan (NDP, 2013) on the development of economic infrastructure including water resources and services where "*water will be recognised as a foundation for activities such as tourism and recreation, reinforcing the importance of its protection*." A key development policy outlined under economic infrastructure is that of tourism infrastructure, including accommodation and tourism products, which will play an important role in attracting a variety of tourists to different parts of South Africa. It also outlines the importance of ensuring environmental sustainability while allowing for the delivery of cultural benefits, including recreational opportunities, in order to achieve the national social and economic development objectives.

Through the protection of coastal infrastructure and property and the enhancement of the local amenities which are considered attractions to tourism and recreational activities the project can be regarded as very desirable.

9.5 Public Participation Process

The current EIA process for the project has been subjected to a rigorous Public Participation and stakeholder engagement process (PPP) to date, as comprehensively described in Section 8 of this EIR.

The following public participation was conducted as part of the previous S&EIR process:

Phase	Requirement	Date
Inception Phase	Site notices	Placed on 21 December 2018 and 9 April 2019.

	Pre-Assessment Public Meetings	Held on 20 December 2018.
	Pre-Assessment consultation with DEDEAT	Held on the 18 April 2019 and 1 March 2019.
Scoping Phase (30 day Pre-Assessment PPP period)	Newspaper Adverts	Placed in the Herald on the 27th of March 2019, Kouga express on the 28th of March 2019 and the St Francis Chronicle on the 4th of April 2019.
	Notifications	Sent at the commencement of the PPP period on the 1st of April 2019.
	Commenting Period	29th of March 2019 until the 29th of April 2019.
	Public Meeting	Held on the 15th of April 2019.
Scoping Phase (Formal Mandatory 30 day PPP Period)	Newspaper Adverts	Placed in the Herald on the 20th of August 2019, Kouga Express on the 22nd of August 2019 and the St Francis Chronicle on the 19th of August 2019.
	Notifications	Sent at the commencement of the PPP period on the 20th of August 2019.
	Commenting Period	20th of August 2019 until the 18th of September 2019.
	Public meeting	Held on the 27th of August 2019.
	Ongoing consultation meeting with DEDEAT	Held on the 29th August 2019
	Site visit by Department of Environmental Affairs – Oceans and Coasts	5th September 2019.
EIA Phase (Formal Mandatory 30 day PPP Period)	Newspaper Adverts	Placed in the Herald on the 18th December 2019. Kouga Express 19th December 2019.
	Notifications	Sent at the commencement of the PPP period – 19th December 2019.
	Commenting Period	19th December 2019 – 5th February 2019.
	Public Meeting	19th December 2019
	Newspaper Adverts	Placed in the Herald 17th January 2020.
	Notifications	Sent out on the 16th January 2020.
	Public Meeting	29th January 2020

Comments received varied between those related to the engineering solutions and those regarding environmental / social considerations.

There has been a history of coastal protection attempts in St Francis Bay and many of the solutions have been compromised over time. Concerns over the suitability of the proposed solution included groyne design, orientation and the effects of the design on the coastline.

9.6 Summary of Impacts

The no-go alternative assumes that the status quo will remain unchanged and that there will be no new development. Under the No-go alternative, the erosion of the St Francis Bay beach will continue and as has occurred during the course of 2020, breaches in the spit will occur again and damage to infrastructure and property along the entire length of the beach will continue. The No-go alternative will mean that there will be no groyne construction, beach nourishment and therefore no protection of backshore infrastructure and residential properties.

A total of 41 impacts have been identified for this project. These are a combination of construction (30) impacts and operational (10) impacts. This is due to the scale of the activity during construction as opposed to operation which essentially only involves maintenance related activity. One (1) cumulative impact was identified.

After mitigation, there are no negative impacts of HIGH significance.

Seventeen construction impacts (Table 9.1), prior to mitigation, were considered to have moderate negative significance while nine impacts had low significance. Three of the impacts were seen as moderately beneficial as a result of the construction. One impact had no significance attached to it's assessment.

All but three impacts identified as moderately negative were reduced to low negative significance as a result of the suggested mitigation measures. In these three cases, it is not possible to carry out the construction of the project without loss or damage to estuarine and dune ecology. Given the sensitivity and conservation status of these habitats the impact remains of moderate negative significance.

The beneficial impacts are associated with the potential increase in available habitat for both marine flora and fauna and socio economic benefits. The groynes may provide for additional hard substrate for algal species, while the gaps in the rocks making up the groynes create crevices for crustaceans etc. This is considered more of a by-product of the project rather than a specific design decision.

The construction activities will lead to temporary and permanent job opportunities both directly associated with this project and indirectly through hospitality.

During the operational phase (Table 9.1), five impacts of negative significance have been identified.

The changes to the hydrodynamics of the Kromme estuary are not considered to be significant other than in the mouth area temporarily following the dredging activity. The removal of sand material from the channels will facilitate vessel traffic through more states of the tide and with increased vessel traffic is the impact of erosion from vessel wake. It should be noted that wind generated waves on the estuary throughout the year also result in erosion.

The visual impact of the groynes are anticipated to result in a negative impact since they will result in an altered landscape and seascape. The presence of the groynes may also result in rip tides. These rip tides are often in close proximity of the groynes structures themselves. The structure will also not be designed for public access. However, it is anticipated that the public will try and access these structures. Therefore, a health and safety impact has been identified.

Five beneficial impacts have been identified resulting in moderate to very high beneficial impacts. These beneficial impacts as associated with the nourishment of the beach providing additional local amenity and coastal protection. Two socio-economic benefits are of HIGH positive significance (Increased boat access during all tidal cycles and potential increased tourism). The protection of Coastal Public Property is seen as a benefit of VERY HIGH significance, as the no-go option will eventually result in the loss of almost all beach amenities, and quite possible infrastructure and property along the length of the frontage.

The only cumulative impact identified, since no other specific projects are planned, is the potential for the scheme to result in an increase in boat traffic. This in turn could result in accelerated erosion to the banks of the estuary. The impact is deemed to be of moderate negative significance prior to mitigation. However, since vessel numbers are monitored and managed, this impact can be reduced to low.

Table 9.1 Project related impacts

IMPACT	SIGNIFICANCE	RISIDUAL RISK
CONSTRUCTION PHASE IMPACTS		
Estuarine Physical Characteristics – Change in hydrodynamics	LOW –	LOW –
Estuarine Physical Characteristics – Alteration of water channel due to scour	LOW –	LOW –
Estuarine Physical Characteristics - Erosion of the Kromme riverbanks and beach spit (also applicable for operation phase)	LOW-	LOW-
Surface Water Pollution (machinery)	MODERATE –	LOW –
Estuarine Ecology – Suspended sediment / turbidity (also applicable for maintenance dredging during operation phase)	MODERATE –	LOW --
Estuarine Ecology – Flora (Direct loss of estuarine floral species) (also applicable for maintenance dredging)	MODERATE –	LOW –
Estuarine Ecology – Estuarine Functional Zone (also applicable during operation phase)	MODERATE-	MODERATE-
Estuarine Ecology – Fauna (Direct loss of faunal) (also applicable for maintenance dredging)	MODERATE -	LOW –
Estuarine Ecology – Fauna (Loss of sandbank habitat)	MODERATE-	LOW-
Estuarine Ecology – Fauna (Impacts on bird species)	LOW –	LOW –
Dune Ecology – Loss of dune vegetation (Sand River)	MODERATE-	MODERATE-
Dune Ecology – Impacts on foredunes due to site access	LOW -	LOW-
Dune Ecology – Impacts on nearshore and beach ecology	MODERATE-	MODERATE -
Marine Ecology – Flora (Loss of nearshore reef)	MODERATE-	LOW-
Marine Ecology – Flora (Increased hard substrate/habitat for attachment of benthic species)	MODERATE+	MODERATE+
Marine Ecology – Fauna (Increased hard substrate/habitat for attachment of benthic species)	MODERATE+	MODERATE+
Local Amenity – Estuary (Temporary restricted access in areas)	MODERATE-	LOW-
Local Amenity – Estuary (Decreased area available for bait digging)	MODERATE-	LOW-
Local Amenity – Beach (Restricted access to areas during construction)	MODERATE-	LOW-
Visual Impact – Dredging and construction machinery	MODERATE-	LOW-
Loss of Archaeological Resources	LOW –	LOW +
Loss of Cultural Heritage (built environment)	NO SIGIFICANCE	NO SIGNIFICANCE
Loss of Cultural Landscape	LOW--	LOW-
Loss of graves	MODERATE-	LOW-
Loss of marine archaeological / heritage resources	LOW -	LOW -
Solid Waste Pollution (Relevant to all project aspects) (also relevant to operation phase)	LOW –	LOW –
Dust Pollution (Implementation of coastal protection infrastructure)	LOW –	LOW –
Increased Traffic (Relevant to sand sourcing should the option of truck transportation be implemented) and vehicle movements related to groyne and revetment construction and material transportation	MODERATE –	LOW –
Noise Disturbance (Relevant to all project aspects)	MODERATE –	LOW –
Employment Creation and Economic Benefits (Relevant to all project aspects)	MODERATE +	MODERATE +
OPERATIONAL PHASE IMPACTS		
Estuarine Physical Characteristics (Increased erosion due to boat traffic)	MODERATE-	LOW-
Dune Ecology (Restoration of beach habitat)	MODERATE+	MODERATE+
Marine Hydrodynamics - Impact (erosion) as a result of the infrastructure and dredging	MODERATE-	LOW-
Marine Hydrodynamics - Impact (reduction of sediment supply) to the northern beaches	MODERATE-	LOW-
Local Amenity – Estuary (Increased boat access during all tidal cycles)	MODERATE+	MODERATE+
Local Amenity – Estuary (Potential increased tourism)	MODERATE+	HIGH+
Local Amenity – Beach (Increased recreational use)	VERY HIGH+	VERY HIGH +
Visual Impact – Presence of groynes	MODERATE -	LOW -
Protection of Coastal Public Property (Relevant to all project aspects)	VERY HIGH +	VERY HIGH +
Public Health and Safety	MODERATE-	LOW-
CUMULATIVE IMPACTS		
Erosion of the banks of the estuary through increased boating activity	MODERATE-	LOW-

9.7 Site Sensitivity analysis

A site development sensitivity map was developed based on specialist and general site information gathered (Figure 9.1), and the site was classified into areas of No Development, Limited Development and No Limitations areas (Figure 9.2 and Figure 9.3).

- No development areas included areas of high sensitivity indicated by the biodiversity specialist.
- Limited Development areas (moderate and high sensitivity areas) are areas where construction is conditional on the fulfilment of certain aspect-specific requirements. For example, Limited Development areas include areas of moderate sensitivity identified by the estuarine and dune ecology experts.
- No Limitations areas are areas of Low Sensitivity where construction may take place without hindrance.

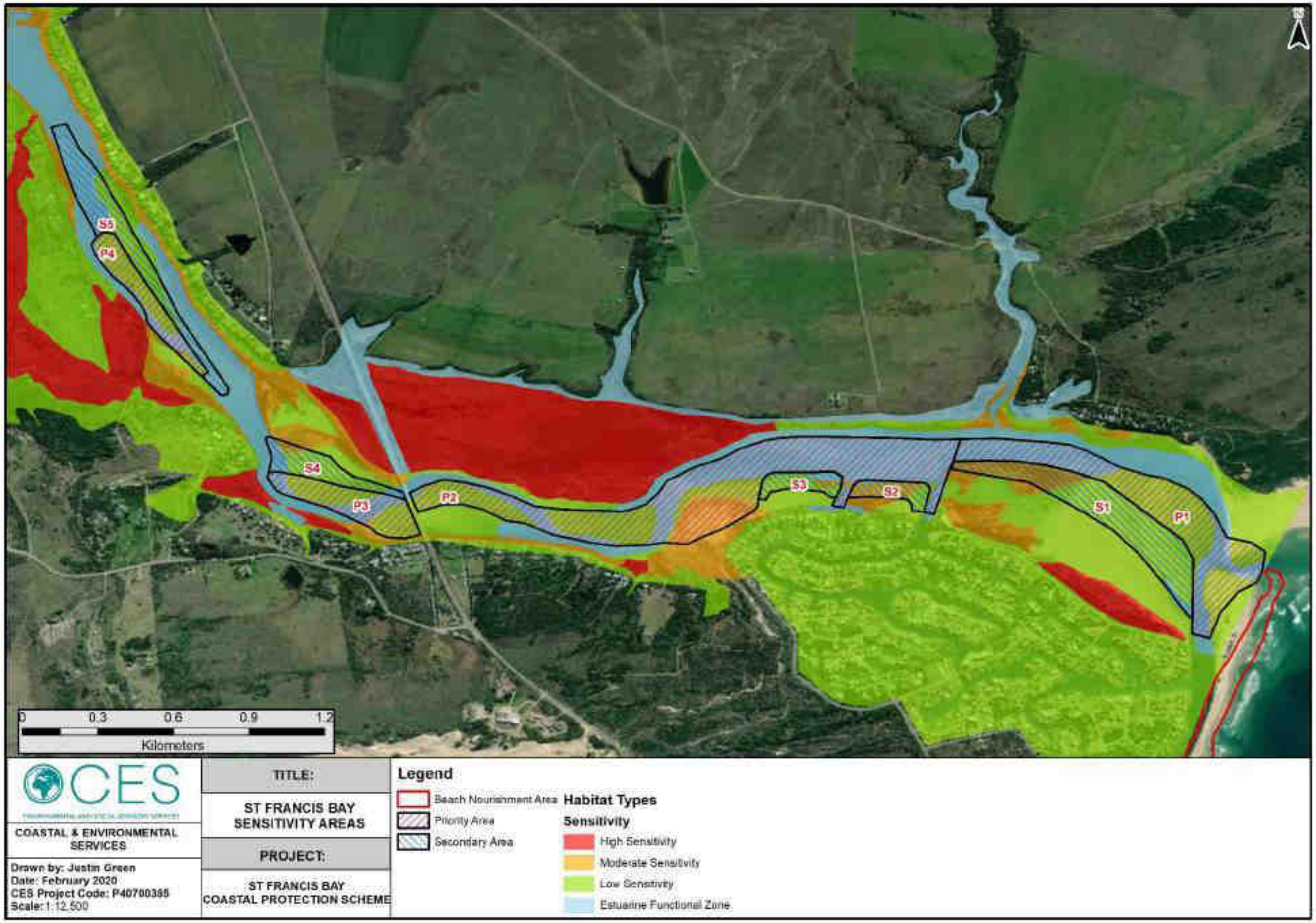

Figure 9.1: The Site Sensitivity map for the Kromme Estuary and the proposed development areas

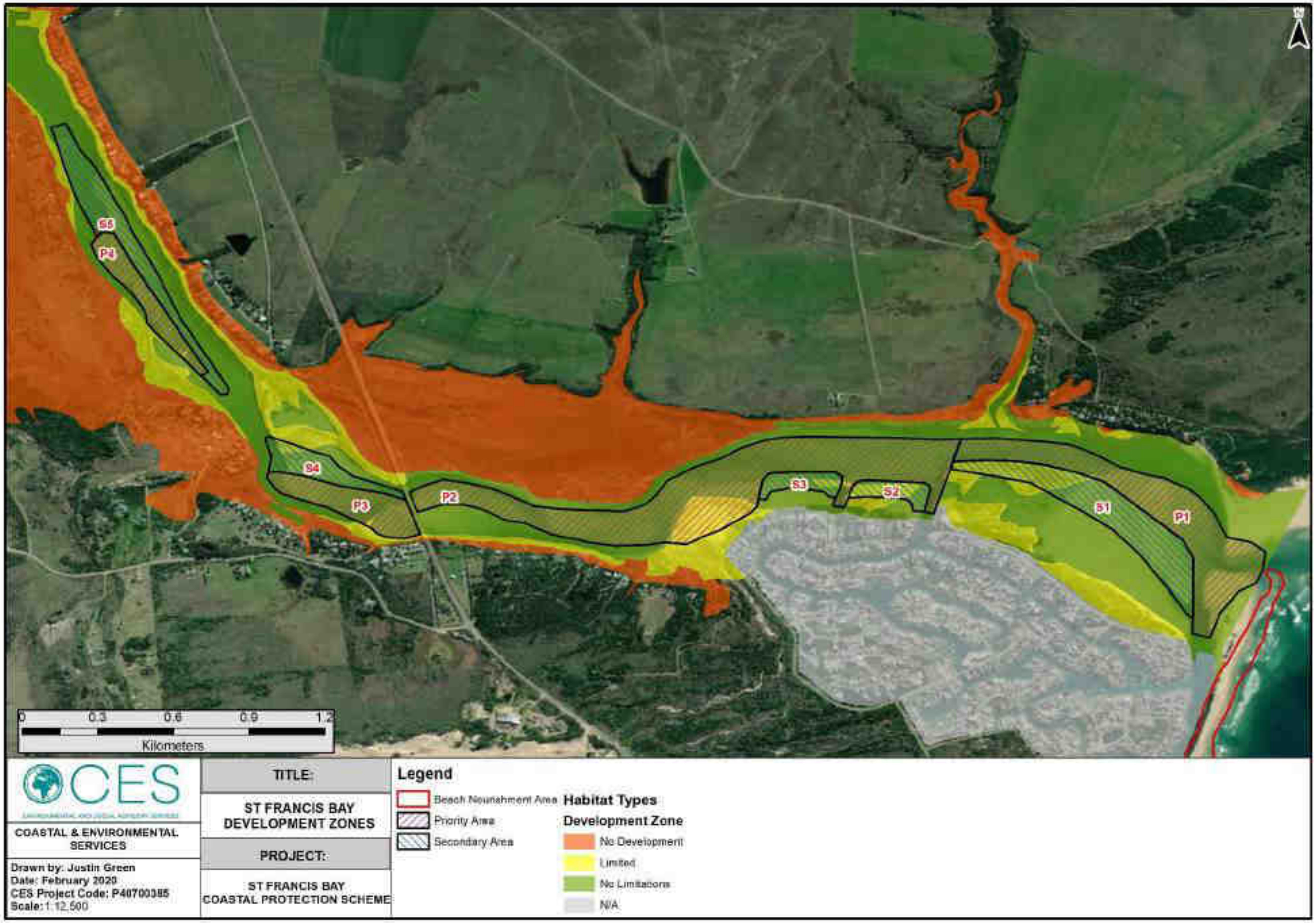

Figure 9.2: The Site Sensitivity map for the Kromme Estuary and the resultant development areas

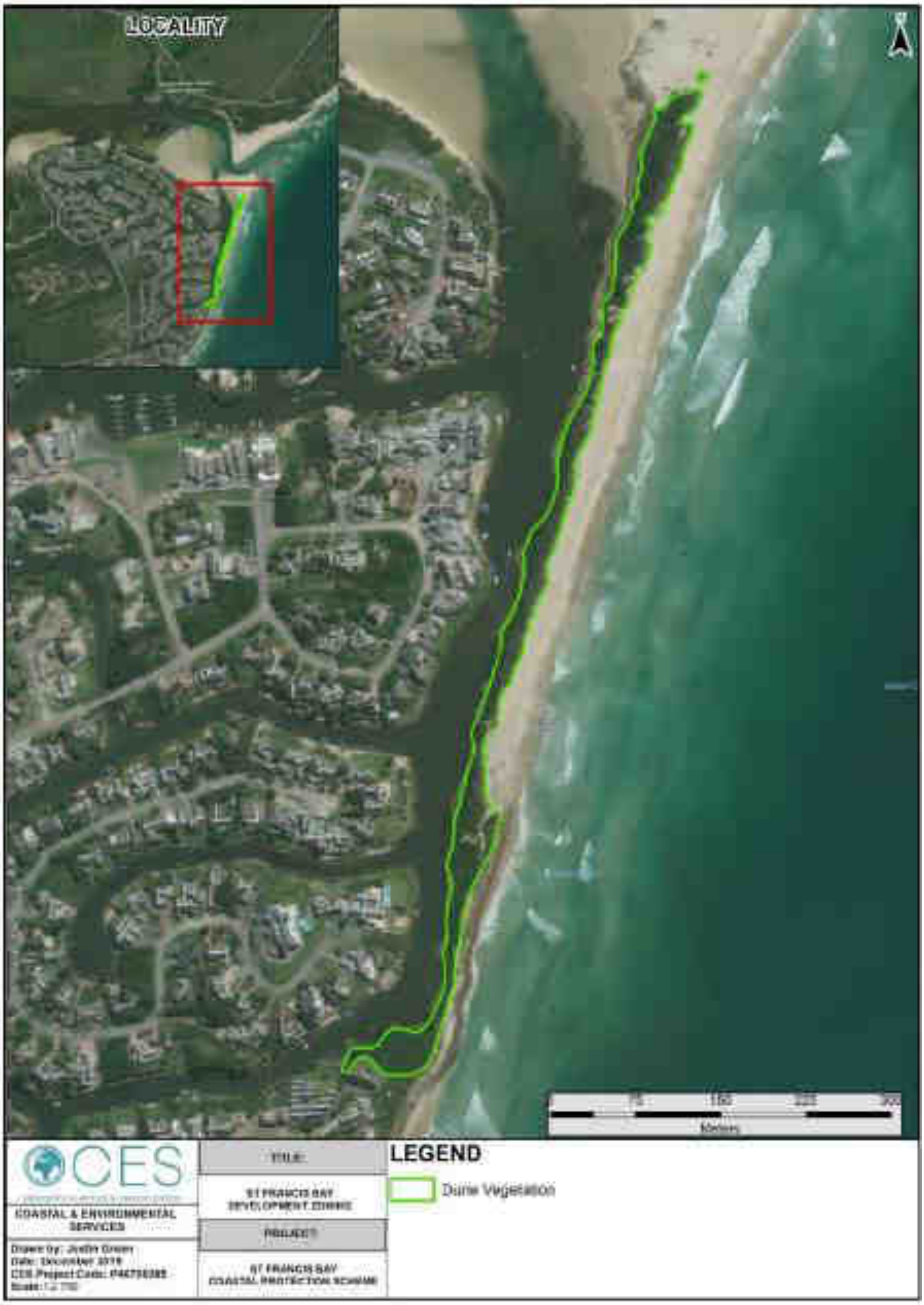

Figure 9.3: The Site Sensitivity map for the St Francis Bay frontage and the resultant development area. The sensitivity was considered high prior to the breaching events in 2020. While vegetation cover is low, the indigenous vegetation should remain intact.

9.8 Environmental Authorisation Requirements

The Environmental Authorisation (EA) for the construction of the proposed development is required for a period of 10 to 20 years to cover the development of each of the phases as the funding becomes available. This will allow sufficient time for the applicant to undertake the procurement process to appoint a contractor, to furnish the appointed contractor with the details of the EA and the conditions included in the EMPr, to complete the construction of the groynes and nourishment of the beach. The activity related to the construction is subject to available funding and, therefore, construction will most probably be undertaken in a phased manner. All phases of the proposed project will only commence once sufficient funds are made available.

An Environmental Site Officer (ESO) must be appointed for the duration of the construction period, full time, and must complete daily check-sheets and the Environmental Control Officer (ECO) must submit monthly audit reports to the DEDEAT. The potential phasing of the project would mean that there would be discreet construction periods for each of the phases.

The operational phase of the proposed development is predicted to continue into perpetuity. It is recommended that an ECO is appointed to conduct quarterly monitoring for the first year following the completion of construction (or per phase) to ensure that the construction has progressed in line with the methodology and the EMPr. Following that, and based on the results of the first year of monitoring, annual monitoring should be considered.

9.9 Opinion of the EAP

Based on the outcomes of the current EIA process, it is the professional opinion of CES and specialists that:

- The project results in no negative impacts of HIGH significance, and only 3 of MODERATE significance following mitigation. The majority of the negative impacts 28 can be mitigated to LOW significance.
- The project results in 8 MODERATE to VERY HIGH positive impacts.
- There are no fatal flaws are associated with the proposed development and all impacts can be adequately mitigated to reduce the risk or significance of impacts to an acceptable level.
- The significance of the benefits associated with the proposed development outweigh the significance of the negative impacts.

It is the opinion of the EAP that this report contains sufficient information to allow the DEDEAT to make an informed decision. It is therefore recommended that the application for Environmental Authorisation should be approved on condition that the recommended mitigation measures stated herein are effectively implemented.

9.10 Recommendations of the EAP:

All mitigation measures, which have been outlined in this report, in the specialist reports, as well as in the Environmental Management Programme (EMPr), must be fully adhered to and implemented.

It is recommended that the following conditions are included in the Environmental Authorisation for the proposed coastal protection project:

1. A regular monitoring programme should be developed and implemented to include the following:
    - Beach profiles must be completed along the St Francis Bay beach, preferably at the same locations that have been measured in the past;

- Profiles of the river bank should be undertaken to monitor erosion of the banks of the Kromme River;
- It is understood that a dredging contractor would carry out regular bathymetric surveys of the lower Estuary area. These are likely to be pre-dredging, once dredging commences, and post-dredging. This monitoring data will provide valuable information on the sediment distribution, accumulation and transport within this dynamic estuarine system, which can be used to assess the volumes of sediment entering this flood-dominated system and any future modifications to the dredging scheme that need to be implemented; and
- A detailed log of sediment discharge quantities must be maintained by the dredging contractor in order to track the volume of sediment that is removed from the estuary.

2. The monitoring regime included in the Estuarine Impact Assessment report (CES, 2020) must be incorporated into the project Environmental Management Programme (EMPr).
3. An adaptive management plan must be developed prior to the start of construction. Adaptive management is a formal, systematic approach to learning from the outcomes of management actions, accommodating change and improving management. It involves synthesizing existing knowledge, exploring alternative actions and making explicit forecasts about their outcomes. Management actions and monitoring programs are carefully designed to generate reliable feedback and clarify the reasons underlying outcomes. Actions and objectives are then adjusted based on this feedback and improved understanding. In addition, decisions, actions and outcomes are carefully documented and communicated to others, so that knowledge gained through experience is passed on. To be effective, adaptive management requires a commitment to learn and adjust, adequate resources (e.g., for monitoring and data analysis), and access to necessary expertise. In this case the adaptive management should be implemented for the dredging of the estuary and the nourishment of the beach frontage.

Please refer to the Environmental Management Programme (EMPr) for detailed environmental management measures.

Environmental Monitoring

The following baseline data needs to be collected prior to construction, certainly for Phase 1. The outcomes of these studies must be used to inform subsequent monitoring.

- ***Sediment contaminant testing*** – while it is anticipated that the sediment suitable for dredging is unlikely to contain harmful contaminants testing of the sediment is required to establish this. Having collected data prior to construction, sediment tested during the dredging would allow comparison to a pre-dredge condition. It is anticipated that samples be taken from those areas to be dredged. A sample of surface and depth should be taken and analysed for *E. coli* and heavy metals. This is anticipated to be carried out by the dredging contractor periodically throughout the dredging process.
- **Ground truthing the distribution of the habitats** identified as part of this study should be considered. Following this, monitoring the sensitive habitats in close proximity to the dredging activities should be carried out to determine die-back as a result of smothering, dredging, loss of habitat. Should these areas be determined to be reducing correction measure should be implemented. This should be carried out by a suitably qualified specialist with the emphasis being on the ability to accurately replicate the activity during the construction phase.

Similarly, during operation understanding the changes to the estuary and hydrodynamics as a result of the dredging of the Kromme would facilitate comment on how the habitats might evolve as a result. It is understood that a dredging contractor would collect bathymetric data during the works. However, it should be provided to a suitably qualified and experienced ecological/environmental expert, in a format that can be easily interpreted, to be able to verify the impacts. It is recommended that this monitoring takes place at least annually.

Similar to the bathymetric surveys, habitat distribution should be monitored during construction. Initially, monitoring should be fairly regular (i.e. once every 3 months) to ensure that any suspended sediment that may be settling is not settling in sensitive habitats at a rate unsustainable for the continuation of that particular habitat. This should be done through the collection of fixed-point photographs and updated distribution mapping.

The outcome of the monitoring should be compiled into an annual monitoring report comparing the monitoring against the baseline data that was collected prior to construction. In addition, there should be comment on the observations and whether they are in line with the impacts identified during the EIA. Should the impacts observed through the monitoring differ from that of the EIA and particularly if adverse, additional mitigation measures should be implemented.

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Whitfield, A.K. and Bate G.C. 2007. A Review of Information on Temporarily Open/Closed Estuaries in the Warm and Cool Temperate Biogeographic Regions of South Africa, with Particular Emphasis on the Influence of River Flow on These Systems. Interim report to the Water Research Commission on the Project “The freshwater requirements of intermittently open Cape estuaries”. WRC Report No 1581/1/07.

Wooldridge, T.H. 2007. Biotic response to altered freshwater inflow patterns to the Kromme River Estuary, South Africa. Transactions on Ecology and the Environment (1): 687-696.

APPENDIX A – EAP DECLARATION

APPENDIX B – PUBLIC PARTICIPATION DOCUMENTATION

APPENDIX C – THE SCOPING AND EIA PROCESS

APPENDIX D – ASSESSMENT METHODOLOGY

APPENDIX E – CVS OF THE PROJECT TEAM

APPENDIX F – ADVISIAN DESIGN REPORTS

APPENDIX G – EXIGO ARCHAEOLOGICAL SPECIALIST REPORT

APPENDIX H – EXISTING ENVIRONMENTAL AUTHORISATION

APPENDIX I – SAND SOURCING SPECIALIST REPORT

APPENDIX J – ESTUARINE AND DUNE ECOLOGY SPECIALIST REPORT

APPENDIX A – EAP DECLARATION

Province of the
EASTERN CAPE
ECONOMIC DEVELOPMENT, ENVIRONMENTAL AFFAIRS & TOURISM

DETAILS OF EAP AND DECLARATION OF INTEREST IN TERMS OF REGULATIONS 12 AND 13 OF THE AMENDMENTS TO THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014 AS AMENDED

	(For official use only)
File Reference Number:	
NEAS Reference Number:	
Date Received:	

Application for environmental authorization in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Amendments to the Environmental Impact Assessment Regulations, 2014. This form is valid as from 8 January 2021.

PROJECT TITLE

COASTAL PROTECTION SCHEME. ST FRANCIS BAY. KOUGA MUNICIPALITY. EASTERN CAPE PROVINCE

Environmental Assessment Practitioner (EAP):	Dr Anthony Mark (Ted) Avis		
Contact person:	Mr Gregory Shaw		
Postal address:	PO Box 934, Grahamstown / Makhanda		
Postal code:	6140	Cell:	+27 606 715 914
Telephone:	+27 (46) 622 2364	Fax:	-
E-mail:	g.shaw@cesnet.co.za		
Professional affiliation(s) (if any)	SACNASP, EAPSA, SAAB		

Project Consultant	CES		
Contact person:	Mr Gregory Shaw		
Postal address:	PO Box 934 Grahamstown / Makhanda		
	6140	Cell:	+27 808 715 914
Postal code:			
Telephone:	+27 (46) 622 2364		
E-mail.	g.shaw@cesnet.co.za	Fax:	-

4.2 The Environmental Assessment Practitioner

I, Dr Ted Avis , declare that –

General declaration:

- I act as the Independent environmental practitioner in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting environmental impact assessments, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity,
- I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in regulation 8 of the regulations when preparing the application and any report relating to the application,
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority, and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority,
- I will ensure that Information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by Interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;

- I will keep a register of all interested and affected parties that participated in a public participation process; and
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- all the particulars furnished by me in this form are true and correct;
- will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I realise that a false declaration is an offence and is punishable in terms of section 24F of the Act

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Amendments to Environmental Impact Assessment Regulations, 2014 as amended.
- ~~I have a vested interest in the proposed activity proceeding, such vested interest being:~~

Signature of the environmental assessment practitioner:

CES - Coastal & Environmental Services Pty Ltd

Name of company:

19 January 2021

Date:

Signature of the Commissioner of Oaths:

19TH JANUARY 2021

Date:

Commissioner of Oaths

Designation:

The CV of the EAP must be attached as Annexure 1

Official stamp (below)

LYNN SMIT
COMMISSIONER OF OATHS
REFERENCE NUMBER: 9/1/8/2 EAST LONDON
25 TECOMA STREET, BEREA
EAST LONDON, 5214

Annexure 1
EAP CV

ANTHONY MARK AVIS
Curriculum Vitae

CONTACT DETAILS

Legal Name of Company	**Coastal and Environmental Services (Pty) Ltd**
Trading Name of Company	**CES Environmental and Social Advisory Services**
Designation	Cape Town Branch
Profession	Managing Director
Years with firm	Thirty (30) years
E-mail	t.avis@cesnet.co.za
Office number	+27 (0)21 045 0900
Nationality	South African
Professional Affiliations	**SACNASP**: South African Council for Natural Scientific Profession **EAPSA**: Environmental Assessment Practitioner Southern Africa **MRSSAF**: Member of the Royal Society of South Africa **BotSoc**: Botanical Society of South Africa **SAAB**: South African Association of Botanists **SAIE&ES:** South African Institute of Ecologists & Environmental Scientists **IAIA:** International Association of Impact Assessment
Key areas of expertise	Environmental & Social Impact Assessment Environmental & Social Management Plan preparation Terrestrial vegetation and flora specialist studies Coastal dune ecology specialist studies Integrated coastal zone management Strategic Environmental & Social Assessment

PROFILE

Dr Anthony Mark Avis

Ted Avis is a leading expert in the field of Environmental Impact Assessments, having project-managed numerous large-scale ESIAs to international standards, especially those of the International Finance Corporation (IFC). From 1997 to 2005 Ted acted was principle environmental consultant to Corridor Sands Limitada, managing all environment aspects of the US$1,2billion Corridor Sands Project, including five ESIA's, associated ESMPs, and the RAP. He has managed ESIA studies and related environmental assessments of similar scope in Kenya, Madagascar, Egypt, Malawi, Zambia and South Africa. Ted also has experience in large scale Strategic Environmental Assessments in southern Africa, and has been engaged by the IFC on a number of projects.

Between 1994 and 1996 Ted was instrumental in establishing the Environmental Science Department at Rhodes University, whilst a Senior lecturer in Botany at that time. This resulted from his experience running honours modules in EIA practice and environmental management, as well as the applied research he undertook in these disciplines. He was an Honorary Visiting Fellow in the Department of Environmental Sciences at Rhodes between 1998 and 2003. He was one of the first certified Environmental Assessment Practitioner in South Africa, gaining certification in April 2002. He has delivered papers and published in the field of EIA, Strategic Environmental Assessment and Integrated Coastal Zone Management, and has been a principal of CES since its inception in 1990, and Managing Director since 1998.

Ted holds a PhD in Botany, and was awarded a bronze medal by the South African Association of Botanists for the best PhD adjudicated in that year, entitled "Coastal Dune Ecology and Management in the Eastern Cape". Ted is a Certified Environmental Assessment Practitioner (since 2002) and a professional member of the South African Council for Natural Scientific Professionals (since 1993).

EMPLOYMENT EXPERIENCE

2017 – Present: Divisional Director and head of the Environmental Cluster at NEXTEC (part of the EOH Group). EXCO member of the Industrial Technologies Division of NEXTEC.

- 1998 – Present: Full-time Managing Director of Coastal & Environmental Services.
- 1989 – 1997: Lecturer and Senior Lecturer in Botany at Rhodes University.
- 1990 – 1997: Private environmental consultant and partner of Coastal & Environmental Services (CES, established January 1990).
- 1987 – 1988: Ecological Consultant with Loxton Venn and Associates, responsible for vegetation, soils and land surveys; veld conditions assessments and EIAs.
- 1983 – 1987: Full time post-graduate research in plant ecology, including coastal management studies and Environmental Impact Assessments (EIAs).

ACADEMIC QUALIFICATIONS

- PhD, Rhodes University, 1993
- BSc (Honours), Rhodes University, 1984
- BSc, Rhodes University, 1983

PUBLICATIONS AND TEACHING

- *Presented 29 conference papers at local and international conferences, including plenary presentations.*
- *Published 19 scientific articles in peer reviewed scientific journals.*
- *Published 6 popular articles in local journals.*
- *Published 2 chapters in scientific books.*
- *Supervised 17 post graduate students (honours (10), masters (4), PhD (3)) in plant ecology, coastal ecology and vegetation science.*

COURSES PRESENTED

Presented the following:

- *Tools of Sustainable Coastal Zone Management. Short course (2 x 1-week courses) presented on behalf of NACOMA / World Bank. (Presenter on Coastal zone management and strategic environmental assessment).*
- *Environmental training and teaching for a number of professional short courses, and at undergraduate and postgraduate level at Rhodes University, most notably as a key presenter on the EIA Short Course offered by CES since 2000*
- *Training course on the Integrated Coastal Zone Management Act. Four two day short courses presented to various Government and NGO stakeholders to introduce and explain the NEMA: Integrated Coastal Zone Management Act. Presented on behalf of DEA: Oceans & Coasts. [Study leader and lead presenter).*

CONSULTING EXPERIENCE

SELECTED LARGE ENVIRONMENTAL IMPACT ASSESSMENTS

- Principal consultant for the specialist studies for the Environmental Impact Assessments of proposed dune mining on the Eastern Shores of Lake St Lucia.
- Overall responsibility as EIA project manager for all environmental aspects of Billiton's TiGen mineral sand mining

operations in Mozambique, to produce an EIA that meets international standards.

- EIA project manager for the Corridor Sands mineral sand mining project in southern Mozambique, to produce four EIAs to World Bank standards for the project's bankable feasibility study. EIAs produced for the mine site and smelter, the 400Kv power line, the 87km rail route and a bulk cargo facility at Matola Port. All these EIAs included the preparation of Environmental Management Plans.
- EIA project manager for Tiomin Resources Inc (Toronto, Canada) for their Kwale mineral sands project in southern Kenya. Responsible for producing all six volumes of the EIA, regarded as the most comprehensive in Kenya to date.
- EIA project manager for the EIA to support the rezoning of land to special purposes for the establishment of the Coega Industrial Development Zone (IDZ).
- EIA project manager for the EIA to support the rezoning of land to special purposes for the establishment of the East London IDZ.
- Numerous small-scale Scoping Reports as part of the Environmental Impact Assessment Process and in accordance with the requirements of the Environmental Conservation Act.
- Pre-feasibility Environmental Impact Assessments, including one for BHP's mineral sand mining project in northern Mozambique, and similar projects in south-west Madagascar and Mozambique.
- Study leader for a comprehensive EIA for the World Bank funded 400Kv Mozambique Malawi Interconnector project power line, Malawi sector.
- EIA for a dedicated haul road, material handling facility and jetty near Praia de Xai Xai, Mozambique for WMC Resources, Australia.
- EIA Project Manager for the Nuclear Materials Authority of Egypt, to prepare the EIA as part of the Downer EDI Feasibility Study Team. (2007).
- EIA for a large scale resort development, including two golf courses and three hotels in the Eastern Cape, South Africa. (Ongoing).
- EIA for the Madiba Bay resort development, incorporating the development of various portions of land within a 5000 hectare site for a range of resort type facilities. (2005 – 2008).
- Study Leader for an EIA for a large heavy mineral mining project in South West Madagascar for Exxaro (2006 – 2008).
- Study Leader for an EIA for a proposed heavy mineral mine on the shores of Lake Malawi near Chipoka. (2005 – 2006).
- Study Leader for an ESIA for a proposed large scale integrated tourism resort development in the Eastern Cape (2007 – 2008).

- Environmental and Social consultants to the International Finance Corporation for the Kafue Gorge Lower Hydropower project, Zambia.
- Study Leader for an Environmental, Social and Health Impact Assessment for a proposed large sugar cane to ethanol biofuel project in Sierra Leone for Addax Bioenergy, Geneva (2009 - 2010).
- Study Leader for an ESHIA for a proposed large scale Jatropha biofuels project in Mozambique (2009 - 2010).
- Study leader for Environmental Impact Assessment for a proposed large scale copper and nickel mine in the North West Province of Zambia (2010).
- Lead consultant for an addendum Environmental Impact Assessment for the proposed expansion of a heavy mineral mining project in Nampula Province, Mozambique (2010).
- Quality control reviewer for approximately 8 EIA's for various Windfarm Projects in South Africa (2009 – 2010).
- Study leader for an ESHIA for a proposed large scale palm oil plantation in Sierra Leone (2010).
- Study leader for ESIA for a rare earths mine in Kangankula, Malawi for the Lynas Corporation.
- Study leader for ESIA for a large scale copper mine in the North West Province of Zambia for First Quantum Minerals (2011).
- Study leader for an ESIA for a proposed Cement Plant and for a proposed Limestone quarry in southern Mozambique (2012).
- Study Leader for an Environmental Impact Assessment of the Mooi-Mgeni Transfer Scheme – Phase 2, KwaZulu-Natal Province, South Africa for TCTA (2012).
- Study leader for an ESHIA for a proposed large scale palm oil plantation and estate in Liberia, compliant with international sector specific guidelines. For EP Oil (2012).
- Study leader for an ESHIA for a proposed large scale forestry plantation in Niassa Province, Mozambique for Niassa Green Resources and to be compliant with international sector specific guidelines (2010).
- Study leader for an EIA for a proposed golf course in Makana District, South Africa (2012)
- Study leader for an EIA for a proposed housing and residential estate in Makana District, South Africa (2012).
- Study Leader for an ESHIA for a heavy mineral mining project in South West Madagascar for World Titanium Resources (2013).
- Study Leader for an ESHIA for a heavy mineral mining project on the West Coast of South Africa for Zirco Resources (2013).
- Study Leader for the Tete Iron Ore project ESHIA located in Tete province, Mozambique for Baobab Resources and Capitol Resources Lda (2013 - 2016).

- Study Leader for an ESHIA for the Nicanda Hills Graphite mining project in Cabo Delgado Province, Mozambique for Triton Resources, Perth (2015 - 2016)
- Study Leader for an EIA for the proposed Riemvasmaak Hydropower Station in the Augrabies Falls National Park, undertaken for HydroSA (2015-2016).
- Study Leader for an ESHIA for the Ancuabe Hills Graphite mining project in Cabo Delgado Province, Mozambique for Triton Resources, Perth (2015 – 2016)
- Study Leader for an ESHIA for a tin mine in North Kivu province, DRC for Alphamin Resources (2015 - 2016).
- Study Leader for an EIA for a floating power plant, Port of Ngqura, Eastern Cape Province of South Africa. Prepared as part of the Independent Power Producers Programme on behalf of the Department of Energy's IPP Office and Transnet (2015-2106).
- Study Leader for an EIA to facilitate the import of Liquefied Natural Gas (LNG) at the Port of Ngqura, Eastern Cape Province of South Africa. Prepared as part of the Independent Power Producers Programme on behalf of the Department of Energy's IPP Office and Transnet (2015-2106).
- Study Leader for an ESHIA for the Balama Graphite mining project in Cabo Delgado Province, Mozambique for Battery Minerals Resources, Perth (2017 – 2018)
- Reviewer and co-author for an ESHIA for the Pilivili Mineral Mine, Nampula Province, Mozambique for Kenmare Resources (2018 - 2019)
- Reviewer, co-author and study leader for the Boulders Wind Farm EIA located at near Paternoster, Western Cape, South Africa for Vredenberg Wind Farm (Pty) Ltd. (2019).
- Reviewer for the EIA for the proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province (2019-2020).
- Study Leader for an ESHIA for a Coal to Urea project in the Highveld Industrial Park on behalf of Wison Engineering (China) and the Industrial Development Corporation (2019 – 2020).

POLICY AND STRATEGIC ASSESSMENTS

- The development of the Eastern Cape Coastal Management Plan, to be adopted as policy by the Eastern Cape Government
- Study leader for the preparation of a State of Environment Report, and Environmental Implementation Plan for the Amatole District Municipality, covering an area of approximately 25 000 km.
- Reports on ecological assessments of the damage caused to the environment by alleged illegal developments along the former Transkei coastline.

- Study leader and project manager for the preparation of a World Bank/Global Environmental Facility funded geographic Strategic Environmental Assessment of the proposed greater Addo Elephant National Park, Eastern Cape, South Africa.
- A Strategic Environmental Assessment of four land use options in the Centane district of the Wild Coast.
- SEA covering an area half the size of the Eastern Cape (former Transkei) to identify where afforestation projects could be implemented on a sustainable basis for poverty alleviation. Prepared for the Department of Water Affairs and Forestry (2006 – 2007).
- Integrated Coastal Zone Management Plan for the Buffalo City Municipality, Eastern Cape South Africa, including numerous Management Plans for estuaries, beaches etc. (2006 – 2007).
- A Sustainability Analysis of various land use alternatives to determine optimum land use for the future rehabilitation of lease areas at Richards Bay Minerals. (2006).
- State of Environmental Report and Environmental Management System for the Ukhulambe District Municipality. (2005).
- Strategic Environmental Overview for two integrated tourism anchor projects in Mozambique for the International Finance Corporation (2007).
- Study Leader of the Western Cape State of Coast report prepared for the Department of Environmental Affairs & Development Planning (2017-2018).
- Study leader for the revised Coastal Management Programme of the West Coast, on behalf of the West Coast District Municipality (2019).

ECOLOGICAL AND COASTAL

- Ecological impact assessment for a proposed Zinc and Phosphoric Acid plant in the Eastern Cape.
- Ecological specialist reports for the Coega Industrial Development Zone Strategic Environmental Assessment
- Ecological impact assessment of proposed 800km Wild Coast N2 Toll Road, Eastern Cape.
- Study leader for the ecological impact assessment of the Wild Coast Toll Road EIA, Eastern Cape and Kwazulu/Natal, South Africa (2004).
- Study Leader for Baseline Ecological Surveys of coastal lease areas in southern Mozambique for Rio Tinto exploration (2008).
- Pre-feasibility Ecological Survey of the Skeleton Coast to identify critical impacts linked to Diamond and Mineral Mining exploration (2008).
- Coordinator for ecological investigations to establish a sound baseline prior to implementing an EIA, North West Province, Zambia (2011).

- Assessment of the extent and conservation value of forested areas along the Wild Coast within the former Transkei, on behalf of the Eastern Cape Parks Board (2011)
- Study Leader for a biological and archaeological (including heritage) baseline and impact assessment study of the Lesotho Highlands Water Project – Phase II. Prepared for the Lesotho Highlands Development Authority (2013-2014)
- Study Leader for the preparation of the Nhangonzo Critical Habitat Biodiversity Assessment, Inhambane Province, Mozambique. Prepared for Sasol Petroleum Mozambique Limitada and Sasol Petroleum Temane Limitada (2015).
- Bookram Coastal Dune Specialist Study (2017).
- Coastal Dune and Ecological Impact Assessment for the proposed Mosselbankfontein Farm Housing Development near Witsand, Western Cape Province (2019).
- Strategic Environmental Overview: Development Opportunities and Constraints. Cape Agulhas Municipality: Duiker Street to Struisbaai Harbour Precinct Development Plan (2019 -2020).
- Environmental Management and Maintenance Plans for 3 sites (Gouritz; Still Bay & Witsands) in the Hessenque Local Municipality (2020)
- Environmental Risk Assessment and Revegetation Plan for the Witsands Landfill site near Scarborough, for City of Cape Town (2020).

ENVIRONMENTAL MANAGEMENT

- Project manager for a five-year rehabilitation programme of Samancor's Chemfos mine on the West Coast, which later became the West Coast Fossil Park.
- Development of an Open Space Management Plan for the Coega Industrial Development Zone (IDZ), including the demarcation of open spaces, formulation of uses within the open space, integration with MOSS principles and developing guidelines and a business plan for the management of the open space system.
- Preparation of numerous Environmental Management Programme Reports, in terms of the Minerals Act, for quarry operations in the Eastern Cape, including EMPRs for both the Eastern and Western Coega Kops.
- Study Leader for the development of two detailed and definitive Environmental Management Plans for the construction of two large bridges across rivers in the Wild Coast, as part of the Wild Coast N2 Toll Road Project, for South African National Roads Agency Limited. (2006).
- Joint Study Leader for the development of numerous Construction and Operational Phase Environmental and Social Management Plans for Tiomin's proposed Kwale mineral mine in Kenya.

- Completion of numerous (>20) Environmental & Social Management Plans as part of the EIA process and ESIA deliverables.
- Development of a range of Standard Operating Procedures (SOPs) as part of the operational phase ESMP for a large scale agricultural project.

CERTIFICATION

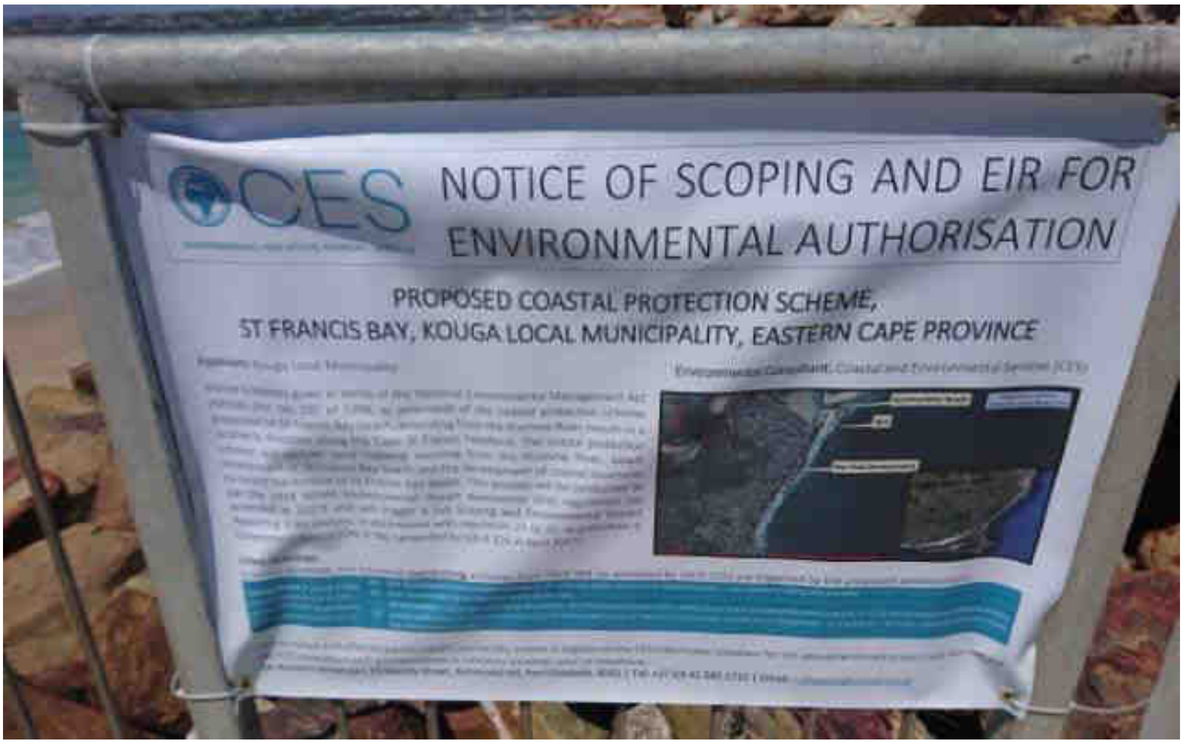
I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes me, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

ANTHONY M. AVIS (TED) Date: 17 January 2020

APPENDIX B – PUBLIC PARTICIPATION DOCUMENTATION

PROOF OF ADVERTISEMENTS TO DATE

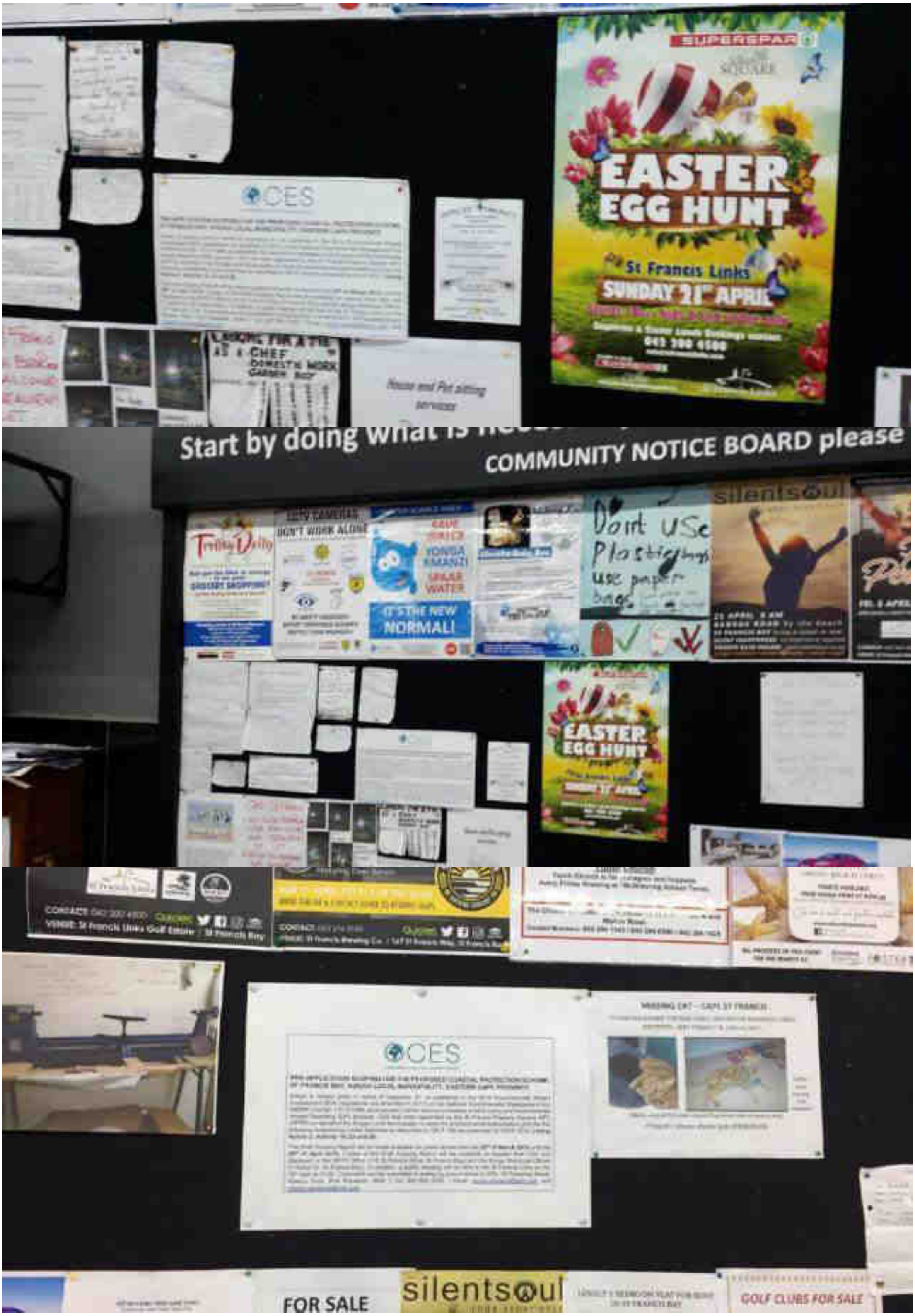
<u>Site Notices:</u>



Sites notices placed at the beach stairway located at the end of Aldbara Run on the 21st of December 2018.



Site notice placed at the intersection of Canal Road and Shore Road on the 21st of December 2018.



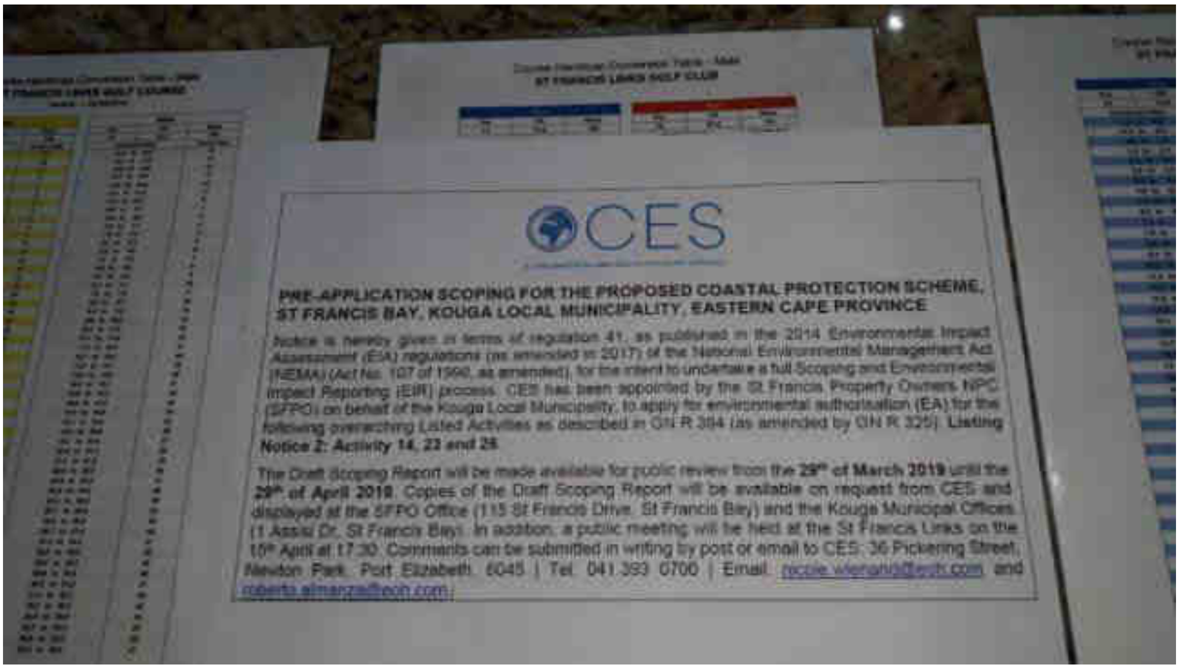
Site notice placed at the Spar located along St Francis Drive on the 9th of April 2019.

Site notice placed at the Main beach located at the end of Nevil Road on the 9th of April 2019.

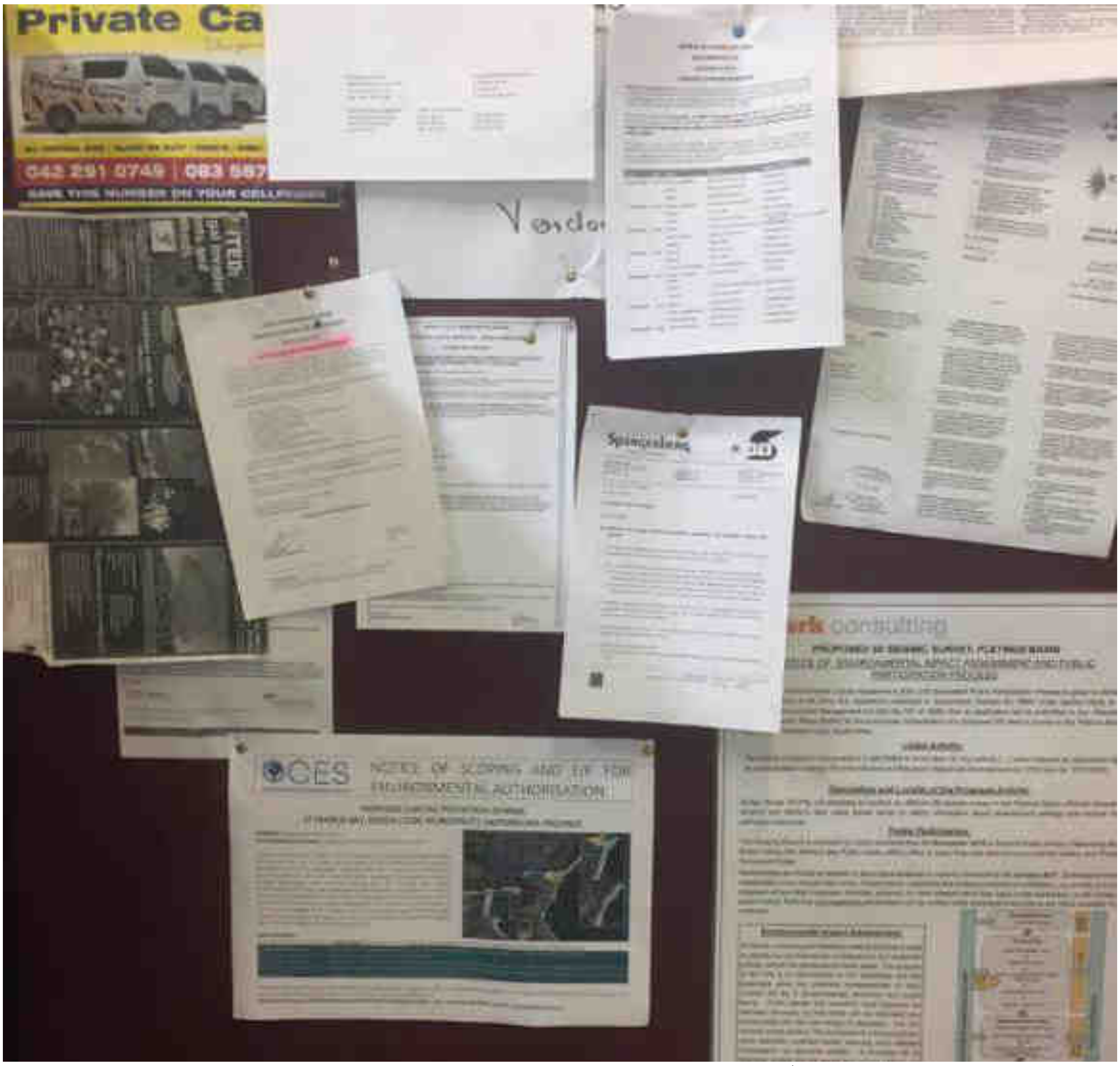
Site notice placed at the Main beach located at the beach parking area at the end of Anne Avenue on the 9th of April 2019.

Site notice placed at the Small Boat Harbour along La Digue Pl on the 9th of April 2019.

Site notice placed at the Library on the 9th of April 2019.



Site notice placed at the St Francis Links on the 9th of April 2019.



Site notice placed at the Kouga Local Municipality Municipal Offices on the 9th of April 2019

Site notice placed at the intersection of Canal Rd and Shore on the 9th of April 2019.

NOTICE OF SCOPING AND EIR FOR ENVIRONMENTAL AUTHORISATION

CES
ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

PROPOSED COASTAL PROTECTION SCHEME,
ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

Applicant: Kouga Local Municipality

Environmental Consultant: Coastal and Environmental Services (CES)

Notice is hereby given in terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998, as amended) of the coastal protection scheme proposed for St Francis Bay beach, extending from the Kromme River mouth in a southerly direction along the Cape St Francis headland. The coastal protection scheme will include sand material sourcing from the Kromme River, beach nourishment of St Francis Bay beach and the development of coastal structures to retard the erosion of St Francis Bay beach. This process will be conducted as per the 2014 NEMA Environmental Impact Assessment (EIA) regulations (as amended in 2017) and will trigger a full Scoping and Environmental Impact Reporting (EIR) process, in accordance with regulation 21 to 23, as published in Government Notice (GN) R 982 (amended by GN R 326 in April 2017).

Listed Activities:

In terms of NEMA, the following overarching activities from GN R 984 (as amended by GN R 325) are triggered by the proposed development:

[illegible]	14	[illegible]
	22	[illegible]
	26	[illegible]

All interested and affected parties (I&APs) are hereby invited to register on the CES stakeholder database for the abovementioned project and can contact the CES consultant with any comments or concerns via email, post or telephone:

Mr Roberto Almanza | 13 Stanley Street, Richmond Hill, Port Elizabeth, 6001 | Tel: +27 (0) 41 585 1715 | Email: r.almanza@cesnet.co.za

Site notice placed on the 21st of December 2018.

NOTICE OF SCOPING AND EIR FOR ENVIRONMENTAL AUTHORISATION

CES
ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

PROPOSED COASTAL PROTECTION SCHEME,
ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

Applicant: Kouga Local Municipality

Environmental Consultant: Coastal and Environmental Services (CES)

Notice is hereby given in terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998, as amended) of the coastal protection scheme proposed for St Francis Bay beach, extending from the Kromme River mouth in a southerly direction along the Cape St Francis headland. The coastal protection scheme will include sand material sourcing from the Kromme River, beach nourishment of St Francis Bay beach and the development of coastal structures to retard the erosion of St Francis Bay beach. This process will be conducted as per the 2014 NEMA Environmental Impact Assessment (EIA) regulations (as amended in 2017) and will trigger a full Scoping and Environmental Impact Reporting (EIR) process, in accordance with regulation 21 to 23, as published in Government Notice (GN) R 982 (amended by GN R 326 in April 2017).

Listed Activities:

In terms of NEMA, the following overarching activities from GN R 984 (as amended by GN R 325) are triggered by the proposed development:

Listing Notice 2 of GN R 984 (as amended in GN R 325) of the 2014 EIA Regulations (amended on 7 April 2017)	14	The development and related operation of—(vi) any other structure or infrastructure — on, below or along the sea bed.
	22	The reclamation of an island or parts of the sea.
	26	Development — (i) in the sea; (ii) in an estuary; (iii) Within the littoral active zone; (iv) in front of a development setback; or (v) if no development setback exists, within a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater in respect of — (c) inlets and sub-tidal structures for entrapment of sand

All interested and affected parties (I&APs) are hereby invited to register on the CES stakeholder database for the abovementioned project and can contact the CES consultant with any comments or concerns via email, post or telephone:

Ms Nicole Wienand| 36 Pickering Street, Newton Park, Port Elizabeth, 6045 | Tel: +27 (0) 41 393 0700 | Email: n.wienand@cesnet.co.za

Site notice placed on the 9th of April 2019.

Newspaper Advertisements Published During the Pre-Application PPP Phase

Newspaper Advertisement - The Herald (27 March 2019):

Newspaper Advertisement - The Kouga Express (28 March 2019):

6 CLASSIFIED

KOUGA EXPRESS | THURSDAY 28 MARCH 2019

Geklassifiseerd

042 293 2973 F: 042 293 3957

CES

PRE-APPLICATION SCOPING FOR THE PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

Newspaper Advertisement - The St Francis Chronicle (4 April 2019):

Municipality hikes electricity to 14% for paying customers - while non payers get free

Kouga Municipality has come under fire on social media for announcing a steep almost 14% increase (13.87% on average) in electricity prices from July this year for paying customers, but allowing illegal increasing numbers of people to build shacks and have illegal electricity connections.

Other municipal services have also increased averaging around 7 % as follows:

- 7,5% for property rates
- 7,5% for water
- 8% for sanitation
- 8% for refuse
- 5% Environmental Management Fee

The steep increases for electricity and other services are part of draft budget and draft Integrated Development Plan (IDP) for the new financial year form July, which were adopted by the Kouga Council on 29 March.

The mayor, Horatio Hendricks, claimed that the municipality tried to keep the prices down but its prices depended on Eskom's prices and how much more Nelson Mandela Bay charged Kouga Municipality for water.

On social media the municipality came under fire for allowing more than 100 hundred 'squatters' or homeless to erect shacks and have illegal electricity connections and has not stopped the increasing illegal electricity usage in Sea Vista. Critics say illegal residents are stealing electricity and having electricity all the time, when hard working people have to find the money to pay for higher prices. If they don't, they get cut off . But electricity thieves keep their lights on.

Municipalities are further compelled by law to cover the cost of delivering basic services through the income for that service.

In terms of the draft budget the operating revenue for 2019/20 totals R833,872-million. This is an increase of 9,7% compared to the 2018/19 Adjustments Budget.The main revenue sources are basic service delivery(54,75%), property rates (23,81%) and operating grants and subsidies (15,96%).

The operating expenditure for 2019/20 totals R889.468-million, resulting in a budget deficit of R55.486-million. It is a 8,5% increase compared to the 2019/20 Adjustments Budget.

The main expenditure items are employee-related costs (32,71%), bulk electricity purchases (25,71%) and depreciation (9,57%).

The draft capital budget for 2019/20 totals R89,932-million, which is a decrease of 57,08% compared to the 2018/19 Adjustments Budget. This decrease is mainly due to the allocation of the Water Services Infrastructure Grant to the municipality during the current financial year.

Capital projects on the draft include R2-million for the acquisition of land for housing projects, a priority identified in the IDP for various communities.

A further R2-million will be used to purchase wheelie bins for households and R1,5-million for roads while almost R10-million has been earmarked for the upgrade of sport facilities, with the bulk going to KwaNomzamo.

Also included are upgrades to parks such as Yellowwoods at Hankey, Pellsrus and Kabeljous at Jeffreys Bay and the Cape St Francis Beach.

Almost R16-million is set to go towards the completion of the Sea Vista Waste Water Works upgrade, R8,7-million for the KwaNomzamo Waste Water Works and R4, 4-million towards the Patensie sewerage package plant.

A further R2,3-million will be used for the municipality's programme to eradicate the bucket system. Several electricity projects have also been prioritized for the new financial year, including the electrification of houses at Ocean View and Kruisfontein. R1,2 million has also been earmarked for public lights.

The full list of proposed capital projects can be viewed in the draft document.

CES

PRE-APPLICATION SCOPING FOR THE PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

Notice is hereby given in terms of regulation 41, as published in the 2014 Environmental Impact Assessment (EIA) regulations (as amended in 2017) of the National Environmental Management Act (NEMA) (Act No. 107 of 1998, as amended) for the intent to undertake a full Scoping and Environmental Impact Reporting (S&EIR) process. CES has been appointed by the St Francis Property Owners NPC (SFPO) on behalf of the Kouga Local Municipality, to apply for environmental authorisation (EA) for the following overarching Listed Activities as described in GN R 984 (as amended by GN R 325): **Listing Notice 2: Activity 14, 33 and 28**.

The Draft Scoping Report will be made available for public review from the **29th of March 2019** until the **29th of April 2019**. Copies of the Draft Scoping Report will be available on request from CES and displayed at the SFPO Office (115 St Francis Drive, St Francis Bay) and the Kouga Municipal Offices (1 Assisi Dr, St Francis Bay). In addition, a public meeting will be held at the St Francis Links on the 15th April at 17:30. Comments can be submitted in writing by post or email to CES, 36 Pickering Street, Newton Park, Port Elizabeth, 6045 | Tel: 041 393 8200 | Email: [illegible] and [illegible]

Popular lifestyle at the Links

Richard Antarne and his wife, Jane, have built a house on the Links, and are enjoying the lifestyle. They have bought another two plots, showing their commitment to the estate.

Harcourts' Marsha Cooper has been involved in sales of the Masters' development at the Links since 2015 and owns a home on the estate. She says the Links, set high above the town, offers sweeping views of the picturesque St Francis Bay, sea and surrounding countryside.

"It is easy to see the appeal of the estate. Featuring a signature Jack Nicklaus designed course that is ranked amongst the top 10 in the country, the estate offers something for everyone.

"That said, the Links is the only secure estate within a 120km radius and is ideal for those looking for security in a well run, well maintained, gated estate, where capital growth of investment is guaranteed."

She reveals the Masters development offers 2 bedroom, 2 bathroom and 3 bedroom or 3 bathroom, all en-suite contemporary homes, architecturally designed with upmarket finishes. The homes offer easy living with spacious, sunny north facing rooms, single story and double garages. Enclosed gardens offer privacy and are pet friendly.

"The Links is most certainly where the activity is and where potential buyers and investors are seeking to invest," Marsha adds.

Links residents, Julie and Charlie Nortje, bought and moved to the Links in 2013 after their canal house burnt down in the dreadful 2012 fires. "It has been one of the happiest times in our lives. We feel secure and cared for," they say.

They love living at the Links in the midst of nature and taking wonderful walks identifying clearly labelled indigenous plants and spotting wild life, such as bush buck and lynx. Plus they love the wide variety of birdlife, particularly those they see regularly, such guinea fowl, crowned plover, francolin and 'dikkops' nesting at the clubhouse.

"The gym and heated pool provide opportunities for fitness and socially there is a monthly get-together at our magnificent clubhouse where we can enjoy weekly dinners and daily meals, plus we have regular coffee with other home owners - all this makes an idyllic lifestyle," Julie says.

"It is small wonder that Links is a sort after destination and many are buying and building here. Living on the Links is a great experience. The estate is run extremely efficiently by competent, friendly management and staff, who provide excellent security and who ensure everything works and is repaired at once!

"It's a brilliant investment as the Links is growing from strength to strength. The new hotel and hundreds of European visitors play here from January to April each year," Julie adds.

And finally one has it from one of the best, Gary Player, who has said the way the homes on this estate were built around the golf course offer the best balance he has ever seen anywhere.

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ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

PRE-APPLICATION SCOPING FOR THE PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

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The Draft Scoping Report will be made available for public review from the **29th of March 2019** until the **29th of April 2019**. Copies of the Draft Scoping Report will be available on request from CES and displayed at the SFPO Office (115 St Francis Drive, St Francis Bay) and the Kouga Municipal Offices (1 Assisi Dr, St Francis Bay). In addition, a public meeting will be held at the St Francis Links on the 15th April at 17:30. Comments can be submitted in writing by post or email to CES: 36 Pickering Street, Newton Park, Port Elizabeth, 6045 | Tel: 041 393 0700 | Email: nicole.wienand@eoh.com and roberto.almanza@eoh.com.

Original Copy of newspaper advertisement

Copy of the Draft Scoping Report published on the CES Website:

Newspaper Advertisements Published During the Draft Scoping PPP Phase

Newspaper Advertisement - The Herald (20 August 2019):

Newspaper Advertisement - The Kouga Express (22 August 2019):

Newspaper Advertisement - The St Francis Chronicle (16 August 2019):

Cape St Francis Resort in Trip Advisor Hall of Fame

Cape St Francis Resort is proud to announce that it has been awarded the TripAdvisor 'Hall of Fame' Award, an award created to honour those businesses that have earned a Certificate of Excellence for five consecutive years.

To qualify for a Certificate of Excellence, an accommodation (Hotels, B&Bs/Inns, Speciality Lodging), restaurant or experience must:

1. Maintain an overall TripAdvisor rating of at least four out of five.
2. Have a minimum number of reviews.
3. Have been listed on TripAdvisor for at least twelve months.

OR

The Certificate of Excellence award, Founded in 2010, honours hospitality businesses that consistently achieve outstanding reviews on TripAdvisor...

To qualify for a Certificate of Excellence, a hospitality business must: Maintain an overall TripAdvisor rating of at least four out of five.

Editorial Column

Editorial Opinion

At the time of going to press late August, we pay tribute to and say farewell to one of St Francis Bay's finest citizens, Duncan Lethbridge.

The whole area of St Francis has reeled in shock at Duncan's tragic passing and St Francis Chronicle joins all the others in expressing its sincerest condolences. He was one of the most respected and well-liked men, considered a pioneer catamaran boat builder and a pillar of the St Francis community. We wish all his family members and friends strength, courage, lots of love and support during this most difficult time.

We are also in shock that just two days later a woman was robbed at gunpoint on the Sea Vista - St Francis Bay pathway, used daily by people who work in the town and daily commute on foot.

We have brought out our September edition fairly early as I will be away from 26 August-12 September to join the volunteer media team for the Expedition Africa Adventure race on the island of Rodrigues.

We will be running a daily update in our online 'St Francis Chronicle Info & News' group on FB, providing info on how the 250 international contestants are faring in the adventure race and will be posting photos of the idyllic island off the coast of Mauritius. So do follow our group for daily updates from the island from 26 August.

Till next time, keep happy, warm and well.

Bev,
The Editor

CES

SCOPING AND EIR FOR THE PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

DEDEAT REFERENCE NUMBER: EC08/C/LN2/M/42-2019

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CES has been appointed by the St Francis Property Owners Non-Profit Company (SFPO NPC) on behalf of the Kouga Local Municipality, to apply for environmental authorisation (EA) for the following overarching Listed Activities as described in GN R 984 (as amended by GN R 326): **Listing Notice 2: Activity 14, 23 and 26.**

The Draft Scoping Report will be made available for public review from the **20th of August 2019 until the 18th of September 2019**. Copies of the Draft Scoping Report will be available on request from CES (including download from www.cesnet.co.za/public-documents) as well as at the SFPO Office (115 St Francis Drive, St Francis Bay) and the Kouga Municipal Offices (1 Assisi Drive, St Francis Bay).

In addition, a public meeting will be held at the St Francis Bowling Club Hall (55 St Francis Dr, St Francis Bay) on the 27th of August 2019 at 17:30 (5:30pm).

Registration as an Interested and Affected Party (I&AP) and/or submission of comments can be done in writing by post or email to CES: 36 Pickering Street, Newton Park, Port Elizabeth, 6045. Tel: 041 393 0700

Email: n.almanza@cesnet.co.za and g.shaw@cesnet.co.za.

CLASSIFIEDS

WORD PUZZLE SOLUTION

coda, dare, darn, cart, date, dead, dean, dent, ... **deodorant**.

Quotation

"We shall not cease from exploration and the end of all our exploring will be to arrive where we began and to know the place for the first time"

- TS Eliot

ALCOHOLICS & NARCOTICS ANONYMOUS MEETING TIMES

Mon - AA Humansdorp 7:30pm
Tuesday - AA St Francis Bay 7:30pm
Friday - NA Jeffrey's Bay 6:30pm

ALCOHOLICS ANONYMOUS

SPIRITUAL

In all my lectures I have taught one doctrine - the infinitude of the private man, the ever availability to every man of the Divine Presence within his own mind, from which Presence he draws, at his need inexhaustible power.

- Ralph Waldo Emerson

A Morning Prayer

Let me today do something that shall take
A little sadness from the world's vast store,
And may I be so favoured as to make
Of joy's too scanty sum a little more.

Let me not hurt, by any selfish deed
Or thoughtless word, the heart of foe or friend;
Nor would I pass, unseeing, worthy need,
Or sin by silence where I would defend.

However meagre be my worldly wealth,
Let me give something that shall aid my kind,
A word of courage, or a thought of health,
Dropped as I pass for troubled hearts to find.

Let me to-night look back across the span
'Twixt dawn and dark, and to my conscience say-
Because of some good act to beast or man-
"The world is better that I lived to-day."

- Ella Wheeler Wilcox

Original Copy of newspaper advertisement

ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

SCOPING AND EIR FOR THE PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

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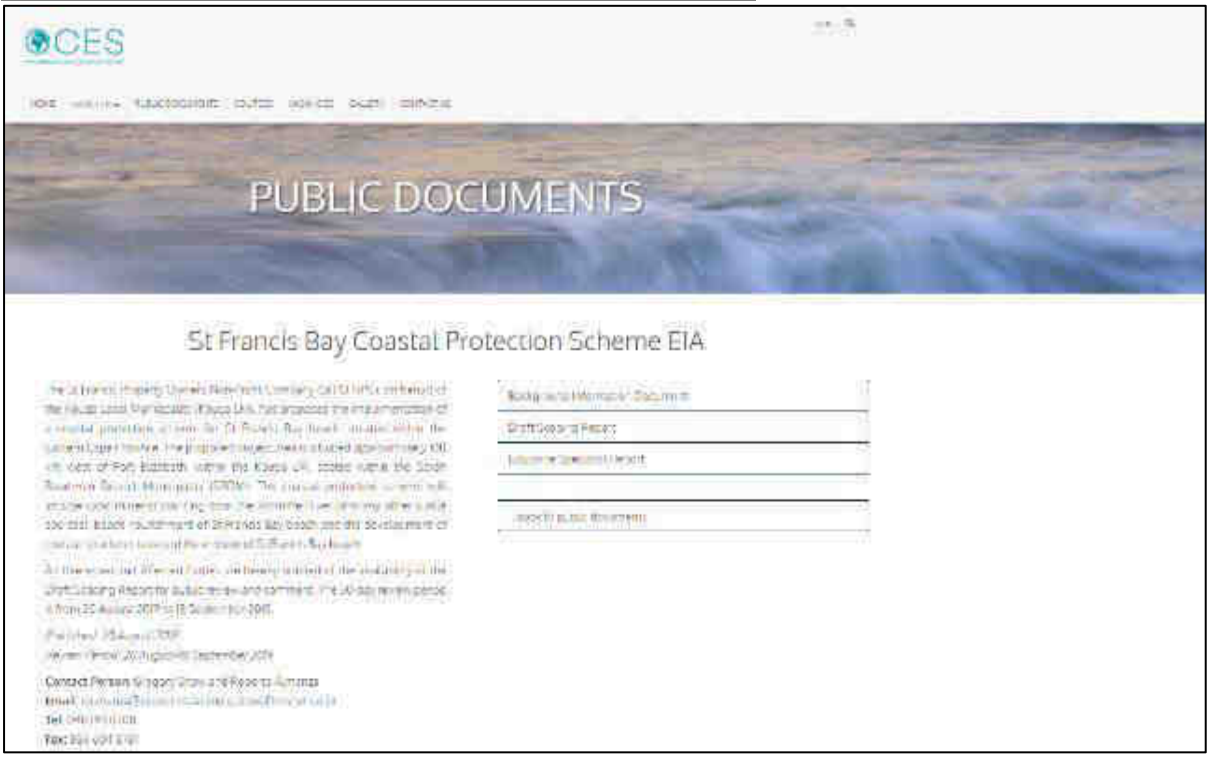
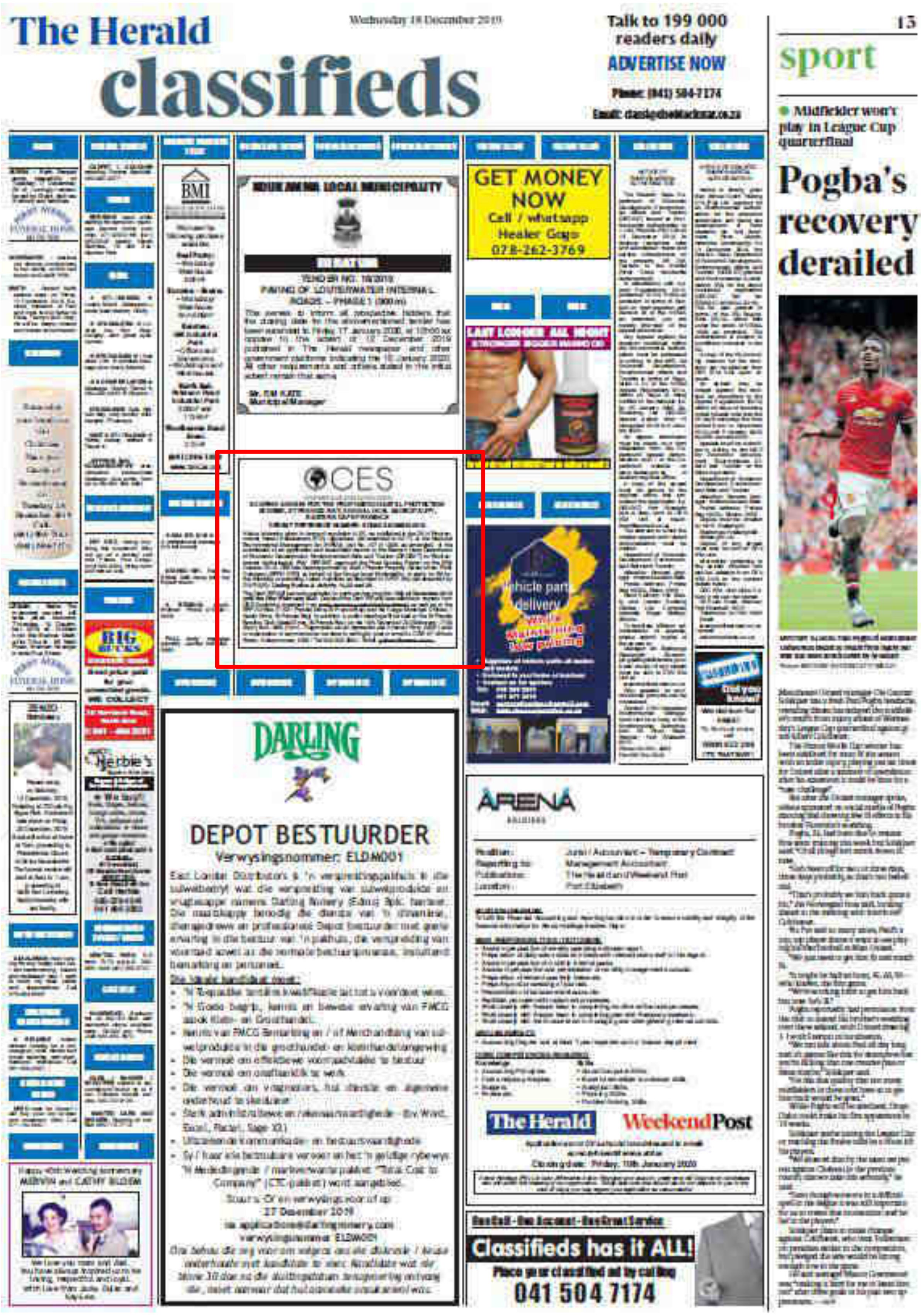
Copy of the Draft Scoping Report published on the CES Website:



Newspaper Advertisement - The Herald (18 December 2019):


The Herald

classifieds

Wednesday 18 December 2019

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Newspaper Advertisement – Kouga Express (17 December 2019)

Original Copy of newspaper advertisement

SCOPING AND EIR FOR THE PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

DEDEAT REFERENCE NUMBER: EC08/C/LN2/M/42-2019

Notice is hereby given in terms of regulation 41(2), as published in the 2014 Environmental Impact Assessment (EIA) regulations (as amended in 2017) of the National Environmental Management Act (NEMA) (Act No. 107 of 1998, as amended), of the submission of an application and associated reports to the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT) for Environmental Authorisation (EA). DEDEAT approved the Final Scoping Report on the 25th October 2019. CES has been appointed by the St Francis Property Owners Non-Profit Company (SFPO NPC) on behalf of the Kouga Local Municipality, to apply for EA for the following overarching Listed Activities as described in GN R 384 (as amended by GN R 325): **Listing Notice 2: Activity 14, 23 and 26.**

The Draft EIR will be made available for public review from the **19th of December 2019 until the 5th of February 2020.** Copies of the Draft EIR will be available on request from CES (including download from www.cesnet.co.za/public-documents) as well as at the SFPO Office (115 St Francis Drive, St Francis Bay) and the Kouga Municipal Offices (1 Assisi Drive, St Francis Bay). In addition, a public meeting will be held at the St Francis Bowling Club (Assisi Drive, St Francis Bay) on the 19th December 2019 between 17:00 (5pm) and 19:00 (7pm). Registration as an Interested and Affected Party (I&AP) and/or submission of comments can be done in writing by post or email to CES: 67 African Street, Grahamstown, 6139 | Tel: 046 622 2364 | Email: g.shaw@cesnet.co.za.

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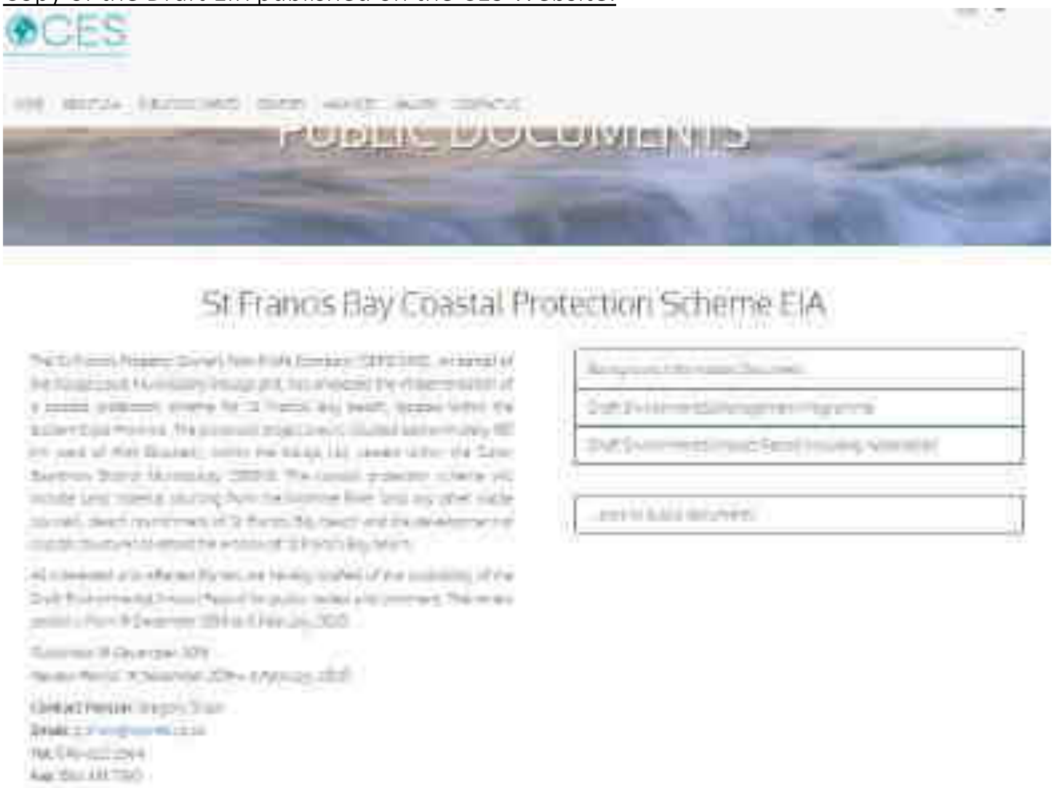
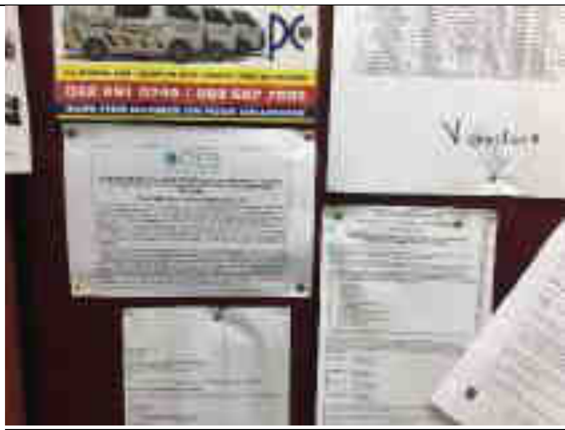
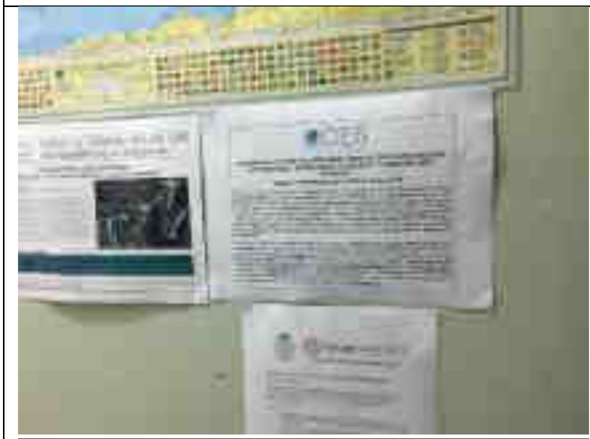
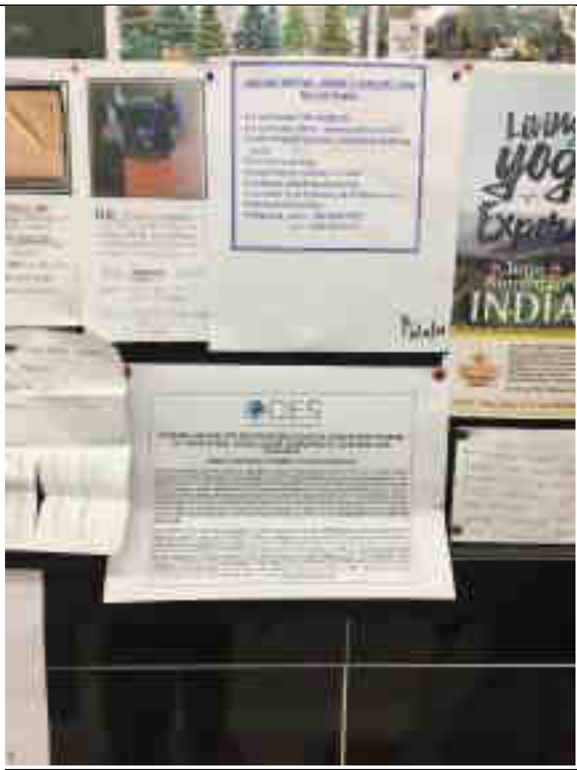


	
Site notice placed at the SFPO NPC offices (17th December 2019)	Site notice placed at the St Francis Bay Municipal Office (17th December 2019)
	
Site notice placed at St Francis Community Library (17th December 2019)	Site notice placed at Small Boat Harbour (outside) (17 December 2017)

	
Site notice placed at Small Boat Harbour (inside) (17 December 2019)	Site notice placed at St Francis Bay Spar (17 December 2019)
	
Site notice placed at Bruce's Ocean Museum (17 December 2019)	Site notice placed at Sea Vista Community Library (17 December 2019)

Newspaper Advertisement – The Herald (17 January 2020)

LEGALS

sport

Auckland win reignites tennis great's desire to surpass 24 Grand Slams

Williams still chasing record

Wozniacki heads into retirement

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VACANCY

ADVENTURE PROVINCE

Eastern Cape

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CES
ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

SCOPING AND EIR FOR THE PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

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An additional public meeting will be held at the St Francis Links Golf Course (1 Jack Nicklaus Dr. St Francis Bay) on the 29th January 2020 between 17:00 (5pm) and 19:00 (7pm).

CES encourage all Interested and Affected Parties (I&AP) to review the documentation prior to the meeting and to provide comments and feedback during the meeting. Registration as an I&AP and/or submission of comments can also be done in writing by post or email to CES: 67 African Street, Grahamstown, 6139 | Tel: 046 622 2364 | Email: g.shaw@cesnet.co.za.

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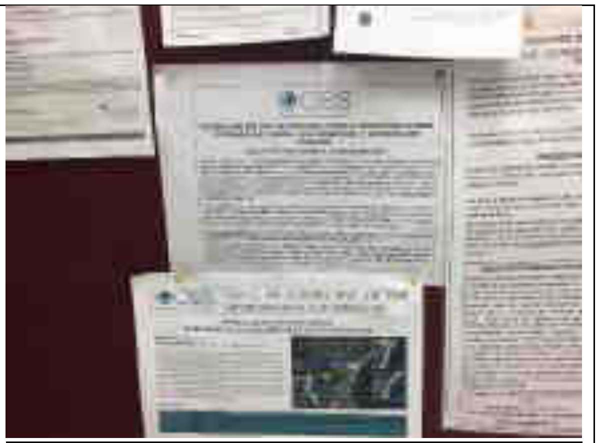
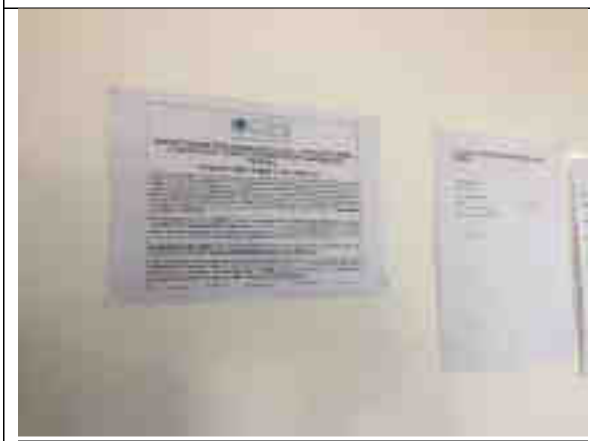
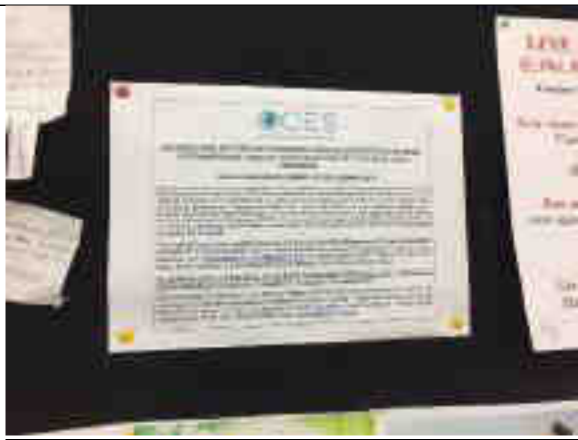
	
Site notice placed at the SFPO NPC offices (25 January 2020)	Site notice placed at the St Francis Bay Municipal Office (25 January 2020)
	
Site notice placed at St Francis Community Library (25 January 2020)	Site notice placed at Small Boat Harbour (outside) (25 January 2020)
	
Site notice placed at Small Boat Harbour (inside) (25 January 2020)	Site notice placed at St Francis Bay Spar (25 January 2020)

	
Site notice placed at Bruce's Ocean Museum (25 January 2020)	Site notice placed at Sea Vista Community Library (25 January 2020)

Contact	Name and Organisation	Email Address	Contact No.	Postal Address
Organ of State – National & Provincial				
Ms Rose Masela	Department of Environmental Affairs (DEA) - Biodiversity	rmasela@environment.gov.za	012 399 9511	Department of Environmental Affairs, A2-2-14, 473 Steve Biko Rd, Environmental House, Pretoria
Danie Smit	DEA: Integrated Environmental Authorisations (Protected Areas)	Dsmit@environment.gov.za	012 310 3659	Private Bag X447, Pretoria, 0001
Ms Toinette Van der Merwe	Department of Environmental Affairs (DEA)	tvandermerwe@environment.gov.za	012 395 1782	Department of Environmental Affairs, A2-2-14, 473 Steve Biko Rd, Environmental House, Pretoria.
Mr Ernest Mokganedi	Department of Environmental Affairs (DEA) - Protected Areas Section	emokganedi@environment.gov.za	012 399 9522	Department of Environmental Affairs, A2-2-14, 473 Steve Biko Rd, Environmental House, Pretoria.
Mr Khayalethu Matrose	Department of Mineral Resources (DMR)	khayalethu.matrose@dmr.gov.za	012 444 3308	Private Bag X59, ARCADIA, 0007
Mr Izak van der Merwe	Department of Agriculture Forestry and Fisheries (DAFF)	izakvdm@daff.gov.za	012 309 5771	Private Bag X9087, Cape Town, 8000
Thoko Buthelezi	Department of Agriculture, Forestry & Fisheries (DAFF)	thokob@daff.gov.za	012-319-7634	Private Bag X120, Pretoria, 0001
Mashudu Marubini	Department of Agriculture, Forestry & Fisheries (DAFF)	mashuduma@daff.gov.za	012-319-7619	Private Bag X120, Pretoria, 0001
Annette Stoltz	Department of Agriculture, Forestry & Fisheries (DAFF)	AnnetteS@daff.gov.za	Not available	Delpen Building Cnr Annie Botha and Union Streets, Pretoria, 84
Sebabatso Mohapi	Department of Energy (DoE)	Sebabatso.Mohapi@energy.gov.za	021 446 3301	5th Floor Constitution House, 124 Adderley Street, Cape Town
Mr Andries van Ross	Transnet	andries.vanross@transnet.net	011 308 1681 083 389 4156	PO Box 72501, Parkview, 2122
Mr John Geeringh	Eskom	john.geeringh@eskom.co.za GeerinJH@eskom.co.za	012 332 5305	P O Box 1091, Johannesburg, 2000.
Sebenzile Vilakazi	Eskom	VilakazS@eskom.co.za	Not available	PO Box 32542, Totiusdal, 0134
Mr Alan Againz	SANRAL	agaienza@nra.co.za	012 426 6211 079 502 3700	38 Ida Street, Menlo Park, Pretoria, Gauteng, 0081
Phuti Namethe	SANPARKS	phuti.namethe@sanparks.org	012 426 5000	South African National Parks, PO Box 787, Pretoria 0001, South Africa
Mari Morland		mari.morland@sanparks.org	013 735 4265	
Akani Shivambu		Akani.shivambu@sanparks.org	013 735 4196	

Contact	Name and Organisation	Email Address	Contact No.	Postal Address
Patricia Mohlala		patricia.mohlala@sanparks.org	013 750 2995	
Lindiwe Mbowane		lindiwe.mbowane@sanparks.org		
Ms Z. Tyala	Department of Mineral Resources (DMR)- Eastern Cape	Zimkita.Tyala@dmr.gov.za	041 396 3900	Pier 14 Building , 444 Govan Mbeki Avenue, North End, Port Elizabeth 6000
Ms Portia Makhanya	Eastern Cape Department of Water and Sanitation (DWS)	MakhanyaP@dws.gov.za	043 604 5400 083 728 9916	Private Bag X7485 KING WILLIAM'S TOWN 5600
Andries Struwig	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT)	andries.Struwig@dedea.gov.za	041 508 5808	Private Bag X5001, Greenacres, Port Elizabeth, 6057
Charmaine Struwig	DEDEAT	Charmaine.Mostert@dedea.gov.za	041 508 5800	
Xolani Nikelo	DEDEAT	Xolani.Nikelo@dedea.gov.za		P.O. Box 16208, Amathole Valley, 5616
Vusi Mthombeni	DEDEAT	vusi.mthombeni@dedea.gov.za		Private Bag X5001, Greenacres, Port Elizabeth, 6057
Dayalan Govender	DEDEAT	Dayalan.Govender@dedea.gov.za	041 508 5893	P/Bag X5001, Greenacres, Port Elizabeth, 6057
Randall Moore	EC Department of Roads and Public Works	Randall.Moore@dpw.ecape.gov.za	041 403 6001	PO Box 1110, Algoa Park, Port Elizabeth
~~Ms Veliswa Baduza (Chief executive officer)~~	South African Heritage Resource Agency (SAHRA)	vbaduza@sahra.org.za	~~021 462 4502~~	PO Box 4637, Cape Town, 8000
Phillip Hine		phine@sahra.org.za	021 462 4502	
Briege Williams		bwilliams@sahra.org.za	021 462 4502/ 8688	111 Harrington Street, Cape Town
Ms Lesa la Grange		llagrange@sahra,org.za		
Funanani Ditinti	Department of Environmental Affairs – Oceans and Coast	FDitinti@environment.gov.za	021 819 2499	East Pier Building, East Pair Road Victoria and Alfred Waterfront, Cape Town 8000
Nontsasa Tonjeni		Ntonjeni@environment.gov.za		
Thandeka Mbambo		TMbambo@environment.gov.za		
John Peter		Jpeter@environment.gov.za		
Makwarela Mnwana		MMnwana@environment.gov.za		
Organ of State - Municipal				
Ted Pillay (Municipal Manager)	Sarah Baartman District Municipality	tpillay@cacadu.co.za sharrington@cacadu.co.za	041 508 7115	PO Box 318, Port Elizabeth, 6000

Contact	Name and Organisation	Email Address	Contact No.	Postal Address
Charl du Plessis	Kouga Local Municipality (Municipal Manager)	jreed@kouga.gov.za	042 200 2200	PO Box 21, Jeffery's Bay, 6330
Clr B.F. Rheeder	Kouga Local Municipality Ward 12	brheeder@kouga.gov.za benrheeder@telkomsa.net	082 848 2514 042 298 0269	
Nomvelo Siwela	Kouga Local Municipality – Environmental Specialist	nsiwela@kouga.gov.za	042 200 2141 067 114 1329	
Ncamile Dweni	Department of Water and Sanitation (Port Elizabeth)	DweniN@dws.gov.za	041 501 0700 082 953 2313	Private Bag X604, Port Elizabeth, 6000
Marisa Bloem	Department of Water and Sanitation (Port Elizabeth)	BloemM@dws.gov.za	041 501 0717	
Other Stakeholders				
Patrick Dowling	Wildlife and Environment Society of South Africa (WESSA)	patrick@wessa.co.za	021-701-1397	PO Box 30145, Tokai, 7966
Rieghard Janse Van Rensburg	National Sea Rescue Institute (NSRI) Station 37	info@searescue.org.za	042 293 4332 079 916 0390	P.O. Box 154, Green Point, 8051
Simon Gear	BirdLife South Africa (Policy and Advocacy Manager)	advocacy@birdlife.org.za	011-789-1122	PO Box 515, Randburg, 2125
Samantha Ralston-Paton	BirdLife South Africa (Manager)	energy@birdlife.org.za	011-789-1122	Private Bag X7, Claremont, 7735
Dale Wright	Birdlife South Africa	dale.wright@birdlife.org.za	011 789 1122	Winter House, Private Bag X7, Cape Town, 7735
Didi Mylne	Kromme Properties Shareblock (Pty) Ltd	didi.mylne@gmail.com	072 297 1209	
Keith Mutch	Registered I&AP	mutch.keith@gmail.com	Not available	Not available
Frank Silberbauer	Registered I&AP	infinity@iafrica.com	Not available	Not available
Franklin Barratt	Registered I&AP	franklin.barratt@gmail.com	Not available	Not available
Rod Suter	Registered I&AP	rod.suter@gmail.com	082 880 7344	
Janine Lochrenberg	Registered I&AP	southerncrisscross@gmail.com	Not available	Not available
Simon Jordan	Registered I&AP	simon.tileandbrick@gmail.com	Not available	Not available
Cilla	Registered I&AP	cilla@tileandbrick.co.za>	Not available	Not available
Daan Botha	Kromme River Mouth Share Block (PTY) Ltd	daanbotha@harvest.co.za	041 581 3032 082 568 2171	Financial Services and Property Administrators (FSPA), P O Box 27311, Greenacres, Port Elizabeth

Contact	Name and Organisation	Email Address	Contact No.	Postal Address
Mr Ebersohn	Registered I&AP	ebersohn@cyberperk.co.za, ebersohn@ecoroute.co.za	Not available	Not available
Shirley Cowling	Registered I&AP	scowling@kingsley.co.za	042 2980 259 082 4616 482	Not available
Robert Turner (Wilton)	Registered I&AP	wilton@telkomsa.net	Not available	Not available
Trudy Malan	Registered I&AP	trudi@amaziko.co.za	Not available	Not available
Harry Millson	Registered I&AP	hacmillson@telkomsa.net	0422940630	Not available
Dave Hurr	Registered I&AP	davehurr@computingservices.co.za	0845132323	Not available
Andrew Bowren	Registered I&AP	ajbowren@gmail.com, bowrenfamily@gmail.com	0825624273	Not available
Frank Baker	Registered I&AP	frank@baker.org.za	0832557069	Not available
Trish Baker	Registered I&AP	trish@baker.org.za	0827894147	Not available
Louis Fouche	Registered I&AP	Louis.fouche@telkomsa.net	0832526706	Not available
John Harrington	Registered I&AP	john@alogoacement.co.za	0832851268	Not available
Peter Long	Registered I&AP	plong@global.co.za	0828002356	Not available
Greg Miller	Registered I&AP	Greg_miller@live.co.za	0726722808	Not available
Deon Pienaar	Registered I&AP	deonpienaar@gjpinternational.com	0835391243	Not available
Ben Rheede	Registered I&AP	benrheeder@telkomsa.net	0828452514	Not available
Wayne Furphy	Registered I&AP	wayne@furphyventures.com	0833954516	Not available
Daryl Staples	Registered I&AP	Darylstaples4@gmail.com	0836592594	Not available
Penny Hulett	Registered I&AP	Penny.quaysyde@gmail.com	0829023295	Not available
Neville Hulette	Registered I&AP	nevilhulett@gmail.com	Not available	Not available
Maggie Langlands	Registered I&AP	maggielanglands@gmail.com	0824588063	Not available
Ken Mc Gregor	Registered I&AP	kenalexmcgregor@gmail.com	0824434448	Not available
Vera Massie	Registered I&AP	vera@anchorenvironmental.co.za	Not available	Not available
Clyde Fitzpatrick Niven	Registered I&AP	nivenclyde@gmail.com	0836565197	12 Ralph Road
Helene Loon	Registered I&AP	helene loon <helene_loon@yahoo.com>	-	-
Dr Anton Boonzaier	Registered I&AP	surfdoc@mweb.co.za	0824037373	PO Box 742, St Francis Bay, 6312
Ron Sams	Registered I&AP	ronsams@btinternet.com	0726864466	Not available
Ryan Donnelly	Registered I&AP	ryazion@gmail.com	0760113347	Not available
Roy Smith	Registered I&AP	smithrns@iafrica.com		Not available

Contact	Name and Organisation	Email Address	Contact No.	Postal Address
Chris Barratt	Registered I&AP	chris@barratt.co.za	0829218984	Not available
Valda Barratt	Registered I&AP	valda@barratt.co.za	0849218984	Not available
David Truter	Registered I&AP	davidtruter@trekliners.co.za	0834635950	Not available
A. Adler	Registered I&AP	Aadler@natglass.co.za	0836567529	Not available
David Micklem	Registered I&AP	micklem.david54@gmail.com	0726516427	Not available
Peter Butland	Registered I&AP	Pbutland09@gmail.com	0834532711	Not available
David Harpur	Registered I&AP	david@harpur.co.za	0824414486	Not available
Craig Jarvis	Registered I&AP	Info@craigjarvis.co.za	0823764443	Not available
Garth Smith	Registered I&AP	garthapp@gmail.com	0825513143	Not available
Mike Lello	Registered I&AP	mlello@iafrica.com	0824548577	Not available
Yvonne Lello	Registered I&AP	mlello@iafrica.com	0824548577	Not available
Tony Smith	Registered I&AP	Apsmith.psc@westnet.com.au	0714140191	Not available
Lois Smith	Registered I&AP	Apsmith.psc@westnet.com.au	0714140191	Not available
Beninie Morsink	Registered I&AP	morsink@stfrancisbay.info	0833067291	Not available
Laureen Payne	Registered I&AP	paynelaureen@gmail.com	0728981001	Not available
Shaun Payne	Registered I&AP	Shaunpayne85@gmail.com	0845161759	Not available
Jason Milne	Registered I&AP	Jason.milne.jm@gmail.com	0744113377	Not available
Trevor Medley	Registered I&AP	lynnemedley@telkomsa.net	0834690774	Not available
Neville Medley	Registered I&AP	neville.medley@gmail.com	0662300230	Not available
T Hedding	Registered I&AP	Not available	0829257231	Not available
B Hedding	Registered I&AP	barry@dhp-qs.co.za	0833266425	Not available
Tessa Suckling	Registered I&AP	tessainstfrancis@gmail.com	0823722332	Not available
John Suckling	Registered I&AP	johninstfrancis@gmail.com	0825581178	Not available
Di Le Roux	Registered I&AP	dileroux1@gmail.com	0829329347	Not available
Adele Dabbs	Registered I&AP	adele@sgrfinance.co.za	0825536684	Not available
Barry Swart	Registered I&AP	barryjswart@yahoo.com	0824900569	Not available
Nigel Harvey	Registered I&AP	guff.harvey@hotmail.com	0764302101	Not available
Chris Roberts	Registered I&AP	chrisroberts367@gmail.com	0828745315	Not available
Francois van Niekerk	Registered I&AP	Not available	0825746433	Not available
Jeff Forrer	Registered I&AP	Not available	0736125575	Not available
Iain Skinner	Registered I&AP	iain@skinnerfam.co.za	0825564523	Not available
Jane Skinner	Registered I&AP	jane@skinnerfam.co.za	0825541828	Not available
Sally Silberbauer	Registered I&AP	sallysil@iafrica.com	0832619195	Not available

Contact	Name and Organisation	Email Address	Contact No.	Postal Address
Susan Colley	Registered I&AP	johndcolley37@gmail.com	0829611992	Not available
DJ Comyn	Registered I&AP	djcomyn@gmail.com	0832618037	Not available
Meryl Comyn	Registered I&AP	Meryl.comyn@yahoo.com	0832641387	Not available
Daron Cock	Registered I&AP	daroncock@hotmail.com	0832522181	Not available
Graham Tugwel	Registered I&AP	Sfbsigns6312@gmail.com	0826141411	Not available
Craig Northwood	Registered I&AP	craignorthwood@gmail.com	0825663646	Not available
Philippa Hill	Registered I&AP	mobydicksa@hotmail.com	0832340747	Not available
D. Hill	Registered I&AP	mobydicksa@hotmail.com	0836552557	Not available
Jonothan Hill	Registered I&AP	Jonothan-Hill@hotmail.com	0739649292	Not available
Matthew Smith	Registered I&AP	Matt@woodenlogic.com	0662514151	Not available
Dylan Stephens	Registered I&AP	dylanstephens007@gmail.com	0658011961	Not available
Simon Fish	Registered I&AP	simon@fishstixsurfboards.co.za	0835577794	Not available
Marc White	Registered I&AP	Marc.whiteza@gmail.com	0834311628	Not available
Geoff Fish	Registered I&AP	geoff.fish@hotmail.com	0798391865	Not available
Chris Middleton	Registered I&AP	Chris.narg49@gmail.com	0836544040	Not available
Barry Platt	Registered I&AP	barry@energyassist.co.za	0824779543	Not available
Brain Wells	Registered I&AP	bawells47@gmail.com	0833857933	Not available
Luke Mulder	Registered I&AP	Lukemulder4@gmail.com	0842671307	Not available
Tyron Mulder	Registered I&AP	tyronmulder4@gmail.com	0847494032	Not available
Trevor Wright	Registered I&AP	Trevoralanwright1953@gmail.com	0765890014	Not available
Lucille Gerry	Registered I&AP	lgerry@telkomsa.net	Not available	Not available
Carol-Anne Killian	Registered I&AP	carolannekillian@hotmail.co.za	0724973822	Not available
Warwick Salier	Registered I&AP	jacqui@itsnet.co.za	Not available	Not available
Rodney Milford	Registered I&AP	Rodney.milford@gmail.com	0828929353	Not available
Michael Hill	Registered I&AP	h.michaellllll@gmail.com	0837141033	Not available
Linda Furphy	Registered I&AP	lindafurphy@gmail.com	0834526232	Not available
Robert Smith	Registered I&AP	rob.smith@woodridge.co.za	Not available	Not available
Calvin Smith	Registered I&AP	calvin.smith33@outlook.com	0787107527	Not available
Les Noah	Registered I&AP	Lfn1@vodamail.co.za, lfn@mweb.co.za	0823732585	Not available
Dawn Noah	Registered I&AP	Lfn1@vodamail.co.za, lfn@mweb.co.za	0823732585	Not available
J. Davies	Registered I&AP	davies@isat.co.za	0833269220	Not available
Michael Ofsowitz	Registered I&AP	michael@vipmartini.com	0747770526	Not available
Craig Kilfoil	Registered I&AP	craigk@polka.co.za	0829449988	Not available

Contact	Name and Organisation	Email Address	Contact No.	Postal Address
Murray Stewart	Registered I&AP	Mugs.stewart@gmail.com	0823721980	Not available
Johathan Paarmon	Registered I&AP	Not available	0833844884	Not available
Nick Munday	Registered I&AP	nick@munday.global, nick@signetbm.oo.za	0834234718	Not available
Norman Dyer	Registered I&AP	dyerndd@gmail.com	0828001195	Not available
Charles Laird	Registered I&AP	chaslaird@telkomsa.net	0825533671	Not available
Chio Moulang	Registered I&AP	chiolaine@gmail.com	0828777365	Not available
Dot Ker-fox	Registered I&AP	dkf@telkomsa.net	Not Available	Not available
Isabeau Plumstead	Registered I&AP	isabeauplumstead@gmail.com	Not Available	Not available
Rob Hallier	Registered I&AP	RobH@itoo.co.za	Not Available	Not available

Given the sheer volume of comments received for this project and in an attempt to save paper and printing the evidence of electronic notification has been limited to that since the Final Scoping Report (FSR). For evidence of electronic communication up to the FSR please refer to the FSR.

Notification of Draft Environmental Impact Report available for review (18 December 2019):

Notification of Draft Environmental Impact Report available for review (16 January 2020):

Gregory Shaw

St Francis Bay - Draft EIR - Additional Public Meeting

Dear Interested and Affected Parties

[illegible]

Kind regards

Greg

Gregory Shaw

Gregory Shaw

St Francis Bay - Draft EIR - Additional Public Meeting

Dear Interested and Affected Parties

[illegible]

Kind regards,

Greg

Gregory Shaw

Proof of delivery of Draft Environmental Impact Report to DEA: Oceans and Coasts (formal PPP phase):

Xolani Myanga <XMyanga@environment.gov.za>

RE: Request for Extension on Dead line for Comments on: Final Scoping Report: St Francis Bay Coastal Protection Scheme

To: Gregory Shaw

Hi Greg,

Thanks, we did receive the copies on the 7th of January 2020.

Regards

From: Gregory Shaw [mailto:g.shaw@cesnet.co.za]
Sent: Monday, January 13, 2020 2:05 PM
To: Xolani Myanga
Cc: Nomusa Tonjeni; Funanani Dzivhani; Thandeka Mbumba
Subject: RE: Request for Extension on Dead line for Comments on Final Scoping Report: St Francis Bay Coastal Protection Scheme

Hi Xolani,

Please can you confirm receipt of the 2 hard copies and 1 electronic copy of the St Francis Bay Draft EIR please?

They should have been at your offices on the 7th January 2020.

Thanks and regards,

Greg

Gregory Shaw
Principal Consultant
CES - Environmental and Social Advisory Services
67 African street
Grahamstown/Makhanda | Eastern Cape | South Africa
Tel: +27 (46) 622 2364 | Cell: +27 (83) 671 5914 | Skype: shaw.gregory
g.shaw@cesnet.co.za | www.cesnet.co.za

Proof of delivery of Draft Environmental Impact Report to DEDEAT (formal PPP phase):

Province of the
EASTERN CAPE

Corner Atfred Fugard Terrace and Castle Hill, Central, Port Elizabeth 6001
Private Bag X5001, Greenacres, Port Elizabeth 6057 | Republic of South Africa

Tel: 041 508 5844 | Fax: 041 508 5865 | E-mail: Nicole.Gerber@dedea.gov.za | www.dedea.gov.za

Reference: ECO8/C/LN2/M/42-2019
Enquiries: N. Gerber

CES - Coastal and Environmental Services (Pty) Ltd
P.O. Box 934
Grahamstown
6139
E-mail: g.shaw@cesnet.co.za

Attention: Mr Gregory Shaw

APPLICATION FOR AUTHORISATION IN TERMS OF SECTION 24 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, ACT 107 OF 1998 TO UNDERTAKE A LISTED ACTIVITY AS SCHEDULED IN THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014, AS AMENDED: PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, WITHIN THE KOUGA MUNICIPAL AREA.

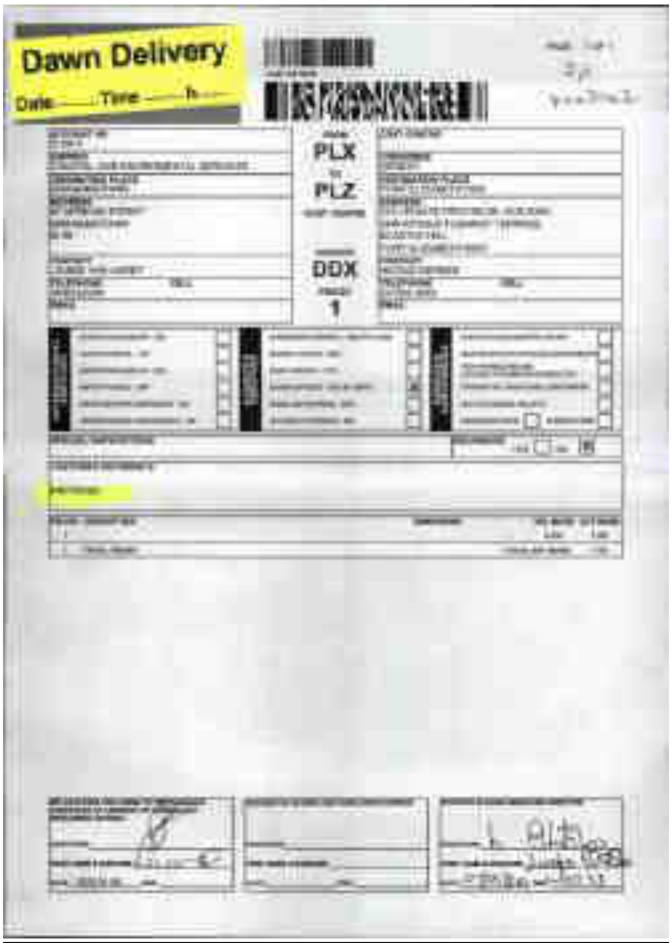
1. The Draft Environmental Impact Assessment Report (DEIR) as well as the Draft Estuarine Report, Draft Sand Sourcing Study and Draft EMPr, with accompanying cover letter, dated 06 January 2020 and received on 07 January 2020 for the above project refers and is hereby acknowledged.
2. The Department notes that the cover letter for the DEIR confirms the dates of the commenting period as being from 19 December 2019 to 05 February 2020. As the Department only received the DEIR on 07 January 2020, the Department's 30-day commenting period technically ends on 06 February 2020.
3. The Department will however endeavour to issue a comment letter on the DEIR before the end of the stated PPP commenting time period.

The EAP is advised to remain cognisant of the contents of the acknowledgment letter of the application and to remind the applicant in writing that the activity may not commence prior to an environmental authorisation being granted by the competent authority.

NICOLE GERBER
ENVIRONMENTAL OFFICER: EIM
CACADU REGION

DATE: 16/01/2020

"Innovation for Sustainable Development"


Dawn Delivery

Date — Time — h —

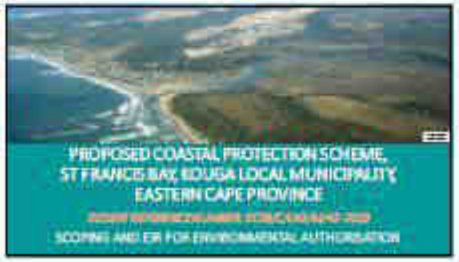
PLX

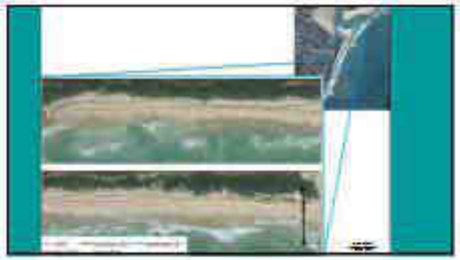
PLZ

DDX

1

Public Meeting:
Presentation given on the 19th December 2019 and 29 January 2020





PROJECT OVERVIEW

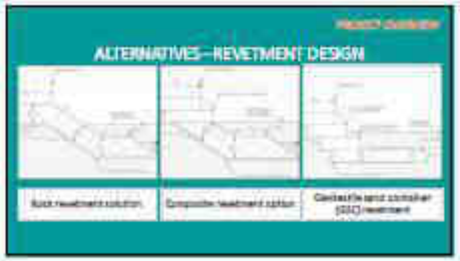
PROJECT OVERVIEW
2. Coastal Structures to Retard the Erosion of St Francis Bay beach

COASTAL PROTECTION ALTERNATIVES

PROJECT OVERVIEW

PROJECT OVERVIEW

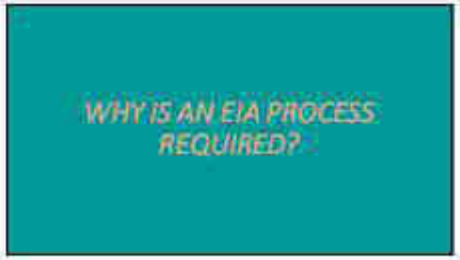
PROJECT OVERVIEW
PHASE 1

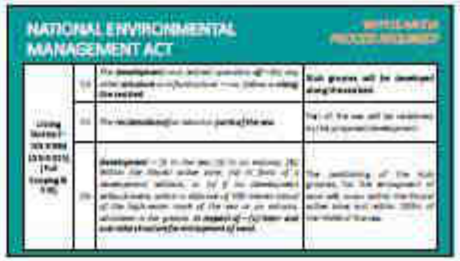


PROJECT OVERVIEW
ALTERNATIVES – REVETMENT DESIGN
Rock revetment solution
Composite revetment option
Geotextile sand container (GSC) revetment

PROJECT OVERVIEW
3. Sand Material Sourcing from the Kromme River

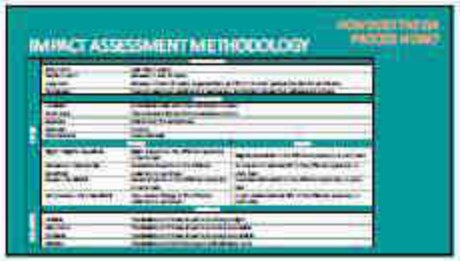

PROJECT OVERVIEW

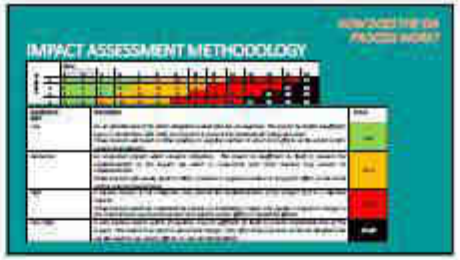

WHY IS AN EIA PROCESS REQUIRED?


NATIONAL ENVIRONMENTAL MANAGEMENT ACT


NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA) LISTED ACTIVITIES


HOW DOES THE EIA PROCESS WORK?


IMPACT ASSESSMENT METHODOLOGY
HOW DOES THE EIA PROCESS WORK?


IMPACT ASSESSMENT METHODOLOGY
HOW DOES THE EIA PROCESS WORK?


ENVIRONMENTAL SENSITIVITIES
CES


CES


CES

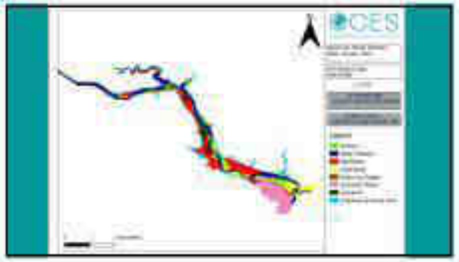

SPECIALIST
STUDIES


Estuarine and Dune Ecology Impact Assessment
• Dr Chantel Bezuidenhout (CES)
• Dr Ted Avis (CES)
• Mr Gregory Shaw (CES)
Source Material Study: High-level Conceptual Study
• Dr David Brew (RHDHV)
• Mr Roberto Almanza (CES)
• Mr Gregory Shaw (CES)
Heritage and Archaeological Assessments
• Mr Neels Kruger (Exigo)

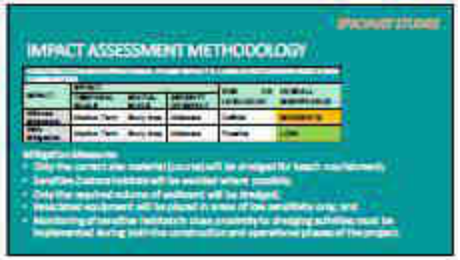

1. Heritage
Specialist Assessment


Heritage Findings
• Low impact on archaeological sites.
• Small possibility of damage to archaeological sites buried under soil surface.
• Revetments will protect any archaeological sites.
• Contractors to remain of aware of the following:
• Dense accumulation of marine shells
• Stone tools and preserved bone
• Burial sites

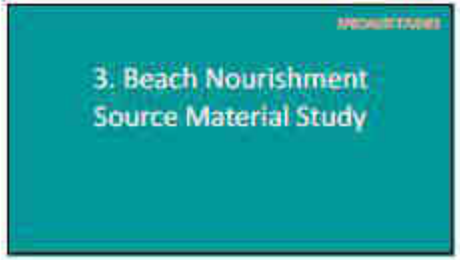

2. Estuarine and Dune Ecology
Specialist Assessment


CES

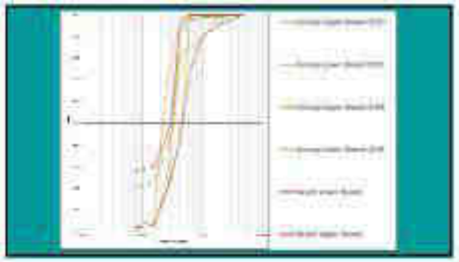

CES
Salt Marsh –
High Sensitivity

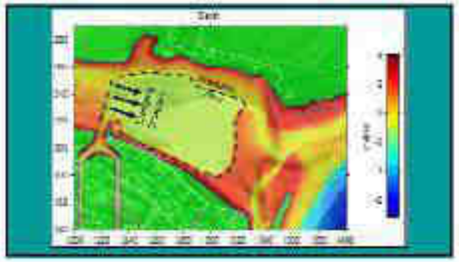

IMPACT ASSESSMENT METHODOLOGY

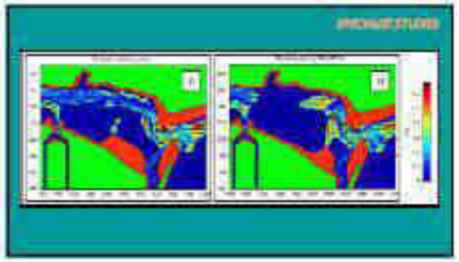

Estuarine Specialist Assessment Findings
Adaptive management plan to be developed.

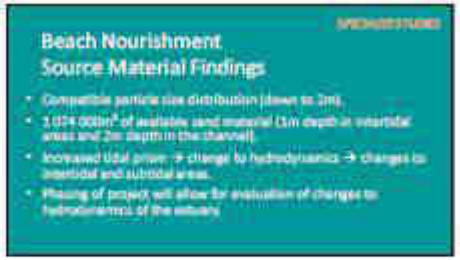

3. Beach Nourishment
Source Material Study


CES








SPECIALIST STUDIES
Beach Nourishment
Source Material Findings
Compatible particle size distribution (down to 2m).
1,074 000m³ of available sand material (1m depth in intertidal areas and 2m depth in the channel).
Increased tidal prism → change to hydrodynamics → changes to intertidal and subtidal areas.
Phasing of project will allow for evaluation of changes to hydrodynamics of the estuary.


IDENTIFICATION OF
POTENTIAL IMPACTS


IDENTIFICATION OF
POTENTIAL IMPACTS


Environmental Management
Programme (EMPr)

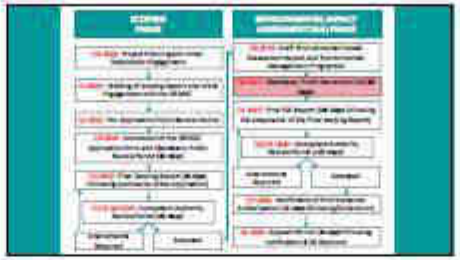

WHAT IS AN EMPr?


DEVELOPMENT AREAS


DEVELOPMENT AREAS


PUBLIC PARTICIPATION
PROCESS AND WAY
FORWARD


PUBLIC PARTICIPATION PROCESS (PPP)




QUESTIONS AND COMMENTS
Mr Gregory Shaw
67 African Street, Grahamstown / Makhanda, 6139
Tel: +27 (0) 46 622 2364
Email: g.shaw@cesnet.co.za
www.cesnet.co.za/st-francis-bay-coastal-protection-scheme-eia
• Background Information Document
• Draft Environmental Impact Report (including specialist reports)
• Draft Environmental Management Programme Report

Minutes of meeting held on the 19th December 2019

CES
ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

DRAFT EIR PUBLIC MEETING FOR THE PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

Notes from the Public Meeting held at the St Francis Bowling Clubhouse, on the 19th of December 2019, at 5pm

ATTENDEES	• Mr Gregory Shaw, EAP Representative; • St Francis Bay Property Owners Association • Various members of the community: please refer to the attendance register.

Mr Shaw welcomed the attendees and proceeded to present the project progress to date, elaborating on the impacts identified and the mitigation measures anticipated to reduce those impacts deemed to be significant (refer to Appendix A for an overview of the contents of the presentation made).

Questions and responses

Question/comments raised	CES/Applicant Responses
Frank Silberbauer: 1. The increase in access to boats on more states of the tide would lead to an increase in boat traffic. How is that a benefit to the amenity when there are already too many boats?	1. The benefit is derived from the point of view that local community members who face challenges with safe navigation of the river channels will gain more accessibility. This is also true for any other boat user. The KJRC are responsible for managing boat licenses and traffic on the Kromme. Norman Dyer (Chairman of KJRC mentioned that it is something that they are aware of and will act accordingly)
2. If sand is being sourced from upstream of the bridge then there is the potential to impact the small vessel harbor and jetties. Who will pay for damage to these structures from all the additional wake from boats?	2. It is anticipated that no-wake zones and channel markers be considered as the estuary becomes more "useable". This will be part of the KJRC responsibility. It is unlikely that the dredging itself will lead to significant changes in river conditions experienced north of the bridge.
Roy Smith: 1. Is the construction noisy? Has that been assessed?	1. Noise was assessed. While working during normal work hours (8-5 weekdays) it is unlikely for the noise of the dredger and pumps to be any louder than the ambient noise in the town. It might be perceived as noisier on the estuary but even then it is unlikely to be significant. Noise mitigation measure (for pumps for example) can be employed.

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2. When will construction commence? i.e. when are we likely to see the first groyne on the beach? 3. Agrees that the protection of the spit area should be the first phase, but would like to see that other areas follow as soon as possible to ensure community support. 4. Comparison between the three revetment options (i.e. performance, aesthetics)? What do they look like?	2. It depends on when environmental approval is obtained, conditions set by DEDEAT and funding availability. 3. Agreed, and the second phase will be implemented as soon as possible thereafter. However construction of any phase will only commence once funding for that particular phase has been secured. 4. Rock is slightly cheaper. Sand bags would need to be filled with sand. Possibility sand covering all the alternatives.
Tony Smith 1. Offered assistance with the development of the project plan. He had also projected project costs and could link that to the project schedule to understand what the scheme would cost over time. 2. There are examples of similar schemes in Australia. They seem to be working there. I will send some photographs through to SFPO.	1. SFPO NPC mentioned that assistance would be appreciated. 2. SFPO welcomed the opportunity of receiving photographs of similar examples to the proposed scheme.
Ron Sams: 1. Will there be screening of contractors to ensure the work is carried out correctly? How will these recommendations be enforced? 2. Is there a possibility that DEDEAT could come back requesting further information delaying the process even further?	1. The mitigation and monitoring is included in the EMPr. It is anticipated that the EMPr will be included in the tender package provided to tenders who would need to comply. Part of the EMPr is the contracting of an ECO will is responsible for monitoring the contractor's activity. 2. The legislation allows for DEDEAT to request further information. DEDEAT are aware of the scope of this report since they have signed off on the Scoping Report and the plan of study. Therefore, it is anticipated that DEDEAT would be able to make a decision within 107 days after submission. However, an additional information request cannot be discounted.
Valda Barratt: 1. Confirmed her understanding that construction would be for 2 years. 2. The estuary cannot be considered an urban environment. Can working hours be restricted? 3. Where would the extraction of material take place?	1. Confirmed, should construction not be phased. Construction is likely to be phased, with the anticipated construction duration for each phases presented in the EIR and the engineering report.

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13 Stanley Street, Richmond Hill, Port Elizabeth, 6001
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4. Were alternative sand sources investigated?	2. Agreed. Working hours (anticipated to be 8 hr/day, 5 days a week) can be restricted, but that will prolong the construction period. 3. The priority areas identified in the draft EIR would be the initial source areas. It would be throughout the length of the estuary within those zones. Likely to be along the river channel. 4. Yes, alternatives were looked at. Offshore sediment would require large, expensive vessels to dredge the sediment. The water depth would restrict the ability for the vessel to get close to shore too. Areas in the Sand River were initially considered but the area was soon declared a protected area. Trucking from other sources (i.e. Jefferys Bay) was initially considered but it was discounted due to feasibility.
Ryan Donnelly: 1. Concerned about short notice of the meeting. 2. Concerned that a member of the EAP team had left the project. Thought that the previous member was more process driven while current EAP seemed to be promoting the project. 3. Was sea level rise taken into account? 4. What about the perpetual maintenance. The community is committed to paying for the ongoing maintenance.	1. Notice of the meeting coincided with the release of the Draft EIR. A meeting in December was scheduled to include non-permanent property owners. 2. The CES colleague who was involved in this project mentioned that his personal opinion regarding the merits of the St Francis Bay project had absolutely no bearing on his decision to leave the company. The current EAP's aim is to provide a balanced and objective summary of the project and the impacts associated with it. 3. The preliminary design does accommodate sea level rise. 4. The cost of the scheme is included in the preliminary design documentation. While the impact of operation of the scheme is discussed in the Draft EIR.
I&AP's name missed: 1. Is there an opportunity to develop additional infrastructure on the groynes themselves (i.e. restaurants)	1. SFPO response was that it could be an option that can be looked into. In fact at some point in the future that might be something the St Francis community may want. However, this application does not include for that at this stage.

Coastal and Environmental Services (Pty) Ltd
T +27 41 585 1715 | F +27 86 604 8781
13 Stanley Street, Richmond Hill, Port Elizabeth, 6001
Reg no: 2012/151672/07
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Attendance register for meeting held on 19th December 2019

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ATTENDANCE REGISTER

PUBLIC MEETING FOR THE PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

Thursday 19th December 2019

Name	Surname	Company / Association (if applicable)	Cell Phone	Email Address
Dean Pienaar	Pienaar	SFPO NPC	083 591 243	[illegible]international.com
Ron Sams	Sams	n/a	082 6864466	[illegible]@btinternet.com
Ryan Donnelly			0760013387	[illegible]@gmail.com
Roy Smith	Smith	N/A	[illegible]	[illegible]@iafrica.com
[illegible]	STEWART	SFPO	[illegible]	[illegible]@gmail.com
D J Cowan	Cowan	–	0832418057	[illegible]@hotmail.com
F B Siegelbauer	SIEGELBAUER	KROMME PROPS	083 2257484	[illegible]@iafrica.com
B	BARTY	Kromme Props	0722977807	bartys@iafrica.com
Chris Barratt			082 421 8984	[illegible]
Valda	BARRATT	–	084 9215754	valda@barratt.co.za
Harry	[illegible]	n/a	042 294 0650	[illegible]@telkomsa.net
DAVID	TRUTER	SFPO	0834635956	[illegible]@[illegible].co.za
Ant ~~Adler~~	ADLER		0836567624	AADLER@NATGLASS.CO.ZA
Dave [illegible]	Micklem	–	[illegible]6427	micklem.[illegible]54@gmail.com

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Name	Surname	Company / Association (if applicable)	Cell Phone	Email Address
Peter Butland	–	–	[illegible]	pbutland[illegible]@gmail.com
DAVID HARPER	HARPER	–	0824414486	david@[illegible].co.za
Craig Jarvis			[illegible]	info@craigjarvis.co.za
Wayne [illegible]		SFPO NPC	[illegible]	[illegible]
Louis Fouché		SFB RHOA + KJPC	[illegible]	louis.fouche@telkomsa.net
Garth Smith			[illegible]	garth[illegible]@gmail.com
Mike & Yvonne Lello	LELLO		[illegible]	mlello@iafrica.com
Tony Smith			0714140191	apsmith.[illegible]@[illegible].com.au

Minutes of meeting held on the 29th January 2020

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DRAFT EIR PUBLIC MEETING FOR THE PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

Notes from the Public Meeting held at the St Francis Links, on the 29th of January 2020, at 5pm

ATTENDEES	• Mr Gregory Shaw, EAP Representative; • St Francis Bay Property Owners Association; and • Various members of the community: please refer to the attendance register.

Mr Shaw welcomed the attendees and proceeded to present the project progress to date, elaborating on the impacts identified and the mitigation measures anticipated to reduce those impacts deemed to be significant (refer to Appendix A for an overview of the contents of the presentation made). Significant time was spent addressing any questions raised.

Questions and responses

Question/comments raised	CES/Applicant Responses
Hilton Thorpe: 1. Was there any consideration for permeable groynes?	1. Permeable groynes were not considered. The EAP's understanding is that a permeable groyne would not provide the same performance as a groyne in terms of retaining sediment. Certainly it would not be considered a permanent solution. Not mentioned during the meeting but included here for reference: From Entech Report: Nov 2002: The concept of permeable groynes constructed from gum poles was put forward by residents during June 2001. This was discussed in Section 3.8 of Entech (2002a). Two permeable gum pole groynes were to be installed along the main beach as an experiment to assess their effectiveness. Each structure consists of gum poles jetted into the sand at 1 m intervals for a total length of some 100 m. The one structure would consist of a single row of poles, while the other consisted of three rows, 1 m apart.

Coastal and Environmental Services (Pty) Ltd
T +27 41 585 1715 | F +27 86 604 8781
13 Stanley Street, Richmond Hill, Port Elizabeth, 6001
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	Although claims for its use were again made during the comment phase of the EIA, Entech is still of the opinion that this type of structure is not a permanent solution to the St Francis beach erosion problem. There is however no harm in installing such a structure on the beach for experimental purposes subject to appropriate approvals. In this way further information on the sediment dynamics of the beach will be able to be gathered. Installation of the structure should however be accompanied by a full monitoring programme to be effective. Furthermore, the structure should be installed in such a way that it can be easily removed if and when required.
Pieter Pretorius: 1. Did the engineers consider a scheme that traps natural sediment movement down the coast rather than taking sediment from the Kromme? It would be cheaper and less damaging.	1. The challenges with trapping sediment naturally moving along the coast are two-fold. 1) The sediment travelling along the coast has been restricted due to development in the St Francis dune field. Therefore, trapping naturally occurring sediment would take a significant amount of time to provide the protection required. 2) While the scheme is designed to trap sediment part of the design is to ensure that some sediment does continue to move along the coast to ensure that beaches to the north of St Francis Bay receive sand.
Tony Butler: 1. How long with the Environmental Authorisation be valid for?	1. At this stage it is difficult to say. It will depend on the recommendations of the EIA, the proposed timeline presented as part of the project construction period and DEDEAT's discretion.
Barry Platt: 1. Where will the pipelines and pumps be placed? Will there be permanent ones?	1. It is not the intention of the project to install permanent pumping infrastructure because the borrow areas are quite widely spread. To get sand from the priority areas means that pump positions and pipeline routes will need to change. 2. The EIR provides guidance on areas to be avoided during construction. The EMPr also provides recommendations for ensuring construction activities do not result in significant environmental impact (i.e. recommendations for where and how plant can be stored).

Coastal and Environmental Services (Pty) Ltd
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Murray Stewart: 1. Oyster Bay are continually having to deal with too much sand. Is it possible to consider using sand from there as part of the scheme?	1. This option was also suggested by DEDEAT. It is a possible source of material. However, the anticipated volume is expected to be significantly lower than that required for this scheme. In addition, the cost of transporting the sand from Oyster Bay is significantly more than that associated with obtaining sand from a closer resource. 2. Depending on the requirements for maintenance this could be considered in future.
Luke Mulder: 1. Were the creation of offshore reefs investigated?	1. Offshore reefs were investigated by previous engineering efforts to address similar issues approximately 15 years ago. Offshore reefs are designed to reduce the wave energy with the intention that the resultant energy reaching the beach would not result in significant erosion. However, offshore reefs do not limit longshore drift and it is anticipated that all the material used to nourish the beach would disappear (into the mouth of the Kromme, offshore and/or to the north) relatively quickly and require significant maintenance.
Tyron Mulder: 1. The spit is eroding quickly. Lots of visitors walk in the dunes creating more problems. What awareness is being raised to try and keep people off the dunes? 2. Could vegetation cuttings be used on the dunes and the scheme to retain the sand placed through nourishment?	1. The EIA has identified the dune vegetation as being sensitive for that particular reason. The EAP is not aware of any local initiative to inform visitors but it is a good idea and would be up to the community to establish and "enforce". 2. Vegetation cuttings are used in dune stabilization and habitation projects. While it is a proven method for dunes it would not provide the integrity required to ensure large volumes of sand stay on the beach.
DJ Comyn: 1. In the construction schedule there is reference to the spit being the first phase of development followed by main beach. In St Francis Bay the main beach is the main amenity and therefore should be prioritized.	1. The engineers identified that the risk to the spit is significant. A breach of the spit could lead to substantial damage to the canal infrastructure and property. The main beach already has a level of protection through the installation of revetments.
Daron Cock: 1. What was the design criteria for the groynes? 2. What kind of materials were considered?	1. The design criteria is included in the engineering report. Essentially the design is to protect the frontage first and foremost. Various alternatives were considered (as reported in the engineering report) and a groyne / beach nourishment option was recommended.

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3. What about the settlement of the rock in the sand? Presumably the groynes would sink? 4. Why not consider dolosse?	2. Groynes are generally constructed from rock since rock is relatively cheap and easy to source. 3. The engineers would design a structure that performs according to the brief. The engineering report discusses the size of the rock material required based on the environmental conditions experienced at St Francis Bay. 4. Dolosse are very expensive and require significant volumes of concrete.
Charles Laird: 1. What would happen if the spit breaches?	1. It is likely there would be damage to the properties and canal infrastructure. The canals would silt up fairly quickly and prevent the flushing effect currently experienced.
Ryan Donnelly: 1. Are the engineers here tonight? 2. Has enhancing existing off-shore reefs being looked at? 3. Deon (SFPO) stated that the surfers input will be invited after DEDEAT approval? 4. Has there been an independent review of the preliminary design? 5. Will there be developments on top of the groynes? 6. Where are the minutes from the previous meeting (19th December 2019)? 7. The beach profiles reflected in the engineering and EIA reports are inaccurate and misleading. 8. Where are the plans in the EIR of the location of pump stations, piping and outlets? 9. With only 1 week left of this commenting period, there is not sufficient time to provide comment. 10. Concerned that a member of the EAP team had left the project. Previous EAP had mentioned that there wasn't sufficient detail for this project to proceed. 11. Areas downstream of the groynes become depleted. 12. Groynes don't always work.	1. No. 2. The number and placement of the groynes are based on the retention of sediment. I am not an engineer so I cannot comment on how the incorporation of existing reefs would benefit the scheme. It has not been looked at. 3. Input from all I&APs is being invited (and has been invited) since the pre-application stage of this project. 4. At this stage a peer-review has not yet been carried out. 5. This application does not include for any development on top of the groynes. 6. The minutes of the meeting will appear as an Appendix of the Final EIR submitted to DEDEAT. 7. The drawings showing the beach profile included in the report are the design specification or "minimum" requirement (i.e. to retain a 40 m wide beach). In reality it might look slightly different. 8. It is anticipated that no permanent structures (i.e. pumps, pipelines) will be constructed. Given that sediment has to be transported from various locations all pumps and pipelines will need to be mobile and in temporary locations. 9. The PPP period was between the 19th December 2019 and 5th February 2020. CES consider this to be sufficient time to provide comment on the Draft EIR. 10. The CES colleague who was involved in this project mentioned that his personal opinion regarding the merits of the St Francis Bay project had absolutely no bearing on his decision to leave the company. The

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	current EAP's aim is to provide a balanced and objective summary of the project and the impacts associated with it. 11. The Draft EIR recognizes the potential for accelerated erosion to the north of the groynes. The design criteria is to design a feature that allows the natural movement of sediment through the scheme. 12. Based on the data the engineers have at the moment and their experience, groynes are anticpated to work.
Rodney Milford: 1. This project needs to proceed and should not be delayed any further.	1. No comment
Jacqui Sauer: 1. These groyne structures and beach nourishment will have an effect on the marine environment. Has this been covered in the EIR?	1. Yes, the EIR considers the impact of the structures and the sand on the marine environment. St Francis Bay is/was characterized by sandy beaches interspersed with reefs. This is a dynamic environment with sand moving regularly. Therefore, the species present are tolerant of levels of disturbance and smothering. It is recognized that large amounts of sand at one time will lead to a loss individuals but it is not anticipated to have a significant impact on any particular species at local and regional level. No particular sensitive species
Tony Smith: 1. I don't understand why full engineering specifications cannot be discussed as part of the EIA process. 2. What is the cost of the scheme? By my calculations the cost of the scheme is likely to be significantly more than what has been reported. 3. What about carrying out a risk assessment on this scheme and understanding how the costs would change going forward based on delays due to funding etc.	1. This meeting is intended to provide a summary of the information contained in the EIR. More details is available in the engineering reports attached as annexures to the EIR report. The EIR also provides a detailed summary of the scheme. The PPP process allows for comments to be raised on the detail in order for a response to be provided. 2. The cost of the scheme is in the engineering report. R89M. It was preliminary design and so the costs could change based on the final design. 3. No specific risk assessment has been carried out on the costs of the scheme and the funding mechanism.
Shaun Payne: 1. Where is the money for the scheme coming from?	1. The SFPO have set up a Special Rates Area as a mechanism of fundraising. Possible public and further private funding opportunities are also being explored.
Chris Roberts: 1. The engineering report is very clear in terms of the brief, the alternatives and costings. Advisian are a specialist firm of coastal engineers.	

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Craig Kilfor: 1. If one considers a cost benefit analysis of the project then all one needs to do is look at the cost of 5-10 houses on the canals to provide justification for protection of the spit.	
Meryl Comyn: 1. The Kromme River is a living organism. It is dynamic and has changed over the years. It is well used by generations of families and it would not be acceptable for this to change because of this scheme. There is an area directly in front of our property which we use extensively.	1. The Draft EIR recognizes the sensitivities of the habitats and physical conditions within the estuary and identifies impacts as a result of the project. As mentioned sensitive areas have been identified, mapped and presented as areas with no or limited development/activity. 2. Please do send through a picture or map of the particular area you refer to so that we can consider that for the Final EIR.
Luke Mulder: 1. Has sand from the dredging of the port been considered?	1. Yes, sand from the port was considered. However, there were three concerns. 1) The particle size may not be suitable given that fine sediment generally settles in ports/harbours. 2) Generally sediment within ports can contain some contamination 3) The volume of sediment is likely to be minimal and not sufficient for the initial nourishment. The availability of the sediment for the maintenance of the beach could be an option but would require investigation at a later stage.
I&AP's name missed: For anyone that has worked in or flown over Maputo there are groynes / pier structures along the beach which have helped retain sand on the beaches. There are examples elsewhere of groynes – its worth doing some investigating if you're interested.	

Coastal and Environmental Services (Pty) Ltd
T +27 41 585 1715 | F +27 86 604 8781
13 Stanley Street, Richmond Hill, Port Elizabeth, 6001
Reg no: 2012/151672/07
www.cesnet.co.za

Comments received following the submission of the FSR and during the Draft EIR phase

DEDEAT:

Province of the
EASTERN CAPE
ECONOMIC DEVELOPMENT,
ENVIRONMENTAL AFFAIRS & TOURISM

Corner Athol Fugard Terrace and Castle Hill, Central, Port Elizabeth 6001
Private Bag X5001, Greenacres, Port Elizabeth 6057 | Republic of South Africa

Tel: 041 508 5844 | **Fax:** 041 508 5865 | **E-mail:** Nicole.Gerber@dedea.gov.za | **www.dedea.gov.za**

Reference: EC08/C/LN2/M/42-2019
Enquiries: N. Gerber

CES - Coastal and Environmental Services (Pty) Ltd
P.O. Box 934
Grahamstown
6139
E-mail: g.shaw@cesnet.co.za

Attention: Mr Gregory Shaw

APPLICATION FOR AUTHORISATION IN TERMS OF SECTION 24 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, ACT 107 OF 1998 TO UNDERTAKE A LISTED ACTIVITY AS SCHEDULED IN THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014, AS AMENDED: PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, WITHIN THE KOUGA MUNICIPAL AREA.

1. Refer to the Final Scoping Report (FSR) dated and received on 25 September 2019, together with the Draft Estuarine and Dune System Impact Assessment and the Beach Nourishment Source Material Study, submitted in support of the application to undertake listed activities as contained in the 2014 NEMA EIA Regulations, as amended.
2. The Department has reviewed the FSR and hereby notes the following:
    a. The comments made by the Department on the Draft Scoping Report (DSR) have been considered and adjustments done in the Final Scoping Report (FSR);
    b. Comment from the National Department of Environmental Affairs, Oceans and Coasts Sub-Directorate were received and included in the FSR;
    c. Other comments from registered I & AP's have also been included and responded to. It is trusted that these comments will be further addressed in the EIA phase, particularly addressing the requirements of the Integrated Coastal Management Act, 2008 and Local Government Municipal Systems Act, 2000;
    d. It is noted that Appendix G includes an archaeological report dated 18 December 2006 from Geological and Environmental Services. In light of the sensitivity of the area, as well as the interest of local I & AP's, the Department requires that this report is updated and/or the findings confirmed by a suitable archaeological specialist during the EIA phase, as well as obtaining any comment from SAHRA or ECPHRA; and
    e. The Plan of Study includes the Source Material Study as well as the Estuarine and Dune Impact Assessment.

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3. The FSR is hereby accepted and the Plan of Study is approved taking cognisance of the above. You are thus to proceed to the EIA phase as per the provision of Section 23(a) of the NEMA: EIA Regulations as published in GN R982 of 14 December 2014, as amended. You are reminded that the Final EIR is to be submitted within **106 days from the date of signature of this letter, i.e. by the end of business on Monday 02 March 2020.** An environmental impact assessment report must contain all information set out in Appendix 3 to these Regulations or comply with a protocol or minimum information requirements relevant to the application as identified and gazetted by the Minister in a government notice.
4. The Environmental Assessment Practitioner is required to notify and inform the applicant in writing that the activity may not commence prior to an environmental authorisation being granted by the competent authority.

ANDRIES STRUWIG
ASSISTANT DIRECTOR: EIM
CACADU REGION

DATE: 25 October 2019

Province of the
EASTERN CAPE
ECONOMIC DEVELOPMENT
ENVIRONMENTAL AFFAIRS & TOURISM

Corner Athol Fugard Terrace and Castle Hill, Central, Port Elizabeth 6001
Private Bag X5001, Greenacres, Port Elizabeth 6057 | Republic of South Africa

Tel: 041 508 5844 | **Fax:** 041 508 5865 | **E-mail:** Nicole.Gerber@dedea.gov.za | www.dedea.gov.za

Reference: EC08/C/LN2/M/42-2019
Enquiries: N. Gerber

CES - Coastal and Environmental Services (Pty) Ltd
P.O. Box 934
Grahamstown
6139
E-mail: g.shaw@cesnet.co.za

Attention: Mr Gregory Shaw

APPLICATION FOR AUTHORISATION IN TERMS OF SECTION 24 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, ACT 107 OF 1998 TO UNDERTAKE A LISTED ACTIVITY AS SCHEDULED IN THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014, AS AMENDED: PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, WITHIN THE KOUGA MUNICIPAL AREA.

1. Your email and attached letter regarding conducting the PPP process for the EIA phase of the assessment for the above application, as well as requesting confirmation of the sufficiency of the PPP process to date, dated and received on 11 November 2019 refers.
2. The Department has reviewed the contents of this letter and hereby notes the following:
    a. The proposed dates for the PPP commenting period beginning in early December 2019 and envisioned to conclude on 21 January 2020 is acceptable to the Department provided that there is definitely a 30-day period outside of the closure period dates; and
    b. The PPP process outlined in this letter and as included in the FSR, is deemed sufficient in terms of the requirements of the 2014 EIA Regulations, as amended, pertaining to the public participation process.
3. The Department requires that the Draft EIR has a cover letter which specifically indicates the PPP commenting dates, and that all registered I & AP's are made aware of these commenting dates as well.

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4. The applicant must remain cognisant that the activity may not commence prior to an environmental authorisation being granted by the competent authority.

ANDRIES STRUWIG
ASSISTANT DIRECTOR: EIM
CACADU REGION

DATE: 9 December 2019

Gregory Shaw

From:	Nicole Jane Gerber <Nicole.Gerber@dedea.gov.za>
Sent:	Monday, 09 December 2019 12:03
To:	Gregory Shaw
Cc:	Andries Struwig
Subject:	RE: St Francis
Attachments:	09-12-2019 PPP for EIR phase.pdf

Good day Mr Shaw

Please find the attached letter for your attention regarding the PPP.

Regards

Nicole Gerber

Environmental Officer: Environmental Affairs

Environmental Impact Management Unit

Cacadu Regional Office, Port Elizabeth

Sarah Baartman District

Province of the EASTERN CAPE
ECONOMIC DEVELOPMENT, ENVIRONMENTAL AFFAIRS AND TOURISM

Tel: 041 508 5844 • Fax: 041 508 5865
Cell: 073 022 9765
Fax2E-mail: 086 527 4311
Collegiate House, Cnr. of Athol Fugard Terrace and Castle Hill, Central, Port Elizabeth
P/Bag X5001, Greenacres, Port Elizabeth, South Africa, 6057
http://www.dedea.gov.za/
Nicole.Gerber@dedea.gov.za

From: Gregory Shaw <g.shaw@cesnet.co.za>
Sent: Friday, 29 November 2019 11:02
To: Andries Struwig <Andries.Struwig@dedea.gov.za>
Cc: Nicole Jane Gerber <Nicole.Gerber@dedea.gov.za>
Subject: RE: St Francis

Hi Andries

Following up on the below, would you be able to advise please?

We would like to start preparing for the PPP and having your thoughts on the PPP would be helpful – specifically whether you are happy that we run it over the December holidays and have our main meeting in December to accommodate the largest number of I&APs?

Ideally we would be seeking your opinion on the second point (i.e. the inclusivity of the PPP process to date) in my letter but that is less pressing at this stage.

Thanks and regards,

Greg

Gregory Shaw
Principal Consultant
CES - Environmental and Social Advisory Services
67 African street
Grahamstown/Makhanda | Eastern Cape | South Africa
Tel: +27 (46) 622 2364 | Cell: +27 (60) 671 5914 | Skype: shaw.gregory
g.shaw@cesnet.co.za | www.cesnet.co.za

From: Gregory Shaw
Sent: Wednesday, 20 November 2019 10:01
To: Andries Struwig <Andries.Struwig@dedea.gov.za>
Cc: Nicole Jane Gerber <Nicole.Gerber@dedea.gov.za>
Subject: RE: St Francis

Hi Andries

Have you had a chance to consider our request?

Regards,

Greg

Gregory Shaw
Principal Consultant
CES - Environmental and Social Advisory Services
67 African street
Grahamstown/Makhanda | Eastern Cape | South Africa
Tel: +27 (46) 622 2364 | Cell: +27 (60) 671 5914 | Skype: shaw.gregory
g.shaw@cesnet.co.za | www.cesnet.co.za

From: Gregory Shaw
Sent: Monday, 11 November 2019 09:18
To: Andries Struwig <Andries.Struwig@dedea.gov.za>
Cc: Nicole Jane Gerber <Nicole.Gerber@dedea.gov.za>
Subject: St Francis

Morning Mr Struwig

St Francis this time...

Please find attached for your consideration.

A request for the St Francis PPP to run through the December shutdown period and to confirm that the PPP to date has been sufficient.

Kind regards,

Greg

Gregory Shaw
Principal Consultant
CES - Environmental and Social Advisory Services
67 African street
Grahamstown/Makhanda | Eastern Cape | South Africa
Tel: +27 (46) 622 2364 | Cell: +27 (60) 671 5914 | Skype: shaw.gregory
g.shaw@cesnet.co.za | www.cesnet.co.za

ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

Reference: EC08/C/LN/M/42-2019

Mr Andries Struwig
Department of Economic Development, Environmental Affairs and Tourism
Corner Athol Fugard Terrace and Castle Hill
Central
Port Elizabeth
6001

11 November 2019

RE: ST FRANCIS DRAFT EIR PPP

Mr Struwig

CES would like confirmation, from DEDEAT, that the following approach is suitable for the St Francis Bay EIA.

Given that many of the stakeholders in St Francis Bay are holiday makers and in town over the December holidays, CES would like to ensure that the Draft EIR PPP process occurs during this period. However, we are also aware that there is a permanent community in St Francis too, which is why we are proposing to start the PPP at the beginning of December (preliminary) with the intention for it to run to approximately 21st January 2020. This would provide a 30 day period outside of the holiday period (13th December – 6th January) as well as the duration of the holiday period for the public to provide comment on the draft EIR, the sand sourcing study and any other documentation made available.

During this proposed PPP period we would likely hold 1 public meeting between 17th – 20th December to ensure the largest turnout of I&APs.

Secondly, during the Scoping Phase, comments regarding the notification of I&APs was questioned. The Final Scoping Report detailed the extent to which the I&APs were provided an opportunity, namely:

Site notices

Site notices were initially placed in two (2) locations on the 21st of December 2018: 1) At the intersection of Canal Rd and Shore Rd and 2) At the beach stairway located at the end of the Aldbara Run. Site notices were later placed at the following locations on the 9th of April 2019: 1) At the Spar located along St Francis Dr; 2) Main beach located at the end of Nevil Rd; 3) At the beach parking area located at the end of Anne Ave; 4) At

Coastal and Environmental Services (Pty) Ltd
T +27 46 622 2364 | F +27 86 410 7593
67 African Street, Grahamstown, 6139 | PO Box 934, Grahamstown, 6140
Reg no: 2012/151672/07
www.cesnet.co.za

the intersection of Canal Rd and Shore Rd; 5) At the Small Boat Harbour located along La Digue Pl; 6) The Library; 7) The St Francis Links; and 8) The Kouga Local Municipality Municipal Offices.

Written Notice
Letters of notification and Background Information Documents were sent to all registered Stakeholders and I&APs at the commencement of the Pre-Assessment PPP. Additional notices were sent to all registered I&APs informing them of the availability of the Draft Scoping Report the commencement of the mandatory formal thirty (30) day public review period, which ran from the 20th of August 2019 until the 18th of September 2019.

Advertisement
Newspaper advertisements were placed in the Herald on the 27th of March 2019, the Kouga Express on the 28th of March 2019, and the St Francis Chronicle on the 4th of April 2019, in order to notify the general public of the proposed project and the availability of the Draft Scoping Report for public review during the pre-application public participation process. During the formal public participation process on the Draft Scoping Report, advertisements were placed in the Herald on the 20th of August 2019, the Kouga Express on the 22nd of August 2019, and in the St Francis Chronicle on the 19th of August 2019.

Public meeting
A pre-application public meeting was held on the 20th of December 2018 to introduce the proposed project to the affected community. An additional public meeting was held at the St Francis Links on the 15th of April 2019 during the pre-assessment review of the Draft Scoping Report. The details of these meeting were conveyed to the public in newspaper advertisements that were placed in the Kouga Express, the St Francis Chronicle, and the Herald, notifying the availability of the DSR, as well as via email and SMS. During the formal public review period for the Draft Scoping Report, a public meeting was held at the St Francis Bowling Club Hall on the 27th of August 2019.

CES have also been informed by the Kouga Municipality that this project has and will form part of their regular ward meetings. It is our understanding that these meetings are held in all wards on a monthly basis with time allocated for discussion regarding all significant projects within the municipality's jurisdiction. It is also our understanding that the community has been informed to contact their ward councillors should they wish to learn more or provide comment.

Since access to the beach and estuary amenity will not be restricted in its entirety (i.e. free and open access to all), CES deem the current approach appropriate and sufficient.

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T +27 46 622 2364 | F +27 86 410 7593
67 African Street, Grahamstown, 6139 | PO Box 934, Grahamstown, 6140
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ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

As mentioned, CES would seek confirmation from DEDEAT that the measures taken to inform I&APs of this project and to afford them the opportunity to provide feedback is proportionate and inclusive.

Kind regards,

Shaw

Gregory Shaw
Principal Consultant

Coastal and Environmental Services (Pty) Ltd
T +27 46 622 2364 | F +27 86 410 7593
67 African Street, Grahamstown, 6139 | PO Box 934, Grahamstown, 6140
Reg no: 2012/151671/07
www.cesnet.co.za

Fri 2020/02/07 12:24

Nicole Jane Gerber <Nicole.Gerber@dedea.gov.za>

St Francis Coastal Protection Scheme (Ref. no. EC08/C/LN2/M/42-2019)

To Gregory Shaw

Cc Andries Struwig; Dhaxan Govender

You replied to this message on 2020/02/26 14:38.

Message | 07-02-2020 Comment on DBR.pdf (785 KB)

Good day Mr Shaw

Please find the attached comment letter on the DEIR for your attention. Could you kindly confirm receipt hereof?

Regards

Nicole Gerber

Environmental Officer: Environmental Affairs

Environmental Impact Management Unit

Cacadu Regional Office, Port Elizabeth

Sarah Baartman District

Province of the EASTERN CAPE ECONOMIC DEVELOPMENT ENVIRONMENTAL AFFAIRS AND TOURISM

Tel: 041 508 5844 • Fax: 041 508 5865
Cell: 073 822 9765
Fax2E-mail: 086 527 4311
Collegiate House, Cnr. of Athol Fugard Terrace and Castle Hill, Central, Port Elizabeth
P/Bag X5001, Greenacres, Port Elizabeth, South Africa, 6057
http://www.dedea.gov.za/
Nicole.Gerber@dedea.gov.za

Province of the
EASTERN CAPE
ECONOMIC DEVELOPMENT
ENVIRONMENTAL AFFAIRS & TOURISM

Corner Athol Fugard Terrace and Castle Hill, Central, Port Elizabeth 6001
Private Bag X5001, Greenacres, Port Elizabeth 6057 | Republic of South Africa

Tel: 041 508 5844 | **Fax:** 041 508 5865 | **E-mail:** Nicole.Gerber@dedea.gov.za | **www.dedea.gov.za**

Reference: EC08/C/LN2/M/42-2019
Enquiries: N. Gerber

CES - Coastal and Environmental Services (Pty) Ltd
P.O. Box 934
Grahamstown
6139
E-mail: g.shaw@cesnet.co.za

Attention: Mr Gregory Shaw

APPLICATION FOR AUTHORISATION IN TERMS OF SECTION 24 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, ACT 107 OF 1998 TO UNDERTAKE A LISTED ACTIVITY AS SCHEDULED IN THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014, AS AMENDED: PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, WITHIN THE KOUGA MUNICIPAL AREA.

1. The Draft Environmental Impact Report (DEI R), which is inclusive of the Draft Estuarine and Dune System Impact Assessment Report, as well as the Draft Beach Nourishment Source Material Study, and a separately bound Environmental Management Programme (EMPr) dated 06 January 2020 and received on 07 January 2020 for the above project refers.
2. Refer also to the acceptance of the FSR letter dated 25 October 2019.

The Department has reviewed the DEIR and hereby provides the following comments:

a. The DEIR does not contain any A3 maps or layouts. The FEIR must include all maps, layouts and diagrams included at an appropriate scale, at least in A3;
b. It is noted that the concerns raised during the PPP at Draft Scoping Phase have been addressed and these are captured in the I & AP Issues and Responses Trail. However, there is no register of I & AP's, no copies of I & AP correspondence and public meeting minutes, as well as no copies of the Department's letters in relation to the project, and particularly the letter accepting the FSR and POSEIA included in Appendix B. Such must be included in order to fulfil the requirements of the Department;
c. The EMPr is lacking in terms of operational management. The Department requires that a maintenance management plan for the required actions envisaged in the operational phase is drafted and included in the EMPr to be included in the FEIR;
d. The adverse impacts of possible acceleration of erosion, particularly regarding the northern banks of the Kromme River mouth and the northern beaches has not been satisfactorily addressed – the impact assessment, Section 7, Table 7.2 only briefly addresses this by

"Innovation for Sustainable Development"

indicating that the banks must remain intact. The method of doing so as well as mitigation measures and ongoing monitoring must be specifically addressed. The few bulleted points contained in the EMPr also do not give sufficient information besides monitoring being enacted; and

e. The Estuarine and Dune System Assessment, dated August 2019, **has not, as per the comments in the acceptance of the FSR dated 25 October 2019**, addressed possible impacts of the proposed coastal protection scheme on areas northwards of the area proposed for the groynes, specifically addressing any potential accretion/erosion of the northern beaches/coastline.

It is trusted that the above will be addressed in the FEIR.

The EAP is to remind the applicant in writing that the activity may not commence prior to an environmental authorisation being granted by the competent authority.

ANDRIES STRUWIG
ASSISTANT DIRECTOR: EIM
CACADU REGION

DATE: 7 February 2020

I&APs

Reply Reply All Forward

Wed 2020/02/05 17:04

Gregory Shaw

RE: St Francis Bay - Draft EIR

To Rod Suter

Hi Rod

Thanks for your comments.

These will be captured in the IRT together with CES' responses and included in the submission to DEDEAT.

Regards,

Greg

Gregory Shaw
Principal Consultant
CES - Environmental and Social Advisory Services
67 African street
Grahamstown/Makhanda| Eastern Cape | South Africa
Tel: +27 (46) 622 2364 | Cell: +27 (60) 671 5914 | Skype: shaw.gregory
g.shaw@cesnet.co.za | www.cesnet.co.za

From: Rod Suter [mailto:rod.suter@gmail.com]
Sent: Wednesday, 05 February 2020 16:13
To: Gregory Shaw <g.shaw@cesnet.co.za>
Subject: St Francis Bay - Draft EIR

Hi Greg

Attached comment for your attention.

Regards, Rod

R C SUTER
e-mail : rod.suter@gmail.com
mobile :
+27 82 880 7344

PROPOSED COASTAL PROTECTION SCHEME
ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE
DEDEAT REFERENCE NUMBER: EC08/C/LN2/M/42-2019

Comments by R C Suter : IAP : 5 Jan 2020

My earlier Comments in the EIA Process, as recorded in the IRT, are referenced.

I submit that the Mandatory Public Review process for the Draft EIR and Environmental Management Programme is flawed and has not been performed as required in terms of the relevant norms, legislation and regulations.

The motivation for this opinion is:

1. Notification was issued of the Mandatory Public Review process on 18 December 2019, principally by e-mail. This notification advised that (1) the PPP period for comments and inputs would close on 5 Feb 2020, and (2) that there would be one public meeting held on 19 Dec 2019 – i.e. giving 1 days' notice.

   This PPP period covered the annual year-end holiday period in South Africa; this is the time of the year when many St Francis Bay residents are away from home and thus unable to attend the meeting – the reasoning behind this timing has not been forthcoming.

   After objections and interactions between interested parties and the EAP, a further meeting was grudgingly arranged by CES on 29 Jan 2020 (i.e. well after the end of the holiday period). The fact that the first meeting was attended by some 20 people, and the second meeting by more than 80 people, indicates the level of interest from the local community.

2. At the meeting on 29 Jan 2020, there were many questions from the floor concerning the fundamental concepts and details of the Engineering Design Report – authored by Advisian. Mr G Shaw from the EAP, CES, stated he was not an engineer, and was thus unable to respond to these questions. He undertook to forward them to Advisian, but how the responses were to be circulated was unclear.

   As the Advisian engineering concepts and designs are key to the definition, execution and success of the proposed scheme, this serious deficiency in the PPP process is unacceptable and could lead to delays and appeals at later stages in the EIA.

   The EAP was approached with the suggestion to extend the closing date of the Mandatory Public Review process, and to then arrange a further public meeting on the engineering aspects of the scheme with Advisian in attendance. These approaches were rejected by the EAP.

Accordingly, the Competent Authority (DEDEAT) is requested to intervene and instruct that the proposed public meeting with Advisian is put in hand by the EAP and included in the PPP prior to DEDEAT undertaking their review of the EIR for this scheme.

R C SUTER
PrEng, MSAICE, BScEng

Gregory Shaw

From:	Rod Suter <rod.suter@gmail.com>
Sent:	Thursday, 30 January 2020 09:58
To:	Gregory Shaw
Subject:	Re: St Francis Bay - Draft EIR - Additional Public Meeting

Hi Greg

Thanks for the additional meeting last night - I think the number of attendees shows it was necessary, and some the inputs from the floor were of value. Unfortunately it was apparent that a large number of the attendees had not bothered to properly read and understand the report - and in spite of the total number number of pages, the core info is probably no more than 100 pages at most.

A suggestion in light of the discussions - it would seem to be invaluable from an information dissemination and public support perspective to set up (very soon) a PPP-type public meeting with the Advisian Engineering report as the topic, obviously with Advisian attending to explain/defend their engineering report and design. I don't know how this would fit into the formal EIA framework, if at all, but I think it is very necessary; and I believe SFPO would probably support this suggestion as well.

I would also again support Ryan's proposal that the PPP period is extended beyond 5 Feb.

Regards, Rod

R C SUTER
e-mail : rod.suter@gmail.com
mobile :
+27 82 880 7344

On Wed, Jan 22, 2020 at 7:21 PM Gregory Shaw <g.shaw@cesnet.co.za> wrote:

> Hi Rod
>
> Thanks for your time last week it was good to get a bit more context behind your original comments and your current concerns.
>
> CES are confident that, with two meetings for the Draft EIR and the fact that we have significantly extended the mandatory PPP period, Interested and Affected Parties have all had sufficient time to review the documentation and to provide comment.

1

I will record your comment below in the Issues and Response Trail which will form part of the Final EIR so that the Department are aware of your request.

Let me know if you have any additional comments.

Regards,

Greg

Gregory Shaw
Principal Consultant
CES - Environmental and Social Advisory Services
67 African street
Grahamstown/Makhanda | Eastern Cape | South Africa
Tel: +27 (46) 622 2364 | Cell: +27 (60) 671 5914 | Skype: shaw.gregory
g.shaw@cesnet.co.za | www.cesnet.co.za

From: Rod Suter [mailto:rod.suter@gmail.com]
Sent: Sunday, 19 January 2020 13:24
To: Gregory Shaw <g.shaw@cesnet.co.za>
Subject: Re: St Francis Bay - Draft EIR - Additional Public Meeting

Hi Greg

Thank you, noted that we now have a second PPP meeting, with slightly more notice.

However, the period of 1 week after the meeting until the closing of the Comment period seems insufficient.

I suggest it should be extended to at least 3-4 weeks - seeing that this post-meeting period was planned to be about 7 weeks after the first PPP meeting on 19 Dec.

Look forward to your response.

2

Regards, Rod

R C SUTER

e-mail : rod.suter@gmail.com

mobile :

+27 82 880 7344

On Thu, Jan 16, 2020 at 3:02 PM Gregory Shaw <g.shaw@cesnet.co.za> wrote:

Dear Interested and Affected Parties

Notice is hereby given in terms of regulation 41(2), as published in the 2014 Environmental Impact Assessment (EIA) regulations (as amended in 2017) of the National Environmental Management Act (NEMA) (Act No. 107 of 1998, as amended), of the submission of an application and associated reports to the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT) for Environmental Authorisation (EA). DEDEAT approved the Final Scoping Report on the 25th October 2019. CES has been appointed by the St Francis Property Owners Non-Profit Company (SFPO NPC) on behalf of the Kouga Local Municipality, to apply for EA for the following overarching Listed Activities as described in GN R 384 (as amended by GN R 325): **Listing Notice 2: Activity 14, 23 and 26.**

The Draft EIR was made available for public review from the **19th of December 2019 and is available until the 5th of February 2020**. Copies of the Draft EIR are available on request from CES (including download from http://www.cesnet.co.za/st-francis-bay-coastal-protection-scheme-eia) as well as at the SFPO Office (115 St Francis Drive, St Francis Bay) and the Kouga Municipal Offices (1 Assisi Drive, St Francis Bay).

An additional public meeting will be held at the St Francis Links Golf Course (1 Jack Nicklaus Dr, St Francis Bay) on the 29th January 2020 between 17:00 (5pm) and 19:00 (7pm).

CES encourage all Interested and Affected Parties (I&AP) to review the documentation prior to the meeting and to provide comments and feedback during the meeting. Registration as an I&AP and/or submission of comments can also be done in writing by post or email to CES: 67 African Street, Grahamstown, 6139 | Tel: 046 622 2364 | Email: g.shaw@cesnet.co.za.

3

Gregory Shaw

From: Gregory Shaw
Sent: Wednesday, 05 February 2020 09:42
To: Ryan Donnelly
Subject: RE: Submission for the st francis beach groyne public EIA process

Hi Ryan

Comments received – thank you.

Your comments will be recorded and responded to as part of the Issues and Response Trail in the subsequent round of documentation.

That documentation will be made available in due course with notifications sent out.

Kind regards,

Greg

Gregory Shaw
Principal Consultant
CES - Environmental and Social Advisory Services
67 African street
Grahamstown/Makhanda | Eastern Cape | South Africa
Tel: +27 (46) 622 2364 | Cell: +27 (60) 671 5914 | Skype: shaw.gregory
g.shaw@cesnet.co.za | www.cesnet.co.za

From: Ryan Donnelly [mailto:ryazion@gmail.com]
Sent: Monday, 03 February 2020 16:15
To: Gregory Shaw <g.shaw@cesnet.co.za>
Subject: Submission for the st francis beach groyne public EIA process

Hi Gregory Shaw

Here with is my comment for the st francis beach EIA process.

1. With regard to the feasible Alternatives, Gregory Shaw said that enhancing existing offshore reefs has not been considered or investigated.

2. The draft makes mention that the surfers input has been sent to AVISAN for the next design phase. I am a local surfer of 27 years and was involved in the Save the Beach committee. I researched and presented the ASR technology to the Save the Beach committee, attended the meetings and lived with the ASR costal engineers during their visit. My input comes with a meaningful and educated background in the save st francis beach project and it has not been considered, captured or sent to AVISAN.
Dion of SFPO said to me that the surfers input is invited AFTER DEDEAT approval of the project.

3. Roberto a CESNET EIA consultant said to me over the phone that the project is not ready for the public EIA process and that the draft wording allows for far too much leeway for change after DEDEAT approval.

1

4. ASR costal engineers reminded me that the groyne structures will not work in st francis bay. Dion of SFPO said that he thinks the groyne's will work. With the permanent financial consequences to our small village involving an independent costal engineer is likely a responsible thing to do.

5. There was mention by Wayne Furphy of the SFPO about above groyne developments at the second last public meeting and that they are looking for investors for this. Information in the draft about the intended above groyne developments is non existent.

6. Where are the minutes of the last two meetings?

7.The drafts predicted beach profile is NOT consistent with a groyne structure. This is misleading to the public. The predicted beach profiles in the draft are consistent with submerged groyne's, permeable groyne's and offshore reefs.

8. With regard to beach nourishment. Where in the Draft can we find plans of the pump stations their positions and outlets? How have the impacts on the roads been looked at for sand nourishment and project build?

9. Gregg Shaw said at the last meeting that there has been no study or survey to establish where the bedrock is in the bay. This survey has the potential to change the design, cost and location of the groyne structures in a significant way. This survey should be done before close of public participation.

10. In light of there currently being only 2 days left of public participation for this IEA, with so many grey areas, un answered questions, with many SFPO mentioned updates and changes to the draft still in store, the recent new above groyne development information pertaining to this project and a lack of crucial information. I herby formally request an extension to the public EIA process. That there be key stakeholder focus group meetings with all relevant persons including the engineers, all with the agenda to look at the grey areas, deficiencies in information, to help avoid oversights, improve the integrity of the project and work together toward solutions where needed. To update the draft so the public can be in a position to make an informed comment for this EIA process.

Regards
Ryan

Gregory Shaw

From:	Les & Dawn <LFN1@vodamail.co.za>
Sent:	Wednesday, 05 February 2020 14:35
To:	Gregory Shaw
Subject:	RE: REQUEST FOR AN EXTENSION OF THE DEADLINE OF THE EIA FOR ST FRANCIS BAY BEACH GROYNES
Importance:	High

Hello Greg,

Thank you for your prompt response.

Kind regards,

Les

From: Gregory Shaw [mailto:g.shaw@cesnet.co.za]
Sent: Wednesday, February 5, 2020 9:42 AM
To: Les & Dawn
Subject: RE: REQUEST FOR AN EXTENSION OF THE DEADLINE OF THE EIA FOR ST FRANCIS BAY BEACH GROYNES

Morning Les

Comments received – thank you.

More information on our previous work can be found on our website http://www.cesnet.co.za/company-profile

Please note that your comments will be recorded and responded to as part of the Issues and Response Trail in the subsequent round of documentation.

That documentation (which will include meeting minutes, presentation, etc.) will be made available in due course with notifications sent out.

Kind regards,

Greg

Gregory Shaw
Principal Consultant
CES - Environmental and Social Advisory Services
67 African street
Grahamstown/Makhanda | Eastern Cape | South Africa
Tel: +27 (46) 622 2364 | Cell: +27 (60) 671 5914 | Skype: shaw.gregory
g.shaw@cesnet.co.za | www.cesnet.co.za

From: Les & Dawn [mailto:LFN1@vodamail.co.za]
Sent: Monday, 03 February 2020 14:47

To: Gregory Shaw <g.shaw@cesnet.co.za>; LFN1@vodamail.co.za
Subject: REQUEST FOR AN EXTENSION OF THE DEADLINE OF THE EIA FOR ST FRANCIS BAY BEACH GROYNES
Importance: High

g.shaw@cesnet.co.za

PROJECT MANAGER / REPORT REVIEW

GREG SHAW

03 February, 2020.

Dear Sir,

We attended the meeting for the EIA for the proposed construction of the groynes to the Saint Francis Bay beaches, on 29 January 2020.

There were some points and questions which were put to you, and you were unable to answer at the meeting, as you stated each time "I am not an engineer". These questions are important questions, and remain unanswered.

We need a further meeting, and we request that an engineer be present, who can answer the questions and the concerns put forward by the public participants, and give us the answers, and be able to explain it to us, as we too are not engineers.

Please can you also furnish us with any other EIA on groynes that your company has been involved with along our coastline.

As a result of this last EIA meeting, it has brought up more questions than answers. We need a fully comprehensive understanding of the proposal before any informed decisions can be made.

For this reason, we request an extension of the deadline for the EIA, for a further 60 days, for us to do more research, and to understand that the EIA covers all the questions that are extremely important before submission to the next relevant authorities.

A further request is that the minutes of the previous two meetings be available.

Many thanks and kind regards

Les Noah.

2

Thu 2020/01/30 08:43

helene loon <helene_loon@yahoo.com>

Comments on the St Francis Bay Coastal Protection Scheme Draft EIR

To Gregory Shaw

You replied to this message on 2020/02/05 09:34.

Message | St Francis Coastal Protection scheme EIR.docx (19 KB)

Dear Greg

Attached please find a few comments on the St Francis Bay coastal protection scheme EIR.
I learnt an enormous amount through reading the very thorough and informative document - thank you !

All the best
Helene Loon

To whom it my concern

Comments on the St Francis Bay Coastal Protection Scheme Draft EIR

I would like to submit comments on the Draft EIA document as an I&AP who has grown up close to the Kromme River estuary, and witnessed how the ecological and physical nature of this fragile river system has been altered significantly in the past few decades, as a direct result of human interference. These impacts include the construction of two dams in the catchment area, a canal system significantly impacting the functioning of the sensitive river mouth, a bridge crossing the river and effecting sand movements, to coastal housing developments covering once mobile dunes that used to be an integral part of the natural sand movements replenishing the St Francis Bay beach. I am writing as someone who would prefer not to see even further degradation to a system already on the edge.

The Kromme River estuary is regarded as one of the most important estuarine systems in South Africa. The Draft EIA document covers in detail the incredibly valuable ecological role that the salt marshes, reed beds, as well as the intertidal sand and mudflats play as integral components of the estuarine environment. It recognises the vital role that estuaries play as nurseries and feeding grounds for numerous fish species, and that a wide diversity of invertebrates species inhabit the estuarine substrate. Local bird species as well as numerous Palearctic migrants rely on the rich pickings on the mudflats and sandbanks.

The document also realistically acknowledges that even with mitigation processes in place, it is just not possible to carry out the proposed coastal protection scheme without some loss or damage to the integrity of the estuarine system during the dredging process, and gives a detailed and thorough analysis of the potential impacts to the system – both negative and positive. While it is very reassuring to know that the EIA document reflects a comprehensive understanding of the potential impacts at stake, there are a few questions that I would like to put forward for clarification.

It was encouraging to read that should the development proceed, a regular monitoring programme would be put in place to track the ecological well-being of the ecosystem over time, as well as the fact that regular beach profiles would be taken at St Francis beach and in the river, that sediment discharge quantities and changes to hydrodynamics would be monitored - and that this would be done pre-dredging, during dredging and post dredging.

Based on this, my questions would be :

1) Is there sufficient ecological baseline data from which to measure subsequent changes and compare results over time?

For example, in the EIR it states that 'There is a significant lack of recent literature concerning the ichthyofaunal composition of the Kromme Estuary'. This leads me to question whether enough research has been done on fish recruitment in the estuary prior to dredging, to know whether the impacts of dredging are affecting the nursery areas used by young fish, and to gauge their survival rates? And do we know enough about seasonal variations in fish numbers? How will we know whether suspended sediment from dredging is smothering macrobenthic communities and negatively affecting their biology, eg the filter feeders? And how will disruption to the estuarine substrate and sandbanks effect creatures such as bloodworms, pencil bait, sandprawns and numerous other crustaceans ? How will the change in hydrodynamics effect the system as a whole? One can speculate based on knowledge of the ecosystem, but is it enough to justify the risk involved? Severe negative impacts on even one species could have repercussions for so many others.

2) Most importantly, if significantly negative impacts to the environment ARE detected during the ongoing monitoring process in either the beach or estuarine environments - despite the numerous mitigation measure put in place – will the beach nourishment activities of the St Francis Bay coastal protection scheme be halted, and who would be in a position to make this vital decision ? I would like to be assured that measures are FIRMLY in place to stop further developments should the coastal environment be significantly compromised, before irreplaceable loss of sensitive habitats and biodiversity takes place. I feel that this is urgent given that the operation phase of the development is predicted to continue into perpetuity.

3) Would experts be able to advise on what time-span is needed before such a cut-off decision is put in place? I feel that it is vital to be able to recognise the point at which further degradation would be irreversible, and halt activities in order to prevent long-term damage.

While I really do respect the economic importance of promoting and sustaining tourism in the area, I am just so aware that dredging activities and the artificial manipulation of estuarine mouths are known to have potentially disastrous impacts on estuaries. It would be wonderful to be able to avoid further impacts on this valuable and beautiful area.

Thank you very much for the efforts that you are putting into this important consultation process.

With best regards

Helene Loon

Gregory Shaw

From:	Gregory Shaw
Sent:	Wednesday, 05 February 2020 09:42
To:	'David Comyn'
Subject:	RE: Beach

Morning Dr Comyn

Comments received – thank you.

Your comments will be recorded and responded to as part of the Issues and Response Trail in the subsequent round of documentation.

That documentation (which will include meeting minutes, presentation, etc.) will be made available in due course with notifications sent out.

Kind regards,

Greg

Gregory Shaw
Principal Consultant
CES - Environmental and Social Advisory Services
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Tel: +27 (46) 622 2364 | Cell: +27 (60) 671 5914 | Skype: shaw.gregory
g.shaw@cesnet.co.za | www.cesnet.co.za

From: David Comyn [mailto:djcomyn@gmail.com]
Sent: Tuesday, 04 February 2020 21:54
To: Gregory Shaw <g.shaw@cesnet.co.za>
Subject: Beach

Dear Mr Shaw,
Please acknowledge receipt of my letter of opposition to the proposed SFB beach plan.
Dr David Comyn
0832618037

Dr David Comyn
djcomyn@gmail.com
0832618037

IN OPPOSITION TO THE PROPOSED PLAN TO REPLENISH THE BEACH AT ST FRANCIS BAY

Whereas replenishment and nourishment of the beach is the priority, the current proposed plan is impractical and unacceptable for the following reasons. This paper follows two meetings to discuss its environmental impact on the Kromme River and the beach.

1. The entire project was conceived by a narrow group whose stated purpose is to "preserve the value of their properties", not the greater good of the community. This is evidenced by the plan to make the "spit" the first priority in preference to the main beach. The reasons given for this environmental priority were poor and evasive. By far the greater good to the community would be to rectify the beach. Indeed the environmental plan acknowledges that the northward continental sand drift will favourably impact on the "spit" in time anyway. There is a widely held view that as soon as the "spit" is protected at the completion of phase one, the driving force behind this project will dissipate. If the "spit is breached the canal entrances can be protected by maintenance dredging as happens right now, at a fraction of the cost. Thousands of visitors have voiced their disappointment at the condition of the beach and this poses the real danger to the town as a popular resort.
2. The plan is flawed.
   A. It is incomplete. At both the recent meetings the main gist of many of the questions, which reflect the uncertainty of the community, concerned the engineering plan. It has not been fully explained. To answer "I am not an engineer" is just not good enough. Understanding the engineering plan is key to understanding the environmental impact. The rate and levy paying residents deserve more detail. To impose a regulatory time frame for evaluating an incomplete plan is not the best way to encourage the wider community to accept it.
   B. It has not been fully costed and there is no definite plan as to where the money will be sourced. This is pertinent to permanent residents who will bear the burden for many years.
   C. As a member of the community with property between the bridge and the Sand River delta I view the current dredging plan to be flawed from both an environmental and loss of amenity perspective. The environmental plan is confusing because sections of this area are variably described as sensitive and non sensitive at the same time. To accept the environmental plan I need to understand this. The proposed dredging of the north bank to create a new channel will seriously impact on the salt marsh as boat wake action will erode the bank. This is an important habitat for Kromme River estuarine flora and fauna. The greatest damage to this area was done when the Sand River disgorged thousands of cubes of sand into the river. Old photographs will show that the original channel hugged the south bank. The most favorable sand removal by dredging or road will be to re-establish the original river course. Geophysical examination will confirm the river course. The river frontage of these properties is a playground for young children and adults alike. Long standing sporting traditions will be impacted. The biggest value of dredging will be to open the original channel by making it wider and deeper thereby making it safer and easier to navigate.

Conclusion.

I propose the least damage for the most good, environmentally, financially and in the interests of the wider community (visitors and permanent residents) will be to concentrate all available energy and finances to restore the beach by fully planning and costing revetment protection and sand replenishment and nourishment. I also propose a rethink of the dredging plan immediately below the bridge.

Dr D J Comyn.


Frank Silberbauer Environmental Consultant


Kromme Properties - Appointment of Frank Silberbauer

Issues and Responses Trail (IRT)

APPENDIX C – THE SCOPING AND EIA PROCESS

According to Appendix 2, Section 2 (1), of the 2014 EIA Regulations (as amended), a "*scoping report must contain the information that is necessary for a proper understanding of the process, informing all preferred alternatives, including location alternatives, the scope of the assessment, and the consultation process to be undertaken through the environmental impact assessment process, and must include—*

(g) a full description of the process followed to reach the proposed preferred activity, site and location of the development footprint within the site, including—

(ii) details of the public participation process undertaken in terms of regulation 41

(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;

In terms of the South African Environmental Legislative Framework, this project will be subject to the Environmental Authorisation process, which came into effect on 4 December 2014 and was subsequently amended on 7 April 2017. This process has been implemented by South African National Government to streamline the environmental process due to the number of authorisations required for these types of projects. It is intended to save time, rationalise the management of the number of competent authorities and prevent delays due to the lack of resources and time for the review process. Based on the scope of work, this project requires an Environmental Authorisation (EA) in terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998, as amended) and the 2014 EIA Regulations (as amended). The process triggered is a Scoping and Environmental Impact Assessment report (S&EIR). All the phases including the Environmental Management Programme report (EMPr) must be prepared in terms of the NEMA and GN R. 982, (as amended by GN R. 326) and the associated activities listed under GN R. 983, GN R. 984 and GN R. 985 (as amended by GN R 327, GN R 325, and GN R 324 respectively).

The S&EIR must ensure that all parties involved are aware that the assessment is not solely focused on the biophysical environment, but is inclusive of social and economic considerations. CES's approach to the S&EIR process is to adopt a holistic and integrated view of the environment, with equal emphasis on the ecological and social components. Based on previous experience, incorporating both aspects at an early stage leads to a more comprehensive end product. In order to produce comprehensive and complete documents, the S&EIR must not only identify and evaluate the significance of environmental impacts, but also suggest ways to mitigate any negative impacts and optimise positive impacts.

Scoping and EIR Process

The process to be followed is dictated by the 2014 EIA Regulations (as amended) for projects requiring an S&EIR (Figure C1). The S&EIR process is initiated through a pre-assessment Public Participation Process (PPP). The pre-assessment process is not a mandatory requirement in terms of the 2014 EIA Regulations (as amended) but is a beneficial option for the client and EAP in order to identify key stakeholders and Interested and Affected Parties (I&APs), as well as to identify any fatal flaws, at the onset of a project.

This phase is followed by the Scoping Phase (inclusive of a notice of intent to the authorities, landowners and other I&APs and Stakeholders). During the Scoping Phase, the Terms of Reference (ToR) for the full EIA is formulated, and requirements from the authorities clarified. The Scoping process serves to bring stakeholders on board by means of consultation with relevant government departments, allowing for the identification of potential issues and concerns.

After completion of the Scoping Phase, detailed specialist studies will be undertaken in order to address issues identified during the Scoping Phase. Specialists are expected not only to provide baseline information in their particular field of expertise for the study area, but also to take this study further and identify which project activities will result in significant impacts. Specialists are also expected to suggest ways in which these negative impacts could be mitigated, to reduce their severity.

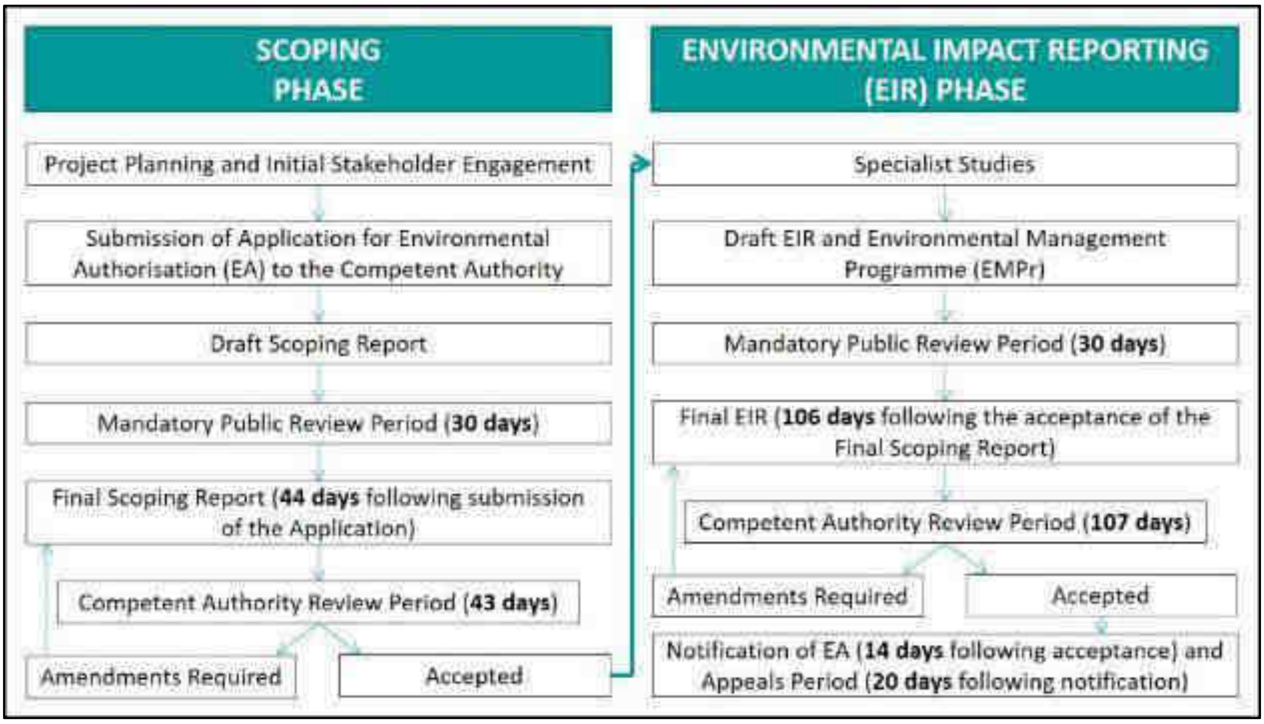

Figure C1: Scoping and Environmental Impact Assessment Process.

All draft reports are submitted for public review, which is a mandatory period of 30 calendar days, during which time CES present the key findings to all I&APs at the provincial and local levels. All comments made by I&APs are captured in an Issues and Response Trail (IRT) and, in this report, responses to all issues and concerns raised during the public review period are provided.

All recommendations cited in the EIA report must be detailed in an Environmental Management Programme report (EMPr), which defines the actions to be implemented. The EMPr is recognised as a very important tool for the sound environmental management of projects.

Scoping Phase

The Scoping Phase is outlined in GN R. 982 (as amended by GN R. 326) 2014 EIA Regulations (as amended) under Part 3, Regulation 21, as well as in Appendix 2. The process consists of a desktop review, site visit, public participation, submission of the NEMA Application Form and the Scoping Report (draft and final versions).

Desktop Review

All aspects of the proposed project are first analysed using a high-level desktop study which looks at the basic description of the project and what the initial environmental and social concerns may be. This includes background information for the project area as well as the proposed activity, details of the activity applied for according to the 2014 EIA Regulations (as amended) (the listed activities) and the type of assessment which will be required. The desktop review involves the interpretation of maps covering the proposed project area, as well as available reports and planning instruments in order to familiarise the project team with the area and the various physical and biological properties of the area. The desktop review also identifies if the project requires any additional licences in terms of water use, waste, air quality, land use or any other environmental requirements.

Site Visit
CES consultants made an initial visit to the proposed project site on the 16th of December 2018 in order to assess the site and initiate the Scoping Phase. Baseline social and ecological data was collected at a screening level.

Public Participation
Interested and Affected Parties (I&APs) play an important role in the S&EIR process, as many of their concerns and issues can be included in the project proposal, to ensure a project which is as environmentally and socially acceptable as possible. The general public, key stakeholders, landowners, adjacent landowners and government authorities at National, Provincial and Local level, will be notified of the proposed project. The means by which I&APs were notified are described in full in Appendix B.

Submission of Application Form
An application for Environmental Authorisation (EA) will be submitted to the Competent Authority (CA), the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT), as per the requirements of Regulation 16 of the 2014 EIA Regulations (as amended in 2017). The applicant, the Frances Baard District Municipality, is a municipal entity and therefore the prescribed application fee (effective as of 1 April 2014) will not be applicable.

Draft Scoping Report
The information gathered through the initial PPP phase, as well as the information from the site visit and from the client with regard to the design of the project was integrated into the Draft Scoping Report. The Draft Scoping Report will be made available to the public for a period of 30 calendar days for comment, during which time a public meeting was held. Registered I&APs will be informed of the release of the Draft Scoping Report by email. The release of the report will also be advertised in one provincial and/or one local newspaper. Hard copies of the report will made available in publicly accessible places such as a local public library, and will also be available on request from the EAP.

Final Scoping Report
Any comments, issues and concerns raised by I&APs and the authorities during the review period of the Scoping Phase are included in the Final Scoping Report in the form of an Issues and Response Trail (IRT). The Final Scoping Report will be submitted to DEDEAT, who will decide whether the main phase of the EIA can be initiated. DEDEAT will also approve, with or without amendments, the Terms of Reference (ToR) for the proposed specialist studies, and the Plan of Study for the EIA phase of the assessment, which is presented in Chapter 7 of this report. The Final Scoping Report must be submitted to DEDEAT within 44 days of receipt of the application by the competent authority.

According to the 2014 EIA Regulations (as amended in 2017), Regulation 22, DEDEAT must accept or reject the Final Scoping Report within 43 days of receipt of the report.

Specialist Study Phase

The objectives of the specialist assessments are as follows (full terms of references for each of the above mentioned assessment are available in Chapter 7, Section 7.2):

- Assist in defining possible constraints associated with the proposed project;
- Determine the potential indirect, direct and cumulative environmental risks/impacts to receptors associated with the proposed project;
- Advise on mitigation measures for identified significant risks/impacts and measures to enhance positive opportunities of the project; and
- Guide the project layout.

Environmental Impact Assessment Phase

The EIA Phase is outlined in GN R. 982 (as amended by GN R. 326), 2014 EIA Regulations (as amended) under Part 3, Regulation 23, as well as Appendix 3. This task involves the integrated writing of the Environmental Impact Assessment report (EIR). Specialist input to the proposed project will be undertaken during preparation of the Draft EIR. The report will consist of an introductory section, followed by a detailed project description, sections in which the results of all specialist reports are summarised, and an environmental impact section, where impacts are assessed and rated according to a predefined rating scale. Measures to mitigate negative impacts as proposed by the various specialists will also be included.

Draft Environmental Impact Assessment Report

The primary objective is to prepare a report that is scientifically credible but also understandable, with enough detail to deal with all the issues but not too much detail to confuse I&APs. The EIR will include a detailed Environmental Management Programme report (EMPr), which will be submitted as a separate report, for the proposed project. The EMPr will contain suggested measures to manage and mitigate impacts identified during the EIA Process, for both the construction and operational phase of the project. These measures will be informed by the findings of the EIR, and particularly by the specialist assessments undertaken as part of this process.

Environmental Management Programme

The measures presented in the EMPr will be aimed at enhancing the potential benefits and minimizing the potential negative impacts of the project. The EMPr will specify responsibilities for the implementation and monitoring of the project as well as the periodicity of the audits to be carried out. The Draft EIR and EMPr will be made available to the authorities and the public for a period of thirty (30) calendar days (mandatory). The availability of the Draft EIR and EMPr to the public will be advertised in one provincial and/or one local newspaper. A hard copy of the report will be made available as done in the Scoping Phase.

Final Environmental Impact Assessment Report

A further public meeting (as required) will be held during the public review period, to inform stakeholders and I&APs of the detailed findings of the EIA Phase, and to enable them to raise any issues or concerns. When the Draft EIR and EMPr have been updated to reflect public comments the deliverables from the entire EIA Process, the Final EIR will be prepared. This will include the additional comments, issues and concerns raised by I&APs and the authorities, provided in an updated Issues and Response Trail (IRT). The Final EIR, Final Specialist Report Volume and Final EMPr will then be submitted to DEDEAT for decision making. The Final EIR must be submitted to DEDEAT within 106 days of acceptance of the Scoping Report by the competent authority.

According to the 2014 EIA Regulations (as amended) Regulation 24, DEDEAT must, within 107 days of receipt of the Final EIR and EMPr, either grant or refuse the application by means of a positive or negative Environmental Authorisation (EA).

Environmental Authorisation Phase

Should the EA be granted, it usually carries Conditions of Approval. The project proponent is legally obliged to adhere to all conditions stipulated therein. In accordance with GN R. 982, as amended by GN R. 326, a copy of the EA must be sent to all registered I&APs within fourteen (14) days of the date of issuing the authorisation. The public can then appeal the decision, should they wish to do so. A notice of intent to appeal must be submitted to the relevant competent authority within twenty (20) days upon notice of a decision on the application.

APPENDIX D – ASSESSMENT METHODOLOGY

A. Introduction

The CES rating scale has been updated to meet the requirements outlined in Appendix 2 of the EIA Regulations (2014, as amended). This methodology takes into consideration the following criteria, and includes the new criteria for assessing post mitigation significance, by incorporating the principles of reversibility and irreplaceability:

1. Nature of impact
2. Type of impact
3. Duration (previously called temporal scale by CES)
4. Extent (previously called the spatial scale by CES)
5. Probability (previously called likelihood by CES)
6. Severity or benefits

The overall significance rating for the impact is then obtained from the above six criteria.
It is recommended that we use the terminology aligned to SA regulations i.e. Duration; Extent and Probability (as opposed to temporal scale, spatial scale and likelihood).
If required or deemed necessary, you can also define the Degree of confidence or certainty that you attach to your rating.

B. Explanation of the six impact rating criteria

Criterion 1: Nature
Negative or positive impact on the environment.

Criterion 2: Type
Direct, indirect and/or cumulative effect of impact on the environment.

Criteria 3, 4, 5 & 6: Temporal, Spatial, Likelihood and Severity Scales
These four factors need to be considered when assessing the significance of impacts, namely:

- Relationship of the impact to temporal scales - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
- Relationship of the impact to spatial scales - the spatial scale defines the physical extent of the impact.
- The likelihood of the impact occurring - the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts could occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance. In this case likelihood equates to some extent with risk. If the impact is definite, then there is a high risk that it will occur. However, likelihood and risk are not to be confused, and for certain impacts (e.g. risk of a vehicle accident) a risk assessment will be required (see Section 4).
- The severity of the impact - the severity/beneficial scale is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party. The severity of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it, and how effective the mitigation might be. The word 'mitigation' means not just 'compensation', but includes concepts of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.

Table 1 below provides definitions for Criteria 3,4 & 5, and Table 3.2 for Criterion 6.

Table 1: Temporal, Spatial, Likelihood Scales defined.

Duration (Temporal Scale)		*Score*
Short term	*Less than 5 years*	*1*
Medium term	*Between 5-20 years*	*2*
Long term	*Between 20 and 40 years (a generation) and from a human perspective also permanent*	*3*
Permanent	*Over 40 years and resulting in a permanent and lasting change that will always be there*	*4*
Extent (Spatial Scale)		
Localised	*At localised scale and a few hectares in extent*	*1*
Study Area	*The proposed site and its immediate environs*	*2*
Regional	*District and Provincial level*	*3*
National	*Country*	*3*
International	*Internationally*	*4*
Probability (Likelihood)		
Unlikely	*The likelihood of these impacts occurring is slight*	*1*
May Occur	*The likelihood of these impacts occurring is possible*	*2*
Probable	*The likelihood of these impacts occurring is probable*	*3*
Definite	*The likelihood is that this impact will definitely occur*	*4*

Table 2: Impact Severity explained

Impact Severity (The severity of negative impacts, or how beneficial positive impacts would be on a particular affected system or affected party)		*Score*
Very severe	Very beneficial	4
An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.	
Severe	Beneficial	3
Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.	A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.	
Moderately severe	Moderately beneficial	2
Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated. For example constructing the sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.	
Slight	Slightly beneficial	1
Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.	
No effect	Don't know/Can't know	

Impact Severity *(The severity of negative impacts, or how beneficial positive impacts would be on a particular affected system or affected party)*		*Score*
The system(s) or party(ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.	

** In certain cases it may not be possible to determine the severity of an impact thus it may be determined: Don't know/Can't know*

C. Applying the criteria to determine environmental significance BEFORE MITIGATION

The scores for the three criteria in Table 3.1 are added to obtain a composite score. They must then be considered against the severity rating to determine the overall significance of an activity. This is because the severity of the impact is far more important than the other three criteria. The overall significance is then obtained by reading off the matrix presented in Table 3.3. The overall significance is either negative or positive (Criterion 1) and direct, indirect or cumulative (Criterion 2).

Table 3: Matrix used to determine the overall significance of the impact based on the likelihood and effect of the impact

SEVERITY		COMPOSITE DURATION, EXTENT & PROBABILITY SCORE									
		3	4	5	6	7	8	9	10	11	12
	Slight	3	4	5	6	7	8	9	10	11	12
	Mod severe	3	4	5	6	7	8	9	10	11	12
	Severe	3	4	5	6	7	8	9	10	11	12
	Very severe	3	4	5	6	7	8	9	10	11	12

The **environmental significance** scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of especially a social nature need to reflect the values of the affected society.

It is clear that an impact that has a *slight severity* could be of MODERATE significance because it is permanent (4), has a regional affect (3) and is definite. This elevates it from a LOW to a MODERATE rating. Conversely, a *moderately severe* impact could be rated as LOW since it is short term (1), localised (1) and only probable (3). An impact rated as *severe* could be of VERY HIGH significance because it is permanent (4), of national importance (3) and is definite (4). For example, the impact on a frog species of conservation concern (SCC) might only be rated as *severe* as a result of the project actions, but because the loss is permanent and of national importance (it's a SCC) and is definite, we rate the significance as VERY HIGH and not HIGH. If the impact was long term and not permanent then it would be rated as HIGH.

The Significance Rating Scale is defined in Table 3.4 below.

Table 4: Description of Environmental Significance Ratings and associated range of scores

OVERALL SIGNIFICANCE *(The combination of all the above criteria as an overall significance)*	
VERY HIGH NEGATIVE	VERY BENEFICIAL
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects. *Example: The loss of a species would be viewed by informed society as being of VERY HIGH significance.* *Example: The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.*	
HIGH NEGATIVE	BENEFICIAL
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light.	

OVERALL SIGNIFICANCE *(The combination of all the above criteria as an overall significance)*	
Example: The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated. *Example: The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.*	
MODERATE NEGATIVE	SOME BENEFITS
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial. *Example: The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.*	
LOW NEGATIVE	FEW BENEFITS
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect. *Example: The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels.* *Example: The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.*	
NO SIGNIFICANCE	
There are no primary or secondary effects at all that are important to scientists or the public. *Example: A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.*	
DON'T KNOW	
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information. *Example: The effect of a particular development on people's psychological perspective of the environment.*	

D. Significance Post Mitigation

Once mitigation measure are proposed, the following criteria are then used to determine the overall post mitigation significance of the impact:

- Reversibility: The degree to which an environment can be returned to its original/partially original state.
- Irreplaceable loss: The degree of loss which an impact may cause.
- Mitigation potential: The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. The four categories used are listed and explained in Table 3.5 below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

Table 5: Criteria considered post mitigation

Reversibility	
Reversible	*The activity will lead to an impact that can be reversed provided appropriate mitigation measures are implemented.*
Irreversible	*The activity will lead to an impact that is permanent regardless of the implementation of mitigation measures.*
Irreplaceable loss	
Resource will not be lost	*The resource will not be lost/destroyed provided mitigation measures are implemented.*
Resource will be partly lost	*The resource will be partially destroyed even though mitigation measures are implemented.*
Resource will be lost	*The resource will be lost despite the implementation of mitigation measures.*

Mitigation potential	
Easily achievable	*The impact can be easily, effectively and cost effectively mitigated/reversed.*
Achievable	*The impact can be effectively mitigated/reversed without much difficulty or cost.*
Difficult	*The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs.*
Very Difficult	*The impact could be mitigated/reversed but it would be very difficult to ensure effectiveness, technically very challenging and financially very costly.*

APPENDIX E – CVS OF THE PROJECT TEAM

APPENDIX F – ADVISIAN DESIGN REPORTS

Advisian. 2020. St Francis Bay Estuary Hydrodynamic Modelling Study. C00729-01-PMT-PRE-0004. 70pp.

Advisian. 2020. St Francis Bay Beach Long-Term Coastal Protection Phase 2. Supplementary Shoreline Modelling Report. 154pp.

Advisian. 2018. St. Francis Bay Beach Long-Term Coastal Protection Phase 2. Preliminary Design Report 22/02/2018.

Advisian. 2019. St. Francis Bay Beach Long-Term Coastal Protection Phase 2. Spit Protection: Preliminary Design Report 04/02/2019.

APPENDIX G – EXIGO ARCHAEOLOGICAL SPECIALIST REPORT

APPENDIX H – EXISTING ENVIRONMENTAL AUTHORISATION

APPENDIX I – SAND SOURCING SPECIALIST REPORT

APPENDIX J – ESTUARINE AND DUNE ECOLOGY SPECIALIST REPORT

Issues and Responses Trail (IRT)

The Issues and Response Trail (IRT) includes comments collected for the duration of the project. The table below are separated between:

- Table 1: Comments received on a preliminary version of the Draft Scoping Report following the notification of Intent to Apply for Environmental Authorisation;
- Table 2: Comments received during the formal Public Review Period for the Draft Scoping Report;
- Table 3: Comments received after the submission of the Final Scoping Report was accepted by DEDEAT;
- Table 4: Comments received during the formal Public Review Period for the Draft Environmental Impact Report; and
- Table 5: Comments received during the formal Public Review Period for the Draft Environmental Impact Report from Mr F. Silberbauer.

The columns in the table provide a response from the EAP as submitted to DEDEAT as part of the Final Scoping Report. As additional information has been made available during the EIR the comment has been updated / added to where necessary in a second column. This is to facilitate the understanding of how the I&AP comments were addressed throughout the process.

Table 1 Comments Received Following Notification of Intent to Apply for Environmental Authorisation

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
Rodney Suter 042 294 1627/082 880 7344 rod.suter@gmail.com	1. RISK : ADVISIAN DESIGN : PEER REVIEW While acknowledging the competencies and reputations of Advisian and Worley Parsons, I submit that it is essential that the current design solution they have proposed (notwithstanding that it is labelled 'Preliminary') undergoes an independent technical and financial Peer Review by independent international experts during the upcoming "Specialist Studies" phase of the process. Any future design changes when progressing to the detail design should also be subject to similar scrutiny. A Peer Review is not unusual as part of the normal design process; although in this case it would not be unexpected if strongly opposed by both SFPO and Advisian. Some motivation for a Peer Review: i) The current proposals, once implementation and construction commence, will be irreversible. In view of the many past failed efforts to address the beach erosion problem, it is essential that any new design solution is subjected to the most exhaustive evaluation to ensure, as far as possible, that it is the best solution. A failed project will destroy St Francis Bay beachfront.	Work performed by Advisian was subjected to an internal review process, and their report was approved by Dr. Gary Mocke, an internationally renowned marine engineer with more than 32 years worldwide experience. Nevertheless, neither the SFPO NPC, nor Advisian is opposed to a peer review. This is normally undertaken during the detail design stage.	The Advisian design will be peer reviewed following the submission of the EIR to DEDEAT. Additional coastal modelling has taken place and the output is now available in a supplementary report part of the EIR (Appendix F).

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	ii) Without going into too much detail at this time, perusal of the Design Report by Advisian gives cause for alarm. There are numerous references in the narrative that emphasize significant uncertainties, clearly conveying that this Scheme is viewed almost as an 'experimental' project - one that will require the designs and design assumptions to be reviewed and changed after construction work has commenced. The serious negative impact of this approach on the environmental aspects, the construction time, the budgets and the final cost of the scheme are obvious and not insignificant. By way of example - two abstracts from the Advisian Preliminary Design Report: page 62: "Beach nourishment would be placed between the groynes as shown in Figure 47. It is advised not to reclaim the central section of the coastline as highlighted since the coastline orientation of the central section does not lend itself to a stable beach orientation. This area was found to be a divergence point for the sediment transport with sediment moving at the northern section to north and the southern section to the south. If this area needs to be protected and a beach reinstated, a T-shaped groyne structure may need to be constructed near the centre of this area." "It is noted that the shoreline configurations depicted for Option 1A and Option 1B are purely conceptual, based on engineering judgement and not coastal modelling. Although shoreline configurations of the selected option can be somewhat better assessed in the detailed design phase, there are limitations in the numerical and empirical modelling of such solutions. If such options are adopted there is benefit in phasing the implementation to effectively test effectiveness of an initial structure in prototype." page 69: "As the stub groynes will not extend to the full depth of closure and exact shoreline response is difficult to quantify through modelling, a staged approach will represent an excellent opportunity to evaluate the effectiveness of the stub groyne measures. By monitoring effectiveness of the initial stage in prototype, modifications could be made to subsequent areas prior to their implementation."	During the preliminary design stage the concept of a groyne field and beach nourishment was developed. During the detail design stage the scheme will be developed in greater detail (e.g. exact placement of groynes, groyne lengths and angles, stone size, mass and shape, etc.), and at this stage a peer review may add value.	
	2. RISK: SCHEME ABANDONMENT This Scheme is planned to be funded by the SFPO NPC, which is the legal entity responsible for the St Francis Bay SRA (Special Rating Area). The St Francis Bay SRA is partly funded (46%) by an extra Property Rates Levy, levied by Kouga Local Municipality (KLM) on some (but not all) of the property owners in St Francis Bay.	The SFPO NPC, being mindful of the total anticipated cost to construct long term coastal protection	Responded to and incorporated at scoping phase.

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	Based on information currently in the public domain, SFPO NPC may have some potential financial problems. Firstly, there is currently in progress a court challenge to KLM and SFPO from the CRA ("Concerned Residents Association") regarding the establishment of the SRA and imposition of the extra Property Rates Levy in part of St Francis Bay. Opinion is that this action has a reasonable chance of success, in which case the SRA will in all likelihood be dismantled, the extra SRA Levy income will stop, and all work will probably cease. Secondly, after almost a year in existence, SFPO NPC appear to still be unable to publicly confirm their other supposed sources of income (total 51%) listed in their 10-Year Business Plan (approved by KLM in 2018). These sources were variously identified by SFPO in 2018 as the Riperians, The Port, KJIRC & River Estates and KLM. It should be noted that the projected KLM contribution of R3m per year for 10 years (18% out of the 51%) has already been cancelled. A further issue is a possible change in the political/social circumstances in the currently DA-led Kouga Local Municipality, and a consequent re-alignment of local government financial priorities. These issues indicate that there is a serious risk that the work on the Scheme could be abandoned before completion due to cessation of funding. SFPO NPC, and possibly also KLM, will doubtless strongly dispute this issue, but fact remains that SFPO NPC have not as yet been able to provide proof of their income projections. The environmental impact of an incomplete Scheme resulting in abandoned and partially constructed groynes, revetments, pump stations and pipelines would be disastrous, and the consequent long-term impact on the St Francis Bay community incalculable. This environmental risk must be addressed in the Scoping Report. There are possible ways to mitigate this risk, e.g. financial guarantees from KLM or others, but this topic is outside the remit of the Scoping Report and these Comments.	infrastructure, instructed Advisian to address possible phasing of construction and any cost implications associated with such phasing. The intention of the SFPO NPC is to construct infrastructure as and when funding becomes available. Advisian duly identified possible phasing of the project and the proposed phasing and associated costs are described in their preliminary design report. This phased approach of the SFPO NPC will *ensure that construction of infrastructure in any phase will only commence when sufficient funding for that particular phase has been secured*, and it will effectively negate the risk of partially constructed infrastructure.	The implications of the court challenge to KLM and SFPO from the Concerned Residents Association, and the potential implications of changes to political leadership are beyond the scope of this EIA process.
	3. RISK: DAMAGE TO EXISTING SURFING BREAKS	According to Advisian, the length of the groynes and	Considerable engagement with

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	There are two well-known established surfing breaks in St Francis Bay — Hulett's Reef (an excellent "nursery" wave for beginners, just off Grannies Pool), and Bruce's Beauties (along the point between Grannies Pool and the Port - acknowledged as an iconic international site and made famous by the 'Endless Summer' movie). Both spots are within the area which will be affected by the construction of groynes, the beach sand replacement and the ongoing beach sand maintenance envisaged in the Scheme. However, the Advisian Design Report addresses neither the risk of possible damage or destruction of these surf breaks by groyne construction and/or sand nourishment operations, nor whether this was considered when undertaking the computer modelling or preparing the designs for the Scheme. Planning and executing construction work that could result in damage to these breaks would be a serious mistake and mean the loss of a valuable amenity to both the world-wide surfing fraternity and the Kouga/St Francis community. This would also have negative commercial impacts, and thus conflict with the objectives of the Kouga IDP. I submit that this aspect must be addressed by the appropriate responsible parties before proceeding with the Scheme.	width of the beach nourishment for the proposed scheme are not large enough that it will affect the breaks. (This could potentially be illustrated through further wave modelling during the detail design stage.) The nourishment is intended to provide a wider beach amenity, a bit closer to the historical width of the beach than the present situation.	the surfing community have taken place and the groyne location and orientation have been modified. The modified layout was subjected to further coastal modelling of the scheme (refer to Appendix F of the EIR).
	4. RISK: SEA ACCESS THROUGH KROMME RIVER MOUTH The Advisian Design Report does not adequately address the risk of possible changes caused by the Scheme to the Kromme River Mouth which might negatively affect (or block) access through the mouth to the sea. The initial bulk beach sand replacement operation, the probable large-scale removal/dredging of sand from the sandbanks and/or channels in the river and ongoing beach sand nourishment will significantly change the hydrodynamics of the Kromme River estuary and create a dynamic and complex situation at the Kromme River Mouth. The Design Report shows only a moderate accretion of sand on the river-mouth side of the groyne adjacent to the river mouth, presumably derived from littoral drift spill-over from the beach sand nourishment operations. I submit that this is an important environmental risk, and that further investigative study and design work is vital to ensure that access to the sea at the river mouth is not degraded further than it is now. This would be appropriate during the upcoming "Specialist Studies" phase of the process. Obviously, the ultimate objective should be to improve the present situation and take advantage of the opportunities that the Scheme could provide.	The sand sourcing survey will comment on the likely changes on the hydrodynamics of the estuary through the removal of sediment and the potential environmental impacts associated with it. The environmental impact assessment will comment on the possible impacts of the preferred engineering option and will likely recommend that the design take account of certain environmental	Additional modelling of the Kromme Estuary was carried out by Advisian. The modelling used updated bathymetry and water level data to determine the changes to the system following the sourcing of material from the proposed material borrow areas. Detail on the modelling can be found in the Advisian

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		constraints (for example to limit the accelerated erosion potential on the northern side of the northern most groyne).	engineering report (Appendix F of the EIR). The Sand Sourcing Specialist Report (Appendix I of the EIR) and the Estuarine and Dune Ecology Specialist Report (Appendix J of the EIR) have been updated to reflect the updated modelling results. In summary the dredging of the Kromme Estuary has shown to have very little effect on the hydrodynamic conditions (i.e. current velocity) of the Kromme Estuary. The current velocities increase in the mouth region initially but return to a pre-dredging state in the short term.
	5. OPPORTUNITY: CREATION OF NEW SURFING BREAKS Should the Scheme proceed in its present format, there is an opportunity to utilise the creation of the groynes to create new surfing breaks along the St Francis Bay beachfront.	As acknowledged in the comment the scheme was designed as a beach protection scheme and the brief did not include	Considerable engagement with the surfing community have taken place and the

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	If this one-time opportunity is seized, it would become an enormous asset to St Francis Bay and Kouga, and a significant commercial and developmental contribution to the Kouga IDP. I acknowledge that this topic is probably beyond the remit of the Scoping Report, but it should be considered by the Report authors in the event that initiatives in other forums bear fruit. The current Scheme provides for five 200-metre-long oblique stub groynes, along with sand nourishment, with the single objective of re-establishing a viable beach at St Francis Bay. I suggest that the present design brief should be amended to include, as a secondary objective, the creation of surfing breaks at the groynes. It is probable that this could be achieved by appropriate "tweaking" of the present oblique orientation and sizing of the present designs for the groynes, without negatively impacting the principal objective of sand retention. I recognize that the groynes in the present layout could well produce surfable waves at times, but what I believe could be achieved by careful consideration and implementation of the existing wave research and the technology available is the creation of consistent high-quality surfing waves.	for the generation of surfing breaks. Whilst the reorientation or adjustment of the beach following construction of the groynes could conceivably result in improved surfing conditions, such an outcome cannot be guaranteed. The groynes as they are schematized now are also considered to be too short to significantly impact surf zone conditions. A scheme that could result in consistent surf breaks would likely consist of offshore submerged structures and/or dumped sand. The studies, surveys, design effort and construction of such a scheme would be costly and even then, results would not be guaranteed, as has been shown on artificial surfing reef projects elsewhere in the world.	groyne location and orientation have been modified. The modified layout was subjected to further coastal modelling of the scheme (refer to Appendix F of the EIR).

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		The SFPO NPC has been approached by the surfing community, and they expressed their support for the proposed scheme. They will be put into contact with the design engineer of Advisian prior to the detail design stage to ensure that cognizance be taken of any suggestions that they may have.	
	6. RISK: QUALITY AND SOURCE OF BEACH NOURISHMENT SAND Both the Draft Scoping Report and the Preliminary Advisian Design Report highlight the necessity of nourishing the beach with the correct quality of sand. The Reports further acknowledge that the presently identified sources of sand (the Kromme River sandbanks and channel) must still be tested and confirmed as suitable sources. Should the sand from these identified sources prove to insufficient and/or of the incorrect quality, alternative sources will then obviously need to be identified by SFPO. Of concern is one earlier proposal by SFPO to use the sand dredged from the Port by installing a pipeline and pump station(s) to transport the dredged sand from the Port to the beach near Grannies Pool. Other proposals exist and will doubtless be developed if the need arises. I submit that the Scoping Report should specify clearly that the proposed use of any alternative source of sand would necessitate an additional full EIA process before approval to proceed is granted.	The sand sourcing study has assumed that the sand within the Kromme would be suitable based on the understanding that the majority of the sand in the estuary is derived from the same source as the beach. The other alternative sources in close proximity are likely to be discounted based on feasibility and recently designated conservation protection status. Should the sand not be suitable/sufficient, then alternative/additional	Refer to the Sand Sourcing Specialist Report Appendix I of the EIR. This study revealed that: Sand from the Kromme River is suitable. In addition to the suitability it is also the closest source to the site and relatively easy to extract and transport. Alternative land sources would increase the travel distance and sea based sources would require significant

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		sand sources will have to be identified and evaluated.	offshore capable vessels. Any other alternatives, identified at a later date, would be subject to the National Environmental Management Act (NEMA) (Act No. 107 of 1998, as amended).
	7. RISK : ECOLOGICAL IMPACTS : REMOVAL OF SAND FROM KROMME RIVER ESTUARY The Reports acknowledge that the ecology of the estuary will be affected by removal of sand from the sandbanks and channel of the Kromme River and the consequent change in riverine hydrodynamics. Damage to the existing ecological systems in the estuary would be a travesty and probably irreversible. I believe that insufficient attention has been given to this aspect of the Scheme. I submit that detailed proposals regarding the development and implementation of measures to mitigate adverse consequences to the ecological systems caused by the sand removal should be included in the Design Report and addressed in the EA process.	Yes, it is likely that the removal of sediment from the Kromme Estuary will result in changes to the hydrodynamics. However, that does not necessarily correlate with a change in the ecological functioning of the system, nor does it suggest that any changes would be significant. The estuarine report and the sand sourcing study will include information on the potential changes and the associated impacts. Where impacts are anticipated to be moderate or high,	Refer to the sand sourcing and estuarine specialist report. Specifically, see Sections 4.2.5 and 6 of the Sand Sourcing Report (Appendix I) and Section 8.1 of the Estuarine and Dune Ecology specialist report (Appendix J) which address the potential changes in hydrodynamics and the resultant impacts.

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		mitigation measures will be recommended. This will also be detailed in the EIR.	
Mr Funanani Ditinti 021 819 2499 fditinti@environment.gov.za	This letter serves to acknowledge receipt of the Scoping & Environmental Impact Assessment Report for the Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape. The Department of Environmental Affairs Branch Oceans & Coasts (DEA: O&C) has reviewed the report in terms of the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) ("ICM Act') and notes that the activities associated with the proposed development will have an impact on the coastal zone. The DEA: O&C appreciates the opportunity given to comment on this proposed project and will be providing comments during the next public participation phase of this application. The DEA: O&C further requests to be registered as an I&AP. Kindly note that the department reserves the right to revise its initial comments and may request further information. It is therefore a recommendation of DEA: O&C that the EAP ensures that they submit all future reports via the address provided below. Please note that this should include both a hard copy and an electronic copy. All future correspondence and documentation submitted to this office should be addressed for attention to Funanani Ditinti Physical Address: Department of Environment Affairs (DEA), Branch: Oceans and Coast, 2 East Pier Building, East Pier Road, Victoria and Alfred Waterfront, Cape Town, 8001.	The EAP appreciates DEA: O&C consideration and feedback of this project documentation and will endeavour to keep DEA:O&C informed of progress.	Responded to and incorporated at scoping phase.
Frank Silberbauer 083 225 7484 infinity@iafrica.com	1. One would like to bring to your attention the following extract from the current authorisation EC08/C/LN1&3/M/21-2015 with following notes:	Noted.	Responded to and incorporated at scoping phase.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	The activity entails construction, as well as repair and maintenance of rock revetments on the coastal zone at Erven 720, 623, 2257, 185, 55, 184, and 625 on the St Francis Bay beachfront within the Kouga Municipal area. The existing rock revetments, totalling a distance of 1.7 km along the St Francis Bay beach have over time been degraded and damaged and are in need of maintenance and in some areas, total upgrading. There are also sandy beach areas totalling 1 km in length which have had no protection, and are now eroding to such an extent that infrastructure and buildings, both public and private, including the St Francis Bay Marina and the golf course are severely threatened by sea encroachment and storm surge damage. This will be Phase 1 of a two phase project, which is inclusive of repair and maintenance of existing rock revetments in the Public Open Space, as well as construction of new revetments along the sandy beach areas with no revetments currently, totalling approximately 1 km in length as described above. These activities will provide a short to medium term defence of the coastline of perhaps only 5 to 10 years, which, with correct maintenance could possibly be extended. Phase 1 was assessed with two alternatives, rock revetments and GSC sand bags. **This Environmental Authorisation authorises the use of rock revetment structures only, the reasons for which are set out in Section 5.2 of this Environmental Authorisation: Key Factors in making the decision.** The second phase will be subject to a separate environmental assessment and will focus on beach nourishment and installation of various alternatives to provide further protection and encourage sand accumulation on the beach by means such as groynes, off-shore reefs and/or additional revetments. This second phase will be an ultimate requirement to be undertaken by the Kouga Municipality, in order to ensure the integrity of the Coastal Public Property and Public Open Spaces of the St Francis Bay beachfront. The rock revetments as authorised in this Environmental Authorisation are only a temporary, intermediate solution.		
	a. As Phase 1 is only 1/3 complete, how would this influence, impact and or affect the decision to proceed with Phase 2. Surely the successful completion on the first phase would be a base line to start Phase 2 of the process.	The Environmental Authorisation states that "The rock revetments as authorised in this Environmental Authorisation are only a temporary, intermediate solution." The SFPO NPC and the Kouga Local Municipality agreed that the SFPO NPC would focus on obtaining	Responded to and incorporated at scoping phase. The municipality has since performed emergency work as agreed between SFPO NPC and the municipality.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		approval for the second phase, i.e. the long-term coastal protection, whilst the municipality would attend to the temporary solution. The SFPO NPC and the municipality further agreed that the municipality will respond to any interim emergency measures. The Environmental Authorisation further states that "The second phase will be subject to a separate environmental assessment and will focus on beach nourishment and installation of various alternatives to provide further protection and encourage sand accumulation on the beach by means such as groynes, off-shore reefs and/or additional revetments." This environmental process responds directly to the directive given in the Environmental Authorisation.	

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	b. As you are aware, GSC sand bags were not recommended or authorised in Phase 1, but the Phase 2 specialist report offers GSC containers (although with reservations) as an integral part of the Phase 2 which is also part of Phase 1. Could you provide reasons for this anomaly?	It must be borne in mind that this is a separate environmental assessment as stipulated in the Environmental Authorisation. Nevertheless, the Advisian preliminary design of revetment structures for the Spit area provides a rock revetment design. In addition, it provides alternatives to the rock revetment design, as described in Section 3.3.2 of the Scoping Report. The EIA process will ensure that all three options are evaluated technically and will offer the community an opportunity to express their preference.	Responded to and incorporated at scoping phase. In 2020, the spit breached on four occasions with a temporary emergency revetment installed by the Kouga Municipality. The revetment is constructed of rock material which will form part of the design for the revetment linked to this application. The detailed design will take place when funding is available when the condition of the temporary measure can also be assessed.
	c. Revetments are now an added part of Phase 2 for the Spit. The revetments planned for the Spit for Phase 1, which are priced but not yet started, can you provide reasons as to why these revetments are now included in the second Advisian report for Phase 2 (See PRDW report November 2018).	The revetment in the November 2018 PRDW report (prepared for Kouga Local Municipality and not in the public domain), referred to by the I&AP, has been designed for the current	Responded to and incorporated at scoping phase.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		beach condition and levels. This revetment, if constructed, will in the interim serve as a primary defence. Advisian's brief was to design a revetment that would form an integral part of the long-term coastal protection infrastructure. This results in a revetment that performs the duty of the last defence against wave action (the nourished beach level and width being the first defence). There is a substantial cost saving if the revetment designed by Advisian is constructed. However, this Advisian designed revetment will only be constructed should Environmental Authorisation be obtained before the revetment referred to by the I&AP is installed.	

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	d. Why is there a definite bias towards the Spit to the exclusion of the remaining coastline of the St Francis Beach in the second specialist studies from Advisian? Your comments on this fact is required.	There is no bias towards the spit. The major part of the project entails coastal protection, comprising groynes and beach nourishment, for the entire length of the St Francis Beach.	Responded to and incorporated at scoping phase. In 2020, the spit breached on four occasions demonstrating the urgency and importance of the implementation of a solution.
	e. Phase 2 as defined above, will be financed by a levy on all property owners from the Canal and the Village areas of St Francis Bay and the reason for this is that as the 2.7km coastline includes both groups, but as stated above there is a definite bias towards canal sections of coast line is this bias not contrary to the spirit of the St Francis Property Owners NPC charter?	There is no bias towards the canal area. The project includes revetment and groynes structures along the full frontage as defined in the project description.	Responded to and incorporated at scoping phase.
	2. As is obvious from the report, that the single choice of the Kromme Estuary as a sand source is in our view considered a risky choice, due to cost, environmental issues, access, logistical and public participation, which could disqualify this area. In this instance the absence of alternative sand source(s) poses a risk to this study.	The source within the Kromme provides, what was considered to be, the most accessible sand resource together with the potential volume available for the capital works and the maintenance activity. Additional sources will be identified and evaluated, should the specialist study reveal that the sand available in the Kromme	The Sand Sourcing Specialist Report and Estuarine and Dune Ecology Specialist Report and specifically Section 3 of the EIR comment on the alternatives assessed and the suitability and available volume of material.

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		River is not suitable or insufficient.	
	3. The focus on the Spit is noted but raises a further question – is the protection of the Spit the ultimate and only protection needed for the marina as others exist such as extensive flooding and tidal and storm surges from the Kromme river (August 2008 storms, CSIR predictions for 2050). Should these potential impacts not be included in the overall evaluation as in our view the Spit is only one part of a complex set of problems.	The protection of the spit is considered to be just as important as the other elements of the project. The protection of the Spit forms an integral part of the long-term coastal protection of the St Francis Bay beach and the backshore infrastructure and properties, which is the essence of this project.	Responded to and incorporated at scoping phase.
	4. With reference to point 2 above the proposed extensive removal of sediments from the Kromme river, will exacerbate or enhance the effectiveness of both storm surges and flooding to the canal system as all-natural barriers along the Kromme will be partially or totally removed. Are we attempting to fix one problem but now creating another?	The sand banks located within the Kromme Estuary do not provide any protection against storm surges and higher sea levels in the St Francis canal areas. While river flooding events are anticipated, the presence of the two large impoundments, upstream of the lower reaches of the estuary, do reduce the effect. The scheme is not intending to remove all of the features (sand banks) of the estuary but looking to harvest as much as	This aspect was carefully considered in the EIR and the Estuarine and Dune Ecology Specialist study. The reader is referred to these reports, and in particularly Section 8.1 and Section 9.1 of the Estuarine and Dune Ecology Specialist Report (Appendix J). These reports have considered the recent engineering modelling results on

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		possible while being cognizant of the ecological and social importance of those features. Further to this, it has been noted that, in recent years since the estuary has silted up near the mouth, the strength of the tidal flow through the canals has increased. Therefore, it stands to reason that by dredging and reducing the net resistance in the river channels relative to the canal system, that the flow rate through the canals will be more moderate during flooding events. This will not have any significant effect during the event of a river flood.	the Kromme Estuary where the post dredging scenario show negligible change to current velocities and an overall lowering of the water level at low water under normal conditions.
	5. The scoping report as presented does not speak to the average resident of the area as it is complex and full of scientific jargon and no effort has been made to provide explanatory sections of the complexities of wave dynamics, sediment rates, or erosion rates etc. This scoping report might fulfil the requirements as set out by NEMA, but not to the population of St Francis Bay.	This will be considered and addressed in the EIR.	Sections in the EIR have been edited to facilitate a better understanding of the main concepts. However, given the scientific nature of the specialist studies and the EIA this may appear as a scientific

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			report, since that is what it is.
	6. Generally, costs for the whole project are absent, and as this is a Special Levy project, will full cost budgeting would be available prior to embarking on the full EIA process for general public approval?	The cost estimate for the coastal protection infrastructure (without the Spit revetment) is shown in Section 6.6 (Page 78) of Advisian's Preliminary Design Report, and the cost estimate for the Spit revetment is shown in Section 5.8 (Page 29) of Advisian's Spit revetment report (refer to the Advisian report – Appendix F).	Responded to and incorporated at scoping phase. Advisian' s updated engineering reports (Appendix F of the EIR) contain updated project costs.
	7. Several queries have been raised by individuals as to real reason as to why the Kromme River is to be dredged, that being - that boat owners from the canals would prefer easier access up the river, which is the real reason for dredging. Can you comment on the validity of this perception?	The Kromme estuary is the most feasible source of sediment in both proximity and volume available. The dredging will include sourcing from the existing channels in the estuary. This will result in the estuary channels becoming more navigable by water craft. The Kromme Joint River Committee (KJRC), which represents the Home Owners Associations and Share Blocks along the Kromme River, was	The Estuary and Dune Ecology Specialist Report deals with the historical ecological changes associated with sediment build-up in the system over the past 50 or more years. There is scientific agreement that the Kromme Estuary has silted up over the past 50 years, and the reasons for this are

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		restructured in 2016 to manage and maintain the river boating activities, including law enforcement and the utilisation of income derived from the sale of boating permits. The KJRC expressed their support for the long-term coastal protection project, including the possible sourcing of sand from the river. The entities represented on the KJRC will be contributing financially towards the cost to dredge the river to provide a safer boating environment for river users once an EIA for this work has been approved.	discussed in Section 4 of the Report.
	The below comments are numbered as per the comments made by the I&AP on the pre-application version of the Scoping Report, as per the summary of the comments included in the I&AP's submission to the EAP.		
	Page 8: Commented [FS1]: It would be appropriate to list these other viable sources as the Kromme River will limit the scope of sand supply and limit options especially those involving ongoing nourishment of the beach. This needs clarification as your chosen source of sand is the most difficult source both from methodology, environment and public participation point of view.	The EIA process is considering all likely and feasible options for sand sourcing. All possible alternatives will be assessed and reported on.	Refer to Section 1.2 of the Sand Sourcing Specialist Report (Appendix I of the EIR). In addition, the alternatives have been discussed in

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			the Section 3 of the EIR.
	Page 8: Commented [FS2]: Surely one would expand this decision on the form of coastal protection and who and why made this decision and was it made in the sense that the required public participation has been carried out?	This topic is expanded on in Chapter 3 of the Scoping Report (Reasonable and Feasible Alternatives) and will be further investigated during the EIA process.	Incorporated during scoping phase and included in Section 3 of the EIR.
	Page 8: Commented [FS3]: Is similar grain size the final and only determining factor for beach nourishment or are there be others?	Grain size is the main determining factor for the suitability of the source of sediment. The impact on the source area and the moving of the material from the source area to the nourishment area will be evaluated during the EIA process.	Refer to Section 4 of the Sand Sourcing Specialist Report (Appendix I of the EIR). The Estuarine and Dune Ecology Specialist Report (Appendix J of the EIR) assesses the impacts associated with the removal of the sediment.
	Page 9: Commented [FS4]: Why is the Kromme River functional zone the only chosen source of material? As already this is the most difficult choice and comes with all sorts of issues as mentioned above in the first comment.	The Kromme River is perceived to have the most accessible source of material together with the potential volume required.	Refer to the Sand Sourcing Specialist Report (Appendix I of the EIR) and the Estuarine and Dune Ecology Specialist Report (Appendix J of the EIR). Section 3 of the EIR also discusses the

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			alternatives considered.
	Page 9: Commented [FS5]: Does the 854,000m^3 include for continuous nourishment or is this just to begin this process? What is your approach when you have run out of sand in the Kromme River or there is insufficient supply? Do we have to begin an additional EIA for other sand sources?	This does not include the maintenance material. It is possible that there might be insufficient material available. This is the reason for the study.	The Sand Sourcing Specialist Report (Appendix I of the EIR) has determined that there is 1 074 000m^3 of material available. It is likely that the scheme will be developed in phases and because the estuary is flood dominant the continuous replenishment of sand will ensure sufficient sand for maintenance requirements.
	Page 9: Commented [FS6]: Clarification on suitable burrow sources is required as you are moving the goal posts from the Kromme to other suitable sources? This is confusing and raises questions as to exactly as to what has been decided by those who are making decisions?	Various sources are being considered and the impacts of the alternatives assessed.	Refer to the Sand Sourcing Specialist Report (Appendix I of the EIR) for more information on the preferred option. Section 2.3 of the EIR describes the proposed project description and

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			Section 3 assessed the alternatives.
	Page 10: Commented [FS7]: Is this going to be quantified both on value and quantity. This is critical to the success of this project is clarification not necessary at this stage or has no one thought through this situation in a logical manner. Who is going to finance the ongoing maintenance of the beach?	Advisian advised that the current loss is 50 000 m^3 to 100 000 m^3, but that the loss after full implementation of the preferred solution can be expected to be in the order of 25 000 m^3 to 50 000 m^3. Confirmation of the sand source for maintenance purposes will form part of the sand source study. The cost of this ongoing maintenance operation will be borne by the SFPO NPC.	Refer to the Sand Sourcing Specialist Report (Appendix I of the EIR). As mentioned, the cost of ongoing maintenance operation will be borne by the SFPO NPC. Maintenance dredging operations carried out by the KJRC and SFBRHOA will assist.
	Page 10: Commented [FS8]: This seems a duplication of existing works authorised in 2015 and is confined only to the Spit area. It is noted that the design requirement includes for geotextile containers which are not recommended for this area as per PRDW reports 2015? Why are we not focusing on one section of coast that being the spit and not the remaining 1.9km?	Revetments have been installed along the most vulnerable portions along the St Francis Beach, except for the Spit area. The Spit may be subject to breach in the near future if not provided with some level of protection. The Advisian preliminary design of revetment structures for the Spit area provides a rock revetment design. In	In 2020 the spit breached on four occasions. The Kouga Municipality have installed an emergency rock revetment to repair the breaches. The detailed design of the revetment at the spit (as part of this project) will incorporate these emergency repairs.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		addition, it provides alternatives to a rock revetment design, as described in Section 3.3.2 of the Scoping Report. The EIA process will ensure that all three options are evaluated technically and will offer the community with an opportunity to express their preference.	
	Page 10: Commented [FS9]: By whom and why are shorter groins chosen is it only based on the cost factor or by design? How much more inefficient will the short groyne compared with the long standard ones? what are the differences between the short and ones generally used for coastal protection? Can you site some examples of short groynes which are effective from any similar site in the world?	There are no standard groyne lengths. The effectiveness of groynes depend on the incident wave climate, surf zone width, hydrodynamic regime, bathymetry, sediment transport regime, etc. The intention with the proposed groyne lengths were twofold: reducing costs and still allowing a measure of natural alongshore sediment drift along the beaches. The groyne lengths are similar to those along Durban's North beach.	Incorporated at scoping phase. Advisian's preliminary design and engineering reports (Appendix F of the EIR) describe the potential alternative solutions and elaborate on why stub groynes are the preferred design.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	Page 10: Commented [FS10]: It is noted that the preferred alternative was chosen by 4 parties, would it not be appropriate to put this critical choice to a wider audience especially as these entities are being financed by the people of St Francis Bay and more recently the river folk? The only qualified decision makers in this group are Advisian?	The engineers have proposed the most feasible options based on design, existing conditions and technology employed in other parts of the world under similar conditions. One of the purposes of this EIA process is, inter alia, to present a proposed technical solution for scrutiny to an affected community and to ascertain community feedback and preferences.	The public participation process is designed to allow for public comment.
	Page 10: Commented [FS11]: In the great scheme of things is the loss of beach amenity a critical factor for the development of the SFB community? Please give reasons as to how the proposed project aligns itself with development plans or even the latest special framework. Only 30 temporary jobs – what about the permanent operational job opportunities to maintain the system?	The fundamental aim of the scheme is to protect the frontage from erosion by the sea. A fully developed hard structure is expensive. Beach nourishment has been successfully employed in areas of the world.	The Need and Desirability section (Section 4) of the EIR provides a clear motivation for the project. The studies indicate that the loss of the beach will put backshore infrastructure, public amenities and properties along the entire beach length at risk.
	Page 12: Commented [FS12]: The significance and risk of impacts listed should not be rated at this stage as the impact assessment process still has to run. These are purely arbitrary ratings and hopefully not preconceived ones?	The scoping report is intended to provide possible impacts which	The EIR is required by NEMA, to provide a detailed impact

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		can be modified as the EIA process progresses.	assessment (Section 7.2).
	Page 13: Commented [FS13]: If only key stakeholders are necessary for the S&EIR process it would be necessary to include in this instance those who are members of the St Francis SRA and representative groups for the Kromme River as they are and will be financing this process? This statement will not enhance relations for the public participation process.	There has been a pre-application meeting open to all members of the public. There will be two further opportunities to review and comment on the project documentation.	Responded to and incorporated at scoping phase.
	Page 25: Commented [FS14]: In conflict with previous statements that Stakeholders are exclusive to this scoping process? Please see previous comment.	This will be clarified.	Responded to and incorporated at scoping phase.
	Page 27: Commented [FS15]: NOTED	Noted.	Responded to and incorporated at scoping phase.
	Page 29: Commented [FS16]: Confusing statement on the application of this project as ratepayers have been led to believe that the whole St Francis Beach is being eroded and the whole 2.7km coast is the affected area, but now only a specific area is being identified as being particularly vulnerable. Does this mean that the spit is going to receive preference to other areas? This won't go down well with the Village people?	Revetments have been installed along the most vulnerable portions along the St Francis Beach, except for the Spit area. The Spit area has suffered more aggressive erosion than the rest of the St Francis Beach (refer to the Advisian report – Appendix F) and the Spit may be subject to breach in the near future if not provided with some level of protection. The major part of the project entails coastal	Refer to the project description in Section 2.3 of the EIR, which clearly presents the overall scope of the project. The full 2.7km will be protected. Advisian's engineering reports in Appendix F of the EIR provide significantly more detail on the design. Revetments have been installed along the most vulnerable portions along the St

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		protection, comprising groynes and beach nourishment, for the entire length of the St Francis Beach.	Francis Beach, including emergency repairs along the spit in 2020.
	Page 29: Commented [FS17]: Why are revetments included in this study as they have already been authorised to the areas covered by the proposed study? Why the duplication of works?	Any revetment constructed in isolation under Phase 1 will be constructed for the current beach condition and levels and will in the interim serve as a primary defence. Advisian's brief was to design a revetment that would form an integral part of the long-term coastal protection infrastructure. This results in a revetment that performs the duty of the last defence against wave action (the nourished beach level and width being the first defence).	Responded to and incorporated at scoping phase.
	Page 30: Commented [FS18]: A review for more detail as to why these solutions have proved insufficient over the past 20 years is necessary as each solution adopted has its merits and demerits including the current proposed solution?	This has been done by WorleyParsons in 2014 and they documented their findings in a report titled "Review of Previous Studies and Investigations and Assessment of Potential Remedial Options". This	Responded to and incorporated at scoping phase. The Advisian engineering reports form part of Appendix F of the EIR.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		report will be made available on the SFPO NPC website.	
	Page 34: Commented [FS19]: The current authorisation 2015 has been omitted?	This will be included in the EIR.	See Section 2.2 of the EIR.
	Page 34: Commented [FS20]: It would be appropriate to give reasons as to this being the most suitable option. Who what and why? There are many who think the chosen option is such a compromise that in the end our beach will be worse off than at present.	This is addressed by Advisian in Section 5 of their report (please refer to Appendix F of this report).	Responded to and incorporated at scoping phase..
	Page 34: Commented [FS21]: Again, this is the most difficult source to gain authorisation and again my previous comments are valid. Or is there another reason that there is this focus only on the Kromme river - maybe to open up the river for better boat access?	The Kromme River is perceived to have the most accessible source of suitable material together with the potential volume required.	Refer to the Sand Sourcing Specialist Report (Appendix I of the EIR). .
	Page 35: Commented [FS22]: From where is the 40m being measured?	The 40m is measured from the back of the beach. (Please refer to Appendix F of this report).	Responded to and incorporated at scoping phase.
	Page 35: Commented [FS23]: Yet again we see a focus on one area being the spit and in addition revetments are now included this is a departure from the existing status quo? What about the rest of the beach areas?	Revetments have been installed along the most vulnerable portions along the St Francis Beach, except for the Spit area. The Spit area has suffered more aggressive erosion than the rest of the St Francis Beach (refer to the Advisian report – Appendix F) and the Spit may be subject to breach in the near future if not	Refer to the project description in the EIR, Section 2.3.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		provided with some level of protection. The major part of the project entails coastal protection, comprising groynes and beach nourishment, for the entire length of the St Francis Beach.	
	Page 36: Commented [FS24]: Is the inclusion of geotextile containers and additional revetment along the spit a means to alter the existing reluctance of DEDEAT to authorize these containers?	Revetments have been installed along the most vulnerable portions along the St Francis Beach, except for the Spit area. The Spit may be subject to breach in the nearby future if not provided with some level of protection. The Advisian preliminary design of revetment structures for the Spit area provides a rock revetment design. In addition, it provides alternatives for rock revetment design, as described in Section 3.3.2 of the Scoping Report. The EIA process will ensure that all three options are evaluated	Responded to and incorporated at scoping phase.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		technically and will offer the community with an opportunity to express their preference.	
	Page 36: Commented [FS25]: The reasons to why the shorter groynes were chosen – can reasons be supplied and by whom? After reading Advisian's reports one concludes that these stub groynes are a compromise and definitely not as effective as the longer type.	This is addressed by Advisian in Section 5 of their report (please refer to Appendix F of this report).	Responded to and incorporated at scoping phase.
	Page 36: Commented [FS26]: Will the preferred supply area be able to supply the needed material and top ups for the short term and long-term solution?	This is being investigated and will be reported on through the EIR phase.	The Sand Sourcing Specialist Report (Appendix I of the EIR) has determined that there is 1 074 000m^3 of material available. It is likely that the scheme will be developed in phases and because the estuary is flood dominant the continuous replenishment of sand will ensure sufficient sand for maintenance requirements.
	Page 37: Commented [FS28R27]: Please provide reasons as to why these areas do not need groynes? The phased approach how long and when? Is due to financial considerations or that these areas are out of the considered area that being the spit? It seems that there is a definite bias to the spit.	Areas 4 and 5 are flanked by groynes constructed during previous phases and are 400 m and 650 m long respectively. This has	Refer to the project description in the EIR, Section 2.3. The updated Advisian reports in

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		been clarified in Section 2.4 of the Scoping Report.	Appendix F of the EIR describe the phases of the project. The risk of the spit breaching was identified in the reports and therefore an important starting point. The risk was realised in 2020 with four breaches of the spit.
	Page 42: Commented [FS29]: Previous studies which focused on this sand source and the use of this area was rejected. Past studies will answer this point.	The EAP is aware of the previous studies that considered the Kromme Estuary as a potential sand source. To the best knowledge of the EAP, none of these studies have received comment (let alone rejection) from the competent authority.	The Sand Sourcing Specialist Report (Appendix I of the EIR) has determined that there is 1 074 000m^3 of material available. The Estuarine and Dune Ecology Specialist reports assess the impact on the estuary and dune systems as a result of the abstraction of this material.
	Page 42: Commented [FS30]: It was estimated that 150,000 m^3 was brought down during the 2012 flood, but most of this has dispersed via wind and tide erosion up and down the Kromme river. It is also noted that considerably quantities of vegetation and bridge debris was included in the debris. The sand here will be heavily contaminated with vegetation.	This will be considered in the drafting of the sand sourcing study. The sand sourcing study will provide an indication of the possibility of the use	Responded to and incorporated at scoping phase. .

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		of material from within the Kromme. However, it is not intended to be a detailed analysis of the material in the Kromme. Only once a suitable contractor has been appointed will the detailed nature of the material be known. Certain contaminants such as clays and ash could have an effect on the suitability of the source however, vegetation is easily separated. The separation of the vegetation from the sand will affect the cost of the operation but will not prevent the sand from being a suitable source for beach nourishment.	
	Page 43: Commented [FS31]: This is the purest sand source but not in any quantity as described as needed for the nourishment of the spit area. The environmental implications of opening up these channel areas needs careful consideration of the long-term cumulative impacts on the adjacent wetland system, river traffic, fauna, flora and adjacent properties. Tidal surges will also have an increased impact on general overall erosion. This is a very complex source of material.	This is the subject of both the estuarine and sand sourcing specialist studies.	The Sand Sourcing Specialist Report (Appendix I of the EIR) and the Estuarine and Dune Ecology Specialist Report (Appendix J of the EIR).
	Page 44: Commented [FS32]: The identified source areas are limiting and restrictive from environmental, cost and logistics, as the potential source areas in themselves are heavily	The Kromme River is perceived to have the	The Sand Sourcing Specialist Report

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	restricted by regulatory control by many departments and the energy, cost and time to fulfil the necessary permissions could be too onerous? Recommend that sources outside of these areas be chosen. Further it is generally known that boat users would like to dredge the river as some of the larger boats and less experienced skippers find it difficult to navigate the Kromme in its present state, thus allowing river access to become the key variable for dredging the Kromme?	most accessible source of material together with the potential volume required.	(Appendix I of the EIR).
	Page 48: Commented [FS33]: It seems that the preferred option is the most cost effective but has its disadvantages which should be weighed up against cost as sections of coast will continue to lose sand. More details on the affected beach areas should be discussed and made known to those homeowners adjacent to these areas?	This is addressed by Advisian in Section 5 of their report (please refer to Appendix F of this report).	The Estuarine and Dune Ecology Specialist Report (Appendix J of the EIR) assesses the impacts of the proposed project on the beach. Further to this Advisian's engineering reports (Appendix F of the EIR) provide the output of the coastal model carried out for the groyne and beach nourishment design.
	Page 50: Commented [FS34]: This aspect is already covered within an existing authorisation and why is this now added to the beach nourishment project at this stage when the KLM has already costed the placement of rock revetment on the spit (cost R 37 million) or is this just to ensure that the preferred revetment design by the technical committee for the spit is sandbags? This technology alternative is not part of Phase 2.	The Environmental Authorisation states that "The rock revetments as authorised in this Environmental Authorisation are only a temporary, intermediate solution." The SFPO NPC and the Kouga Local Municipality	Responded to and incorporated at scoping phase.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		agreed that the SFPO NPC would focus on obtaining approval for the second phase, i.e. the long-term coastal protection, whilst the municipality would attend to the temporary solution. The SFPO NPC and the municipality further agreed that the municipality will respond to any interim emergency measures. The Environmental Authorisation further states that "The second phase will be subject to a separate environmental assessment and will focus on beach nourishment and installation of various alternatives to provide further protection and encourage sand accumulation on the beach by means such as groynes, off-shore reefs and/or additional revetments." This environmental process responds directly to the directive given in the	

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		Environmental Authorisation.	
	Page 52: Commented [FS35]: For those living along the Kromme River the inconvenience of dredging equipment on a semi-permanent basis along the river and possibly banks will impact upon riverside homeowners. This will raise several questions which are not answered in this scoping report.	The Scoping Report will be updated to include consideration of the nuisance (noise and visual) effect of dredging equipment along the banks of the estuary.	Section 2.5 of the EIR describes the period of construction and operation expected for the dredging and groyne construction associated with each of the phases. Section 7.2 of the EIR details the impact of noise and potential visual disturbances and the relevant mitigation to reduce the impact to as low as reasonably possible.
	Page 52: Commented [FS36]: As the proposed coastal protection scheme as it stands is the preferred alternative it must be stated that those who have made this decision have made it on behalf of many other persons being the residents who are being levied for this project. Should this decision not be part of the collective?	Prior to the commencement of the formal EIA process, the proposed coastal protection scheme has been presented to the community at meetings held on the 20th of December 2017, the 3rd of January 2018, the 11th of January 2018 and the 20th of December 2018, as well as at a pre-application scoping process public meeting	The public participation process is designed to facilitate input from interested and affected parties.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		held on the 15th of April 2019. Both the Advisian Preliminary Design Reports and the Pre-application Scoping Report have been made available on the SFPO NPC web-site.	
	Page 57: Commented [FS37]: That is why we have been attempting to put revetments on the spit since the 1980's with limited or no success, but rock revetments designed and erected by revetment specialists are revealing that the rate of backshore infrastructure erosion can be halted. The movement of sand on and off the beach areas is a complex dynamic process which results in a percentage loss of sand to longshore drift. It is the loss of sand to the beach areas which is key to the success of Phase 2 nourishment. Should this item not be expanded in order to find a more cost-effective solution?	Beach nourishment will ensure a beach wide and high enough to protect backshore infrastructure and properties. The groynes will reduce sand loss due to long-shore drift and revetments will add to the protection of backshore infrastructure and properties.	Responded to and incorporated at scoping phase. .
	Page 57: Commented [FS38]: Current beach size is closely related to current coastal weather conditions and to an extent this will further play an important part in future beach status.	Climate change will result in larger tides and more intensive storm events. It has been well documented that a beach and associated infrastructure can reduce the impact of those tides and storms on the rate of erosion.	Responded to and incorporated at scoping phase.
	Page 57: Commented [FS39]: Ongoing saga – this study will be the 5th attempt to armour the spit as all others have failed due to various issues both political, financial and personal.	The major part of the project entails coastal protection, comprising groynes and beach nourishment, for the	Responded to and incorporated at scoping phase.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		entire length of the St Francis Beach. Protection of the Spit forms part of the project.	
	Page 57: Commented [FS40]: Yes and no it depends as to what level of river policing and education those in authority are prepared to go and further it must be noted that the Kromme river has had its sandbars and shallow areas since the 1940's when the early holiday makers arrived in this area.	This is not being disputed. The EAP would like the stakeholders to know that the system has been modified in the past.	Refer to the Estuarine and Dune Ecology Specialist Report (Appendix J).
	Page 57: Commented [FS41]: The very presence of the canal system has altered the Kromme Estuary and has had significant impacts to the river but in addition so has development all along the river and the increased volume of users on the river.	This has been included in the scoping report to demonstrate that the estuary has been modified.	Refer to the Estuarine and Dune Ecology Specialist Report (Appendix J).
	Page 57: Commented [FS42]: This is a very loose statement and has no basis on proven fact?	The project need and desirability is outlined in Chapter 4 of the Scoping Report.	Section 4 of the EIR describes the need and desirability for this project. Importantly the project will protect backshore infrastructure while also improving amenities locals and visitors are accustomed to.
	Page 111: Commented [FS43]: This is a most significant statement and should be followed up and reviewed with additional studies, especially as large areas of river sediment are to be stripped out of the estuarine functional zone for the beach.	This will be revisited in the Estuarine Specialist Report.	There will be a direct loss of species and associated habitat as a result of the dredging of the estuary. This will result in an impact. However, when

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			taken into context of the total area of habitat, the distribution of species and the associated mitigation measures the impact is deemed to be acceptable. Refer to the Estuarine and Dune Ecology Specialist Report (Appendix J).
	Page 111: Commented [FS44]: Are we going to rely on information dated 1984 which was just two years after the last full flood in the Kromme? I hope decisions on to the fate of our fish species in the Kromme will not be made on 35-year-old studies? Recommend that an all-inclusive Management Plan be initiated for the Kromme River prior to the current proposal being adopted.	Fish species are unlikely to be directly affected by the dredging activity. There may be a modification to the habitats within the estuary – this is a topic covered by the specialist report and EIR.	The dredging of the Kromme is expected to have very localised impacts. These impacts are determined by the dredging method, the size of the sand particles, the duration of dredging etc. The direct impacts to fish are unlikely since they are able to move from an area of disturbance. Indirect impacts (i.e. food resources) are also expected to be low since there are other

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			locations with the estuary that contain resources which will not be affected. Refer to the Estuarine and Dune Ecology Specialist Report (Appendix J).
	Page 112: Commented [FS45]: Last known observation of this species was about the time that the harbour at River glades was being built possibly in the 1980's. River glades is situated in dredging area C. Just to add the presence of a rare species of Gecko on the wetland area in 1902 should be noted.	This will be included and subject to suitable scientific references.	Refer to the Estuarine and Dune Ecology Specialist Report (Appendix J).
	Page 113: Commented [FS46]: Significant issue. The opening up of the Kromme river will allow unabated access for large vessels up and down the lower reaches of the river. This river is already oversubscribed with water craft especially during the holiday season. To date no study has been done to determine the impact of both motor and jet boats on the Kromme River?	The Kromme Joint River Committee (KJRC), which represents the Home Owners Associations and Share Blocks along the Kromme River, was restructured in 2016 to manage and maintain the river boating activities, including law enforcement. The KJRC expressed their support for the long-term coastal protection project, including the possible sourcing of sand from the river. River control issues and concerns should be raised with the KJRC.	Refer to the Estuarine and Dune Ecology Specialist Report (Appendix J). The EMPr also makes reference to the requirement for the management of vessel numbers and speed within the estuary. This responsibility is currently with KJRC as commented previously.
	Page 114: Commented [FS47]: The opening of the channel through dredging would allow for continuous boat traffic passing at both low and high tides. At present, at least one has some sort of natural barrier/respite at low tide to boating on the river during peak	As per the above response.	See above.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	holiday periods which will allow for the river to recover and let kids and fishermen a chance to enjoy their sports without high speed boats with large wakes traversing the river. It is noted that there are over 1000 boats registered to be on the Kromme, and if dredging occurs as intended there must be greater level of river control which at present is done naturally by the current tidal system.		
	Page 116: Commented [FS48]: What is of concern from the dredging perspective is that the impacts of these works are not reversible so we have to be absolutely certain that what is intended is the correct system.	The EIA will determine the potential impacts based on scientific literature, expertise and past experience. It will be important that monitoring plans are established and implemented to pick up whether the predictions made in the EIA were accurate or not.	Section 7.2 provide the assessment of impacts which have been informed by the Advisian engineering and modelling reports (Appendix F of the EIR) and the specialist reports (Appendix I and J of the EIR). In many cases while the impacts may not be easily reversed, the impacts are deemed to be low with mitigation measures implemented.
	Page 122: Commented [FS49]: More boats deeper water faster speed will result in larger wakes from boats which will slowly erode out the bank of the central wetland. This process is already ongoing due to uncontrolled boat speeds up and down the river, but on a less vigorous level as currently boats have to slow down due to shallow waters. Dredge and more of the river banks will erode into the river. This is such a difficult process to determine but the results are evident at points along areas B and C of the proposed dredging areas, due to large craft moving at speed.	The Kromme Joint River Committee (KJRC), which represents the Home Owners Associations and Share Blocks along the Kromme River, was restructured in 2016 to manage and maintain the river boating activities, including law	Refer to the Estuarine and Dune Ecology Specialist Report (Appendix J). The EMPr also makes reference to the requirement for the management of vessel numbers and speed within the

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		enforcement. The KJRC expressed their support for the long-term coastal protection project, including the possible sourcing of sand from the river. River control issues and concerns should be raised with the KJRC.	estuary. This responsibility is currently with KJRC as commented previously.
	Page 122: Commented [FS50]: And estuarine fauna?	This is included in the Estuarine Specialist Report.	Refer to Section 4.7 and Section 8 of the Estuarine and Dune Ecology Specialist Report (Appendix J of the EIR) for details regarding the fauna of the estuary and the associated impacts.
	Page 122: Commented [FS51]: One talks about not disturbing the special habitats but if one removes the only impediment to slowing down boat speed being the sand banks the resultant wake action will accelerate the erosion of wetland areas.	Erosion of banks due to vessel traffic has been included in the Estuarine Specialist Report.	Refer to the Estuarine and Dune Ecology Specialist Report (Appendix J of the EIR). Section 7.2 of the EIR specifically identified the impact of boating and its potential impact. There are also recommended mitigation measures which fall within the KJRC as mentioned above.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	Page 122: Commented [FS52]: The decrease in navigability of the river also has a positive impact as it allows the river system during peak seasons to rest during low tides. In the lower Kromme river the volume of boats moving up and down the river drop from 1 every 20 seconds to 1 every 5min at low tides. This allows the fishermen and smaller children the opportunity to explore the river without the threat of a 6.5m jet boat riding at 30km/hr in shallow water.	This will be considered during the development of the impacts associated with the amenity of the estuary.	Refer to the Estuarine and Dune Ecology Specialist Report (Appendix J of the EIR). Section 7.2 of the EIR specifically identified the impact of boating and its potential impact. There are also recommended mitigation measures which fall within the KJRC as mentioned above.
	Page 126: Commented [FS53]: This will affect those who live on the banks of the Kromme river and are permanent residents where the canal system is essentially a second home for holidays.	This is not disputed.	Section 7.2 of the EIR has provided a detailed impact assessment covering all the potential risks to natural and built environment as well as social implications.
	Page 131: Commented [FS54]: Your site notices do not exist as they have now got wet and disintegrated. Have only viewed one notice at Shore Rd and none other?	Site notices were initially placed in two (2) locations on the 21st of December 2018: 1) At the intersection of Canal Rd and Shore Rd and 2) At the beach stairway located at the end of the Aldbara Run. Site notices were later placed at the	Responded to and incorporated at scoping phase.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		following locations on the 9th of April 2019: 1) At the Spar located along St Francis Dr; 2) Main beach located at the end of Nevil Rd; 3) At the beach parking area located at the end of Anne Ave; 4) At the intersection of Canal Rd and Shore Rd; 5) At the Small Boat Harbour located along La Digue Pl; 6) The Library; 7) The St Francis Links; and 8) The Kouga Local Municipality Municipal Offices.	
	Page 199: Commented [FS55]: Note this is only a preliminary design report & one would expect the final report to follow ASAP so one can make a fair judgement.	Detailed design will follow the outcome of the EIA so that any recommendations can be incorporated into the design.	Appendix F of the EIR contains Advisian's preliminary design reports as well as updated reports describing the revised location and orientation of the groynes. While these designs are preliminary the supporting coastal modelling that has been carried out allows for the detailed design to follow.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	Page 213: Commented [FS56]: It is noted that this authorisation is missing from the scoping report discussed previously?	This is now included in Appendix H of this report.	Responded to and incorporated at scoping phase.
	Page 222: Commented [FS57]: The option chosen - note constraints based on concept modelling and preliminary design. Decisions are being made on untested proposal. Are we in a position to experiment with our coastline?	This is addressed by Advisian in Section 5 of their report (please refer to Appendix F of this report). Decisions are based on financial considerations, available information and guidance provided by the coastal engineers.	Appendix F of the EIR contains Advisian's preliminary design reports as well as updated reports describing the revised location and orientation of the groynes. These updates have been tested through coastal modelling studies. The various coastal protection options explored for this project are contained in the engineering documents and are based on structures used for these purposes.
	Page 222: Commented [FS58]: Too many what-ifs on this one. Looks like more in-depth research on the feasibility of this option is needed. The success and feasibility of the preliminary design will be incumbent upon several necessary new studies to validate the information based primarily on 15-year-old data of which one of the most important studies is not available. Under these circumstances the overall success of this project is considerably unlikely.	Further development of the design will be undertaken during the Detailed Design and when bathymetric information becomes available.	Appendix F of the EIR contains Advisian's preliminary design reports as well as updated reports describing the revised location and orientation of the groynes. Updated

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		As the project is intended to be implemented in phases, adjustments could be made between phases to improve the performance of the structures.	bathymetry and topographical surveys were obtained and used to carry out the additional modelling studies.

	Page 224: Commented [FS59]: Comparing with PRDW 2018 costing for spit costing estimates are too low and need to be reworked? These figures need to be revised upwards.	The November 2018 PRDW report (prepared for Kouga Local Municipality and not in the public domain), referred to by the I&AP may be outdated and/or incorrect. Advisian will be requested to recalculate their cost estimate and amend this if necessary.	The PRDW 2018 costing, mentioned to be R37 million in Comment FS34 above, has now been proven to be completely inapplicable. The actual cost of the emergency spit revetment constructed by the municipality is approximately the same as the estimated cost of Advisian's rock revetment. The dimensions of the emergency revetment is similar to that of Advisian's rock revetment, albeit that the revetment designed by Advisian will serve as the last defence (the 40 metre wide beach at a level 1 metre higher than the current beach level being the primary defence). This confirms Advisian's estimate as being correct and

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			builds confidence in their cost estimates. Be it as it may, the detailed design of the revetment at the spit (as part of this project) will incorporate the emergency repairs.
	Page 224: Commented [FS60]: Very optimistic and under the current circumstances not true due to lack of adequate finance and priority scheduling.	The construction duration mentioned is for a scenario where funding for the whole project is secured. It is, however, more likely that the project will be phased, as described in Section 2.4 of the Scoping Report.	Section 2.4 and 2.5 of the EIR elaborates on the proposed timing for construction and operation activities. These have been provided by the engineer based on the preliminary design.
	Page 225: Commented [FS61]: The way forward – seems that additional specialist works are needed to be done and these works will have to be costed into the overall project cost?	The items listed are work that will be carried out by Advisian or by specialists under their direct control at the appropriate time. The sand source investigation, listed as Item 5, is being conducted as part of this EIA process.	The specialist reports have been used to inform the EIR. The requirements for the specialist reports was agreed to by the competent authority who also provide comment on their suitability as part of the EIA process. Should additional reports/studies be required, this will be

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			at the request of the competent authority or as a recommendation of the EIR. The costs for these would need to be covered by the proponent.
	Page 231: Commented [FS62]: Advisian does not include for revetment type for the Spit area, but it does, this rather confusing statement?	Advisian was initially not appointed to undertake any design work on revetments. They were, after the submission of their preliminary design report, appointed to design a revetment that would form an integral part of the long-term coastal protection infrastructure.	Responded to and incorporated at scoping phase.
	Page 231: Commented [FS63]: Scope – Restore Beach Amenity, previous it was to prevent erosion. The aims of this project need to be defined and clearly stated.	The primary aim is to restore the beach as a buffer against erosion. The amenity regained as part of this work is an additional benefit.	Responded to and incorporated at scoping phase.
	Page 231: Commented [FS64]: Provide Alternatives	This is addressed by Advisian in Section 5 of their report (please refer to Appendix F of this report).	Responded to and incorporated at scoping phase.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	Page 231: Commented [FS65]: Who selected preferred solution?	This is addressed by Advisian in Section 5 of their report (please refer to Appendix F of this report).	Responded to and incorporated at scoping phase.
	Page 231: Commented [FS66]: Minimize capital cost and maintenance costs	According to the Client, it is normal engineering practice to minimise costs during the detail design stage of a project without compromising the functionality of the designed infrastructure.	Responded to and incorporated at scoping phase.
	Page 231: Commented [FS67]: These items presumably are still to happen. Cost estimate to be included.	The items listed are work that will be carried out by Advisian or by specialists under their direct control at the appropriate time.	Responded to and incorporated at scoping phase.
	Page 232: Commented [FS68]: CD – Chart Datum 0.836m below MSL.	Noted	Responded to and incorporated at scoping phase.
	Page 235: Commented [FS69]: Missing an essential study for Bathymetry. Relevance of previous studies will only be of use if a further current study is undertaken so as comparisons can be made as to the past present and possibly the future? So, in short, we have no Bathymetric data on St Francis Bay since 2005. Trust this will be updated through additional studies.	The information available was sufficient for preliminary design purposes. Any survey work that may be required will be scoped in consultation with Advisian prior to commencement of detail design.	Advisian used updated bathymetry for both the estuary and the coastal environment to conduct the modelling as part of an update to their engineering reporting. Refer to Appendix F of the EIR for further information.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	Page 235: Commented [FS70]: Is a specialist report which is not available for whatever being used in absentia to assist in the design of the preferred defence structure?		The engineering reports in Appendix F provide more detail on the information used to develop the preliminary design.
	Commented [FS71]: Interesting point as it has been commented that the present-day beach has reached a new equilibrium. Is this possible and how would it be determined? On macro visual inspections there seems to be some sort of equilibrium between the erosion and deposition cycle with an overall loss. These are just qualitative statements but as we don't have any quantity measures it remains unproven. Interesting this was noted prior to 2006. It would be of importance to draw a comparison between today and the past.	This is detailed in the engineering reports through the collection of beach profiles. The aim of the project is to restore the beach to act as protection from erosion.	Responded to and incorporated at scoping phase.
	Page 239: Commented [FS72]: Agree on this point as the SFB coast was subject to 2 major storm surges over the mentioned period.	Noted.	Responded to and incorporated at scoping phase.
	Page 240: Commented [FS73]: Is it possible that any one event could be the source of this continued erosion?	Whilst a single event can cause significant loss of sediment from the upper beach to offshore, beach profiles typically experience a recovery period. The long-term erosion of the St Francis beach over several decades have been well studied and also summarized in the WorleyParsons (2014) report.	Responded to and incorporated at scoping phase.

	Page 242: Commented [FS74]: See PRDW costing estimate for spit revetment 2018	The November 2018 PRDW report (prepared for Kouga Local Municipality and not in the public domain), referred to by the I&AP may be outdated and/or incorrect.	The PRDW 2018 costing, mentioned to be R37 million in Comment FS34 above, has now been proven to be completely inapplicable. The actual cost of the emergency spit revetment constructed by the municipality is approximately the same as the estimated cost of Advisian's rock revetment. The dimensions of the emergency revetment is similar to that of Advisian's rock revetment, albeit that the revetment designed by Advisian will serve as the last defence (the 40 metre wide beach at a level 1 metre higher than the current beach level being the primary defence). This confirms Advisian's estimate as being correct and

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			builds confidence in their cost estimates. Be it as it may, the detailed design of the revetment at the spit (as part of this project) will incorporate the emergency repairs.
	Page 246: Commented [FS75]: It is noted that storm event surge information if evaluated from Port Elizabeth. What direct implications of the use of this data is relevant to St Francis. Or what are the local conditions which will possibly make the PE data different in our location?	While some differences in storm surge could be expected between PE and St Francis Bay because of variances in wind speed, direction and atmospheric pressure, the storm surge would be similar in magnitude. As no measured water level data is available for St Francis Bay, this assumption is at presently the most reasonable.	Responded to and incorporated at scoping phase.
	Page 262: Commented [FS76]: Hard core data missing.	The available information is sufficient for preliminary design purposes. Wave modelling is addressed in Section 4.2 of Advisian's report (please refer to Appendix F of this report).	Updated bathymetry data was collected in 2020 which informed the revised design presented in the EIR. Appendix F of the EIR contains the engineering reports which elaborate on

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			the data used to inform the design.
	Page 272: Commented [FS77]: Common occurrence at SFB, but as already stated not proven?	Analysis of the beach profile surveys has indicated that the profiles tend to recover following a storm event, although not always to the same level as prior to the storm event.	Responded to and incorporated at scoping phase.
	Page 314: Commented [FS78]: Is the preferred option not too much of a compromise from the point of view of the deliverables versus cost maintenance and long-term viability? The certainty of these statements negates the purpose of this scoping report as it seems that what we are reading is final?	This paragraph, which compares Option 1A and Option 1B must be read in context with the layout alternatives described in Section 3.3.1 of the Scoping Report (this report).	Responded to and incorporated at scoping phase.
	Page 314: Commented [FS79]: Important statement that the shoreline configurations are purely conceptual, and that further assessment needs to be undertaken. We are viewing a possible concept obviously not a final option.	This option, if finally adopted, will be further developed during the detail design phase.	Responded to and incorporated at scoping phase.
	Page 317: Commented [FS80]: Still further works to be validated and verified.	The suitability (size, shape and material) of revetment material will be verified and validated at an appropriate time during the design phase.	Responded to and incorporated at scoping phase.
	Page 319: Commented [FS81]: Not very optimistic option? This should be compared to the present-day situation with just rock revetments in terms of duration of protection and cost.	The present-day situation does not provide sufficient coastal protection.	Responded to and incorporated at scoping phase.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	Page 320: Commented [FS82]: Are the minutes of this workshop recommendation and preferred option available for comment as these decisions impact on all residents of SFB.	Minutes of the workshop referred to by the I&AP are available on the SFPO NPC website.	Responded to and incorporated at scoping phase.
	Page 322: Commented [FS83]: Please confirm that the spit will receive priority and if the rest of the coast will await funding? What are the consequences of this agreed option? Again, the reasons for these decisions must be made public and the necessary public participation be carried out?	Prior to the commencement of the formal EIA process, the proposed coastal protection scheme has been presented to the community at meetings held on the 20th of December 2017, the 3rd of January 2018, the 11th of January 2018 and the 20th of December 2018, as well as at a pre-application scoping process public meeting held on the 15th of April 2019. Both the Advisian Preliminary Design Reports and the Pre-application Scoping Report have been made available on the SFPO NPC website. The long shore drift is northwards, and it is therefore sensible to construct the northernmost groynes first to intercept the transported sand. One of the purposes of this EIA	Responded to and incorporated at scoping phase.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		process is, inter alia, to present a proposed technical solution for scrutiny to an affected community and to ascertain community feedback and preferences.	
	Page 322: Commented [FS84]: Please confirm that we will go into this major project on prototypes and changes to the proposed option will be necessary?	Advisian are indicating that the phasing of the project, necessitated by funding restrictions, has an advantage in that the performance of the first groyne(s) and nourishment can be assessed, and that any desired adjustments can be made to groynes constructed in the subsequent phases.	Responded to and incorporated at scoping phase.

	Page 322: Commented [FS85]: On 2018 pricing this would cost 37 million (PRDW 2018)	The November 2018 PRDW report (prepared for Kouga Local Municipality and not in the public domain), referred to by the I&AP may be outdated and/or incorrect.	The PRDW 2018 costing has now been proven to be completely inapplicable. The actual cost of the emergency spit revetment constructed by the municipality is approximately the same as the estimated cost of Advisian's rock revetment. The dimensions of the emergency revetment is similar to that of Advisian's rock revetment, albeit that the revetment designed by Advisian will serve as the last defence (the 40 metre wide beach at a level 1 metre higher than the current beach level being the primary defence). This confirms Advisian's estimate as being correct and builds confidence in their cost estimates.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			Be it as it may, the detailed design of the revetment at the spit (as part of this project) will incorporate the emergency repairs.
	Page 322: Commented [FS86]: More studies more time and issues which negates the validity and effectiveness of the preferred option.	Advisian refer to the risk associated with the Spit being breached before the long-term coastal protection infrastructure is installed. Subsequently, Advisian have been commissioned to do a preliminary design for a revetment for the Spit, and this EIA process has commenced (this process).	Responded to and incorporated at scoping phase.
	Page 323: Commented [FS87]: Too many important statements are being made on unsubstantiated information which degrades the validity of the preferred option.	The preliminary design is based on coastal modelling undertaken by competent coastal engineers. The design will be refined during the detail design stage.	Advisian performed additional coastal modelling in 2020 to support the refinement of the groyne design. Updated bathymetry data was collected and used to perform the modelling. Refer to Appendix F of the EIR for further engineering detail

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			and assumptions made.
	Page 335: Commented [FS88]: Obvious that these are early days and further detailed studies are necessary to ensure the effectiveness of the preferred design?	The items listed, apart from the sand source investigation which is currently underway, are work that will form part of the detail design.	Advisian performed additional coastal modelling in 2020 to support the refinement of the groyne design. Updated bathymetry data was collected and used to perform the modelling. Refer to Appendix F of the EIR for further engineering detail and assumptions made.
	Page 377: Commented [FS89]: It is noted that this is a second preliminary design report – added on 04 February 2019, and generally includes rock revetments and some costings. It again is noted that this report is preliminary but signed of as final below?	This is a preliminary design report for a revetment for the Spit, whereas the previous report prepared by Advisian was for long term coastal protection excluding any revetments. It is the final version of a document reporting on the preliminary design.	Responded to and incorporated at scoping phase.
	Page 382: Commented [FS90]: On what basis was the second report requested, and why?	Advisian has, in their Preliminary Design report for the long-term coastal protection infrastructure, identified the necessity to	Responded to and incorporated at scoping phase.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
		install a revetment to protect the Spit. From an engineering perspective, it is sensible to integrate the revetment design with the rest of long-term coastal protection infrastructure design.	
	Page 382: Commented [FS91]: The same conclusion reached by PRDW.	Noted.	Responded to and incorporated at scoping phase.
	Page 386: Commented [FS92]: Again, we see only reference to the spit area but no mention of any other open beach area such as main beach and George Road?	Advisian reported here on their preliminary design for a revetment for the Spit.	Responded to and incorporated at scoping phase.
	Page 398: Commented [FS93]: The current status is that the KLM would proceed with the construction of revetments along the spit in accordance with design supplied by PRDW (Cost Estimate PRDW October 2018; St Francis Bay Spit Protection Revetment). Obviously, this has changed.	The Kouga Local Municipality is currently preparing an application to the National Department of Environmental Affairs (DEA) (National) and National Treasury for assistance to fund this work. The SFPO NPC and the Kouga Local Municipality are in discussions on how the two Parties can possibly combine funding, if made available, to achieve the best outcome for the Spit and Beach.	Responded to and incorporated at scoping phase.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	Page 399: Commented [FS94]: This is a statement with no visible backup in any report?	It is the opinion of the competent engineer that a built-up beach, 40 metres wide, will allow for construction in the dry and for easy access.	Responded to and incorporated at scoping phase.
	Page 409: Commented [FS95]: This statement backs up the PRDW statement advising against the use of GSC containers along this coast.	Noted.	Responded to and incorporated at scoping phase..
	Page 410: Commented [FS96]: Additional costs and analysis.	Noted.	Responded to and incorporated at scoping phase.
	Page 410: Commented [FS97]: Is this not an attempt to use stock already purchased but not used?	The availability of purchased material has been incorporated into the design of this option.	Responded to and incorporated at scoping phase.
	Page 411: Commented [FS98]: Is this not the case of fitting a square peg into a round hole?	The availability of purchased material has been incorporated into the design of this option.	Responded to and incorporated at scoping phase.

	Page 412: Commented [FS99]: Pricing obtained during late 2018 reflected a rate of R400/ton - and in addition for the rock revetment option the quantities required for a solid revetment do not correlate?	The November 2018 PRDW report (prepared for Kouga Local Municipality and not in the public domain), referred to by the I&AP may be outdated and/or incorrect. Advisian will be requested to recalculate their cost estimate and amend this if necessary. A revetment constructed on the current beach level and width that serves as the primary defence will cost more than a revetment that is integrated into a long-term coastal protection scheme, where it is constructed on a different beach level and will be fulfilling a last defence function.	The PRDW 2018 costing has now been proven to be completely inapplicable. The actual cost of the emergency spit revetment constructed by the municipality is approximately the same as the estimated cost of Advisian's rock revetment. The dimensions of the emergency revetment is similar to that of Advisian's rock revetment, albeit that the revetment designed by Advisian will serve as the last defence (the 40 metre wide beach at a level 1 metre higher than the current beach level being the primary defence). This confirms Advisian's estimate as being correct and builds confidence in their cost estimates.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			Be it as it may, the detailed design of the revetment at the spit (as part of this project) will incorporate the emergency repairs..

	Page 414: Commented [FS100]: Please look at the costings as these costs are lower than pricing obtained in 2010 (+_ R15 million) for the previous spit revetment authorisation?		The PRDW 2018 costing has now been proven to be completely inapplicable. The actual cost of the emergency spit revetment constructed by the municipality is approximately the same as the estimated cost of Advisian's rock revetment. The dimensions of the emergency revetment is similar to that of Advisian's rock revetment, albeit that the revetment designed by Advisian will serve as the last defence (the 40 metre wide beach at a level 1 metre higher than the current beach level being the primary defence). This confirms Advisian's estimate as being correct and builds confidence in their cost estimates.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			Be it as it may, the detailed design of the revetment at the spit (as part of this project) will incorporate the emergency repairs
	Page 415: Commented [FS101]: Such a valid and important comment which should be enforced on all works along the SFB coast which still and in the past was not implemented	Portions of the existing revetments have failed and subsided (which lead to Advisian's proviso "when properly designed and maintained". However, a beach nourished in accordance with the Advisian design will reduce wave action against the revetments.	Responded to and incorporated at scoping phase.
	Page 416: Commented [FS102]: Expensive and will require additional modelling	Noted.	Responded to and incorporated at scoping phase.
	Page 416: Commented [FS104R103]: Is St Francis with all its issues regarding the beach with revetment, PEMs etc. not past high-risk solutions?	Noted.	Responded to and incorporated at scoping phase.
	Page 418: Commented [FS105]: Important	Noted.	Responded to and incorporated at scoping phase.

Table 2 Comments Received During the Public Review Period for the Draft Scoping Report (20 August 2019 to 18 September 2019)

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
Comments Received During the Public Review Period for the Draft Scoping Report (20 August 2019 to 18 September 2019)			
Roy Smith 082 782 4451 smithrns@iafrica.com	Thank you for the opportunity to comment on your Report. Attached please four comments, documented in separate word files, I wish to submit Please acknowledge receipt of this e-mail submission		
	Thank you for the opportunity to comment on your Report. I wish to comment on paragraph 5, page 23: Relevant Legislation There is a significant gap in your legislative framework for not referencing the Local Government Municipal Systems Act of 2000. The following important links should be incorporated: Integrated Coastal Management Act Section — Description 20.(1) (h) — A municipality in whose area coastal access land falls, must describe or otherwise indicate all coastal access land in any municipal coastal management programme and in any municipal spatial development framework prepared in terms of the Municipal Systems Act; 48.(2) — Before adopting a programme contemplated in subsection (1)(a), a municipality must by notice in the Gazette invite members of the public to submit written representations on or objections to the programme in accordance with the procedure contemplated in Chapter 4 of the Municipal Systems Act	Noted. The additional legislative framework will be included in the EIR.	The EIR has been updated. While the property along the frontage is considered private land in parts, the municipality has responsibility for ensuring infrastructure remains fit for purpose. The access to the beach is facilitated through a number of car parks and ramps/stairs along the frontage. Access to these areas are not anticipated to be restricted. This project aligns with the CMP in that is facilitates access to the amenities and enhances them. Tourism has been identified as the main opportunity in St Francis Bay and this

<table>
<tr><th>I&AP DETAILS</th><th>COMMENT</th><th>EAP RESPONSE (FSR)</th><th>EAP RESPONSE (DEIR)</th></tr>
<tr><td colspan="4">Comments Received During the Public Review Period for the Draft Scoping Report (20 August 2019 to 18 September 2019)</td></tr>
<tr><td></td><td><table>
<tr><td>48. (4)</td><td>A municipality may prepare and adopt a coastal management programme as part of an integrated development plan and spatial development framework adopted in accordance with the Municipal Systems Act and if it does so, compliance with the public participation requirements prescribed in terms of the Municipal Systems Act for the preparation and adoption of integrated development plans will be regarded as compliance with public participation requirements in terms of this Act.</td></tr>
<tr><td>51</td><td>An environmental implementation or environmental management plan in terms of Chapter 3 of the National Environmental Management Act, an integrated development plan in terms of the Municipal Systems Act and a provincial or municipal land development plan must (a) be aligned with the national coastal management programme and any applicable provincial coastal management programme; (b) contain those provisions of the national coastal management programme and any applicable provincial coastal management programme that specifically applies to it; and (c) give effect to the national coastal management programme and any applicable provincial coastal management programme.</td></tr>
</table></td><td>Noted.</td><td>scheme will not only protect what is already established but enhance tourism potential through the improvement of the beach amenity.

The final local CMP includes reference to this project.</td></tr>
</table>

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
Comments Received During the Public Review Period for the Draft Scoping Report (20 August 2019 to 18 September 2019)			

52 (1) (b)	For the purposes of this section, "statutory plan" means a plan, policy or programme adopted by an organ of state that may affect coastal management, and without limitation, may include (b) an integrated development plan adopted by a municipality in terms of the Municipal Systems Act;

In addition to your content, the following should be added

Legislation	Relevance to the Proposed Project	Permit / Licence Required	Comment
National Environmental Management: Integrated Coastal Management (ICM) Act (Act No 24 of 2008)	The proposed project occurs within Coastal Public Property (CPP) as it aims to maintain the existing beach located in St Francis Bay. The roles and responsibilities of key stakeholders must be clearly defined to encourage ownership of the ICM goals. The potential impacts associated with the coastal environment will be identified and further assessed in the EIA phase of the project. The ICM Act provides for additional criteria that must be considered by the competent authority when evaluating an application for an activity which will take place in the coastal zone. The EIA must assess the potential risks and impacts that the natural environment will have on the proposed project in terms of storm surges, sea level rise and other coastal processes which occur in the area.	✓	The use of vehicles in a coastal protection zone and the reclamation of land, as well as the dredging of the Kromme Estuary, may require a permit (coastal lease) from the Coastal Conservation and Strategies Directorate of the Department of Environmental Affairs (DEA): Oceans and Coasts Branch.

	Measures affecting erosion and accretion 15. (1) No person, owner or occupier of land adjacent to the seashore or other coastal public property capable of erosion or accretion may require any organ of state or any other person to take measures to prevent the erosion or accretion of the seashore or such other coastal public property, or of land adjacent to coastal public property, unless the erosion is caused by an intentional act or

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<tr><td></td><td>
<table><tr><td></td><td>omission of that organ of state or other person.
(2) No person may construct, maintain or extend any structure, or take other measures on coastal public property to prevent or promote erosion or accretion of the seashore except as provided for in this Act.</td></tr></table>
Thank you for the opportunity to comment on your Report. As invited, I wish to comment on the public participation process, as described in Paragraph 8 and Appendix B of your report published in August 2019. I first wish to provide context to my comments.
I agree with paragraph 5.8, page 56, of your Report. In order to maintain a story line to my comments, I have duplicated the relevant parts of the Integrated Coastal Management Act (ICMA) of 2008 below:

Chapter 2; Part 1; Ownership of Coastal Property; Section 11 (1) states: 'The ownership of coastal public properly vests in the citizens of the Republic and coastal public properly must be held in trust by the State on behalf of the citizens of the Republic'. Further on in the same Chapter; State public trustee of coastal public property; Section 12 states: 'The State, in its capacity as the public trustee of all coastal public property, must (a) ensure that coastal public property is used, managed, protected, conserved and enhanced in the <u>interests of the whole community</u> and..'.
As per the definitions in Chapter 1 of the ICMA <u>"interest of the whole community"</u> means the collective interests of the community determined by (a) prioritising the collective interests in coastal public property of all persons living in the Republic over <u>the interests of a particular group</u> or sector of society.

What you did not reference in paragraph 5.8 of your Report, the relevance of this will become clear in the following paragraphs, are the following provisions in the ICMA:

Chapter 2; Part 3; Responsibilities of municipalities with regard to coastal access land; Section 20 (h) which states: 'describe or otherwise indicate all coastal access land in any municipal coastal management programme and

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I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
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	in any municipal spatial development framework prepared in terms of the Municipal Systems Act' • Chapter 6; Part 3; 48 (2) Municipal coastal management programmes; Preparation and adoption of municipal coastal management programmes; Before adopting a programme contemplated in subsection (1)(a): *'a municipality, must invite members of the public to submit written representations on or objections to the programme in accordance with the procedure contemplated in Chapter 4 of the Municipal Systems Act'* The Local Government Municipal Systems Act (MSA) of 2000 Chapter 1; Interpretation; defines: "local community" or '"community", in relation to a municipality means that body of persons comprising (a) the residents of the municipality; (b) the ratepayers of the municipality, (c) any civic organisations and non-governmental private sector or labour organisations or bodies which are involved in local affairs within the municipality: and (d) visitors or other people residing outside the municipality who, because of their presence in the municipality make use of services or facilities provided by the municipality, and includes, more specifically, the poor and other disadvantaged sections of such body of persons. The poor and disadvantaged is understood to include the residents of Sea Vista, residents living in informal settlements close to St Francis Bay Beach, residents living in informal settlements in Humansdorp, all of whom make use of the beach facilities in St Francis Bay. MSA Chapter 4; Mechanisms, processes and procedures for community participation; section 17. (3) states: *'When establishing mechanisms, processes and procedures in terms of subsection (2) the municipality must take into account the special needs of (a) people who cannot read or write; (b) people with disabilities (c) women: and (d) other disadvantaged groups'* Also refer to the National Coastal Management Programme, Paragraph 3.1 Mandatory Roles and Responsibilities; 3.1.3 Local Government		
	1. No provision was made in public participation process for the *'special needs'* of the poor and disadvantaged people residing in: a. Sea Vista, b. Informal settlements close to St Francis Bay Beach; and c. Informal settlements in Humansdorp.	The intention of the public participation was to be as inclusive as possible particularly focussing on those in the immediate vicinity	Ongoing throughout the EIA process. Please refer to Appendix B of the EIR for more information and detail

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	It is generally accepted that the majority of these residents cannot read, do not readily access the facilities where adverts were placed and do not have access to media platforms used in the public participation process. The public participation process therefore does not comply with the requirements of Chapter 4 of the Local Government Municipal Systems Act of 2000	and adjacent to the project site. We understand and appreciate that those who don't necessarily reside adjacent to the site do make use of the amenities which is why we include the Ward Councillors as I&APs. Notices were displayed in the local SPAR and the municipality engaged with ward councillors and community members during IDP meetings. CES will continue to engage with the Ward Councillors in order to gain their (and their constituents) input.	of the public participation process.
	2. The fact that *'special needs'* of the poor and disadvantaged people were ignored could be interpreted as discriminatory.	Please see comment above.	Please refer to Appendix B of the EIR for more information and detail of the public participation process.
	3. The public participation process placed the interests of St Francis Bay Property Owners above the collective interests of the 'whole community'.	Please see above. The intention was to ensure that all potential I&APs are provided an opportunity to review documentation and	Please refer to Appendix B of the EIR for more information and detail of the public participation process.

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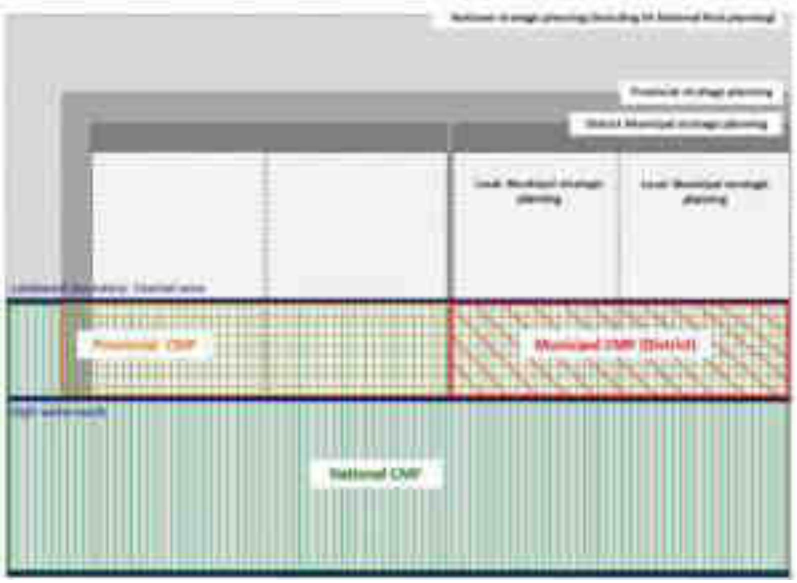
		provide their input. This will continue through the EIA phase.	
	Thank you for the opportunity to comment on your Report. I wish to comment on page 21, paragraph 4.3, of your Report: Alignment with District and Local Development Plans, I refer you to Chapter 6 of the Integrated Coastal Management Act (ICMA) of 2008 and in particular the hierarchical arrangement of coastal management plans, which is depicted below:  Chapter 6; Part 4; Co-ordination and alignment of plans and coastal management programmes states: • Alignment of plans and coastal management programmes; Section 51. An environmental implementation or environmental management plan in terms of Chapter 3 of the National Environmental Management Act, an integrated development plan in terms of the Municipal Systems Act and a provincial or municipal land development		We thank you for your information relating to the ICMA and CMPs. We are familiar with Chapter 6 of the ICMA, having prepared a number of CMPs, but we are uncertain of the relevance of Chapter 6 to the current project. This project, which will take place within Coastal Public Property, is not a programme but a specific intervention with goals aligned to the provisions of the ICMA. It is to improve access to the coastline, improve its recreational value; ensure that the coastlines coastal protection functions can continue; and assist in protecting natural and built assets from sea level rise. The project does

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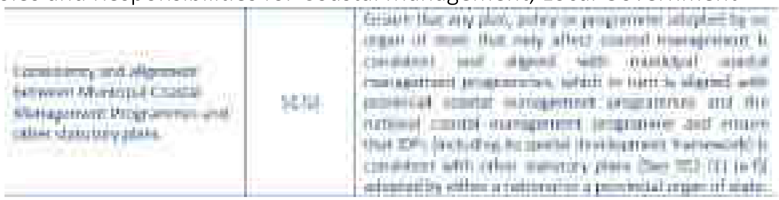
	plan must (a) be aligned with the national coastal management programme and any applicable provincial coastal management programme; (b) contain those provisions of the national coastal management programme and any applicable provincial coastal management programme that specifically applies to it; and (c) give effect to the national coastal management programme and any applicable provincial coastal management programme. • Ensuring consistency between coastal management programmes and other statutory plans; Section 52 (4). Each municipality in the coastal zone must ensure that its integrated development plan (including its spatial development framework) is consistent with other statutory plans adopted by either a national or a provincial organ of state. Chapter 6; Part 3; Municipal coastal management programmes; Contents of municipal coastal management programmes Section 49 (2) A municipal coastal management programme must include (c) priorities and strategies (v) to address coastal erosion and accretion; I also wish to refer you to the extract below from the National Coastal Management Programme of South Africa cited as: Department of Environmental Affairs (2014) South Africa's National Coastal Management Programme. Cape Town; page 59, paragraph 3.1.3 Roles and Responsibilities for Coastal Management, Local Government  The current state of coastal management plans relating to municipal districts and local municipality in the area is as follows: 1. <u>Coastal Management Programme (CMP) for the Sarah Baartman District Municipality</u> Sarah Baartman District Municipality is in the process of developing a Coastal Management Programme (CMP) for the Sarah Baartman District Municipality - Reference: https://environmentcen.co.za/project-items/sarah-baartman-district-municipality-coastal-management-programme/ 2. <u>Coastal Management Programme for the Kouga Municipality</u>		in fact align with the policy guidelines contained in the local CMP and the District level CMP . On page 163 the Kouga CMP talks to various development issues and risks, and highlights the inappropriate locational of developments close to the high water mark, and the resultant threats due to beach erosion. It then goes on to mention under the opportunities section on page 171 that the environmental assessment being undertaken on the coastal erosion and beach nourishment scheme in St Francis Bay is an opportunity. Implicit in this statement is the fact that the Kouga CMP

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	The Integrated Development Plan (2017/2022) 2nd Review 2019/2020 Adopted by Council on 30 May 2019 Resolution No 19/05/MM3 refers. As per SOD 4.6 (Environmental Management Focus Area Coastal Management) the Coastal Management Plan will only be 50% completed by 20/21		supports this initiative, and sees it as consistent with the coastal management programme.
	(a) It does not accurately report on the status of the coastal management programmes for Sarah Baartman District Municipality and the Kouga Municipality,	This will be updated for the EIR. Based on publicly available information the draft SBDM CMP does not provide specific detail at this stage to identify the schemes alignment with it.	Section 4 of the EIR describes the project's alignment with local, provincial and national development plans. The final SBDM CMP is available which identifies the risk of erosion to the infrastructure and the need to mitigate for those risks.
	(b) The context of the paragraph incorrectly implies there is alignment by linking objectives rather than programmes.	As far as CES are aware there are no specific programmes that are currently publicly available with which	Responded to and incorporated at scoping phase.

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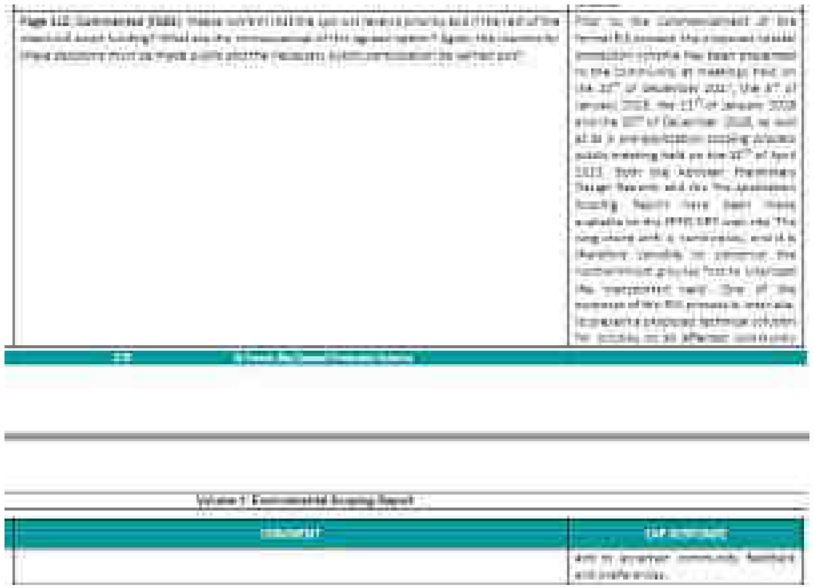
		this scheme can be compared and/or aligned. Hence the use of the objectives which are not in conflict.	
	(c) It does not demonstrate alignment with the hierarchy of coastal management plans as described in Chapter 6 of the ICMA and Section 52 (4)	This will be updated and elaborated upon in the EIR.	The project is aligned with the broad provisions of the ICMA and the National Coastal Management Programme of South Africa, as well as the Kouga CMP.
	I wish to comment FS83 below and relate it to paragraph 4.3 of your report 		Responded to and incorporated at scoping phase.

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	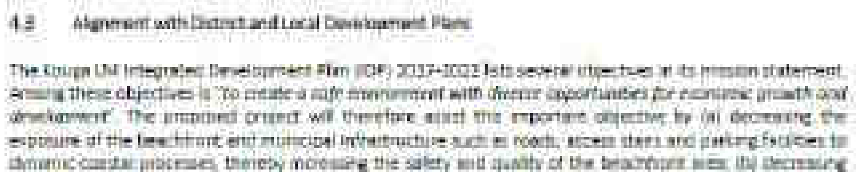 4.3 Alignment with District and Local Development Plans The Kouga LM Integrated Development Plan (IDP) 2017-2022 lists several objectives in its mission statement. Among these objectives is "to create a safe environment with diverse opportunities for economic growth and development". The proposed project will therefore assist this important objective by (a) decreasing the exposure of the beachfront and municipal infrastructure such as roads, access stairs and parking facilities to dynamic coastal processes, thereby increasing the safety and quality of the beachfront area; (b) decreasing If the proposed project is to assist this important objective by (a) decreasing the exposure of the beachfront and municipal infrastructure such as roads, access stairs and parking facilities to dynamic coastal processes, thereby increasing the safety and quality of the beachfront area, the two groins at the spit should automatically be the lowest priority for the following reasons. • The affected community is the public accessing the beachfront area and therefore their safety is of paramount importance • The protection of municipal infrastructure is critical. If municipal infrastructure is destroyed the public will not be able to access the beach and it will have a direct impact on municipal rates, placing a further financial burden on ratepayers The response that community meetings were held is irrelevant as these meeting did not comply with the provisions of the Local Government Municipal Systems Act of 2000, Chapter 4.	There are two reasons for constructing the two groynes at the spit: (1) The rest of the St Francis Bay beach frontage is already protected to some extent by revetments. Priority areas where infrastructure was at immediate risk were dealt with first. (2) The drift of sand is northwards, so it only makes sense to commence intercepting sand with groynes in the north.	
Alan Agaienz 079 502 3700 AgaienzA@nra.co.za	We in the SANRAL Northern Region have no jurisdiction for St Francis Bay area, and hence we are not an IAP. I think you should make sure that you obtain comments from SANRAL's Southern Region, or Western Region, whoever has jurisdiction.	Noted. The relevant stakeholder has been included in the I&AP database.	Responded to and incorporated at scoping phase.

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RC Suter 082 880 7344 rod.suter@gmail.com	Just in case you are not aware - I having a problem downloading the docs - please check your systems. Is the IRT available for download? Any mark-up available for download which identify the changes made between the first and latest Draft docs ?	Issue was resolved.	
	Just to let you know, I am still unable to download the Background and Scoping Report docs		
	Noted with thanks		
	Attached please find Letter (in PDF format) dated 13 Sept 2019 for your kind attention. I also attach an unsigned copy of the letter in MS Word format for your ease of use in preparing the IRT update. Please acknowledge receipt.	Noted.	Responded to and incorporated at scoping phase.
	COMMENT : REVISED DRAFT SCOPING REPORT Proposed Coastal Protection Scheme, St Francis Bay Kouga Local Municipality, Eastern Cape Province I submit herewith my comments on the Revised Draft Scoping Report issued by CES for PPP purposes on 20 August 2019. I am a property owner and resident of St Francis Bay and I am registered with CES as an I&AP. I have reviewed the EAP Responses to the issues raised in my Comment submission of 28 April 2019. Unfortunately, in my opinion, the EAP Responses w.r.t. items 1,2,3 & 5 do not adequately address the specifics of these issues and appear not to appreciate or acknowledge their importance. I submit that it is vital that these issues form part of the formal EIA processes. I therefore again address these issues by submission of the following Comments on the EAP Responses. To avoid the repeat of previous Commentary, these Comments must be evaluated in conjunction with my previous Comments.	Noted.	

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	1. RISK : ADVISAN DESIGN : PEER REVIEW The crux of my initial Comment was that a formal independent external Peer Review of the design work is essential, and I cannot emphasize this strongly enough. The Response states that the work performed by Advisian was subjected to an internal design review by Dr Gary Mocke, who is an employee of Advisian/Worley Parsons. However, an internal design review is expected in the normal course of any project, and in no way can it be considered an "independent technical and financial Peer Review" - which is what is required. The following paragraph of the Response states that a Peer Review "may" be undertaken after the conclusion of detail design stage. This is not acceptable for the following reasons :	A number of coastal protection solutions have been developed over the past 20 years. Groynes with sand nourishment have always been regarded as an acceptable solution. It remains the solution that lends itself best to phasing and is also a more financial viable option. It is therefore unlikely that a peer review will result in a different solution. However, it may happen that during detail design the exact positioning, angle and length of the groynes be optimised. SFPO has indicated that they will involve a suitably qualified coastal engineer when detail design commences to undertake the peer review.	SFPO has indicated that they will involve a suitably qualified coastal engineer when detail design commences to undertake the peer review.
	1. Ideally, an initial Peer Review should have been performed as soon as the concept of the project work was established, and the involvement of the Peer Review Team continued through until the completion of the detail design work. That is why it is essential to initiate a Peer Review as soon as possible, and to make this a requirement for the EIA.		Neither the SFPO NPC, nor Advisian are opposed to a peer review. This is normally undertaken during the detail design stage. During the preliminary design stage the concept of a groyne field and beach nourishment was developed. During the detail design stage the scheme will be developed in greater detail (e.g. exact placement of groynes, groyne lengths and angles, stone size, mass and shape, etc.),

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			and at this stage a peer review may add more value.
	2. In the St Francis Bay Scheme, a complication is the stated intention to perform the initial construction work on a phased "experimental" basis, constructing the first groynes, then observing their effectiveness, and then modifying the future designs if thought necessary. This is high-risk strategy for both the technical and financial aspects of the Scheme.	It is not the intention to perform the work on a phased "experimental" basis. The work is phased due to funding restrictions. Being able to evaluate performance of the first phase infrastructure is just an advantage stemming from phasing.	Responded to and incorporated at scoping phase.
	3. It is universally acknowledged that the ability to influence the outcome of a project, especially the designs and costs, reduces very rapidly as the project development and design work proceeds; therefore, the value of a Peer Review carried out only after conclusion of the detail design is questionable. This is again motivation to initiate a Peer Review as soon as possible.	See comment above.	Neither the SFPO NPC, nor Advisian are opposed to a peer review. This is normally undertaken during the detail design stage. During the preliminary design stage the concept of a groyne field and beach nourishment was developed. During the detail design stage the scheme will be developed in greater detail (e.g. exact placement of groynes,

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			groyne lengths and angles, stone size, mass and shape, etc.), and at this stage a peer review may add more value.

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	2. RISK : SCHEME ABANDONMENT The EAP Response is unsatisfactory, in that it glosses over the very real problems faced by SFPO NPC in ever sourcing enough funding for the Scheme. In the 3 months that have elapsed since the initial Comments, there has been no new public information from SFPO NPC w.r.t. confirmation of the sources of funding necessary for the Scheme, even if constructed on a "controlled phased" basis. Regardless of the reassuring words in the Response, there is nothing that changes the financial risks attached to this Scheme, and a serious risk remains that the work on the Scheme could be abandoned at a partially completed construction stage/phase before completion due to the cessation of funding. This perception is confirmed by the sudden admission SFPO NPC made recently to DEDEAT that the real timeline for the Scheme was likely to be 10 – 20 years, and not the currently publicised maximum of 10 years.	Construction of a phase will not commence before sufficient funding has been secured to complete construction of that particular phase. There will therefore never be partially completed infrastructure. In the meeting held with DEDEAT on 1 March 2019 the Municipal Manager made it clear that funding will be derived from a combination of private, public and governmental funding.	A phased implementation of the coastal beach protection infrastructure will most likely be required due to financial constraints. Should funding for the full scheme be available at the time of construction then the full scheme will be developed. However, the design of the scheme is such that each phase can be regarded as a standalone project, allowing for funding for additional phases to be sourced prior to their construction. As funding becomes available, each of the phases would be reviewed and revised, as necessary prior to implementation.

			As is the case with any project, cost estimates become more accurate as a project progresses through the various stages of project development. A detail design cost estimate is more accurate than a preliminary design cost estimate. The final cost of a project will only be known upon completion of a project. The preliminary design cost estimate available at this stage is regarded as appropriate for the purpose of this EIR. A fairly accurate project cost will be known once tenders to carry out construction work are received. An adequate contingency amount will be allowed for at tender stage, and SFPO NPC has confirmed that no construction work will commence unless sufficient funding to complete any phase of

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			the scheme has been secured.
	3. RISK : DAMAGE TO EXISTING SURFING BREAKS The EAP Response that *"The length of the groynes and width of the beach nourishment for the proposed scheme are not large enough that it will affect the breaks"* is completely unsubstantiated and is questionable in the absence of any previous investigation, research or computer modelling. I again submit that this aspect must be addressed by the appropriate responsible parties during the EIA processes and before proceeding with the Scheme	This will be addressed during the EIA phase.	The Seal Point Boardriders Club declared that they are fully behind the construction of the groynes at St Francis Bay. Various discussions have been held with members of the club, and their input has been fed through to the Coastal Engineers. The input received from the surfing community led to amended groyne placement and orientation. The supplementary shoreline modelling performed by Advisian was based on this amended groyne layout.
	5. OPPORTUNITY : CREATION OF NEW SURFING BREAKS The EAP Response regarding the establishment of artificial surfing breaks is noted. Unfortunately, it comes across as unnecessarily negative, is very generalised and hence needs review and updating to accommodate a more recent perspective.	This will be included in the EIA phase.	The Seal Point Boardriders Club declared that they are fully behind the construction of the groynes at St Francis Bay. Various

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	The statement that *"groynes as they are schematized now are also considered to be too short to significantly impact surf zone conditions"* is completely unsubstantiated and is questionable in the absence of any previous investigation, research or computer modelling. I therefore again submit that the present design brief should be amended to include, as a secondary objective, the creation of surfing breaks at the groynes. I believe this could be achieved by careful consideration and implementation of the existing wave research, computer modelling and the technology available to create consistent high-quality surfing waves. This one-time opportunity should be seized now - it could become an enormous asset to St Francis Bay and Kouga, and a significant commercial and developmental contribution to the Kouga IDP. The EAP Response states that the SFPO NPC has been "*approached by the surfing community*", who expressed their support for the proposed Scheme. I am not aware of any "surfing community" organisation in St Francis Bay. It would therefore be appreciated if SFPO NPC would divulge who this community is, and why they have seen fit to assign to it to the mandate to speak on this issue – an issue which is of interest well beyond St Francis Bay and extends to the wider surfing community, both nationally and worldwide. It is suggested that it would be beneficial to the Scheme to establish a representative structure to collaborate on this issue.		discussions have been held with members of the club, and their input has been fed through to the Coastal Engineers. The input received from the surfing community led to amended groyne placement and orientation. The supplementary shoreline modelling performed by Advisian was based on this amended groyne layout.
Louis Fouché louis.fouche@telkomsa.net	The quick discussion I had with you after the meeting last evening refers. As requested, herewith the points I raised with you: 1) Is there scope for emergency maintenance/repairs to a certain section(s) of the Kromme River which have become dangerous due to silting up of the navigable channel? The "Z area" opposite Rivertide, generally referred to as "The Drift", has now become so bad that it is impossible to pass through this section with a craft at low tide. Currently, occupants have to get out and push/pull the craft through this section. This creates a danger for visitors and other users of the River who are unaware of the sandbar at this point. Should the sandbar in the navigable channel be hit at speed it can result in serious injury (possibly even loss of life) to craft	Noted. This safety concern will be added to the EIR and incorporated into the need and desirability for the project.	Included in Section 4 of the EIR.

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	occupants. Commercial Operators are now restricted to operate when the high tide window period occurs. Furthermore, as the window period changes daily, it makes operation at regular times impossible. This creates a problem for these operators as well as their clients not having fixed operating hours which obviously has an impact on their business, tourists and tourism in general.		
	2) In our opinion, this has become a serious and unacceptable matter which needs to be attended to in order to avoid possible serious injury/loss of life and claims. To the best of our knowledge, the Municipality has been given permission to authorise emergency repairs to be done in the event of a breach of the Spit. In our view, the current situation regarding this particular section of the River can be seen in a similar light as a real and serious emergency. Therefore, dredging of this small section should be allowed as an emergency maintenance/repair in order to create a safe environment for all users of the River at all times. The December holiday period is only 3 months away and the emergency maintenance/repair has to be completed before then and definitely before the holidaymakers and tourists arrive failing which the risk of accidents and serious injury remain a real possibility.	There are a number of other measures that need to be implemented prior to an emergency situation being established. This includes signs, detailed instructions / maps available for the estuary with regards to hazards. The relevant association would also need to establish an emergency response procedure.	Responded to and incorporated at scoping phase.
	3) A further very serious and dangerous matter has come to my attention after our discussion yesterday evening. Some years ago some of the Chokka boats would enter the River through the mouth and anchor the boats just below the bridge over the Kromme River on the northern bank of the River where there was a big concrete block and a 4 metre metal beam buried in the sand. Over the last few months the sand bank in the middle of this part of the River has moved much closer to the northern bank which has caused the carving away of this section of the river bank causing the navigable channel to move in that direction too. The result is that this concrete block and the metal beam is now exposed in the navigable channel and both are visible and protruding above the water at low tide. During high tide they are submerged and cannot be seen. This is a big danger for craft passing through this area as there is a real chance of hitting one or both of these obstacles with substantial damage to craft as well as possible serious injury to occupants. It would	These hazards would need to be marked accordingly.	Responded to and incorporated at scoping phase.

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	appear that it will be possible to get to and remove the concrete block and the metal beam during low tide and permission has to be given for this to be done urgently and definitely before the start of the holiday season.		
	Will you please raise these matters at your meeting with Environmental Affairs tomorrow as we are very concerned about the current state of affairs regarding particularly the two raised herein. Permission and authority must be obtained from the powers that be to urgently address these matters.	The matter was raised with the DEDEAT during the meeting held on the 29th of August 2019.	Responded to and incorporated at scoping phase.
Dave Hurr davehurr@computingservices.co.za	*With reference to the comments submitted by Mr Louis Fouché (above):* I think both these matters are of extreme urgency and agree with you need immediate attention	Noted.	
Andrew Bowren 082 562 4273 ajbowren@gmail.com	I attended the Public Feedback meeting held in St Francis Bay on 27 October 2019. Generally, I guess, the written feedback you receive either involves some form of objection or a range of queries. In my case, I wish to congratulate your team on a professional job thus far. Your feedback was clear, concise and all questions raised were addressed. The proposed Coastal Protection Scheme is extensive and the process of addressing it is huge. Over many years now, close to nothing had been done to address the issue. This is for a range of reasons, not least of all an inordinate amount of objections to any proposal tabled. It is now time to rather find reasons why we can make progress as opposed to many reasons why we cannot. The process embarked upon, initiated by the SFPO – NPC, together with your team deserve all the support we as property owners and interested parties can give. Good luck and may we keep the momentum going.	Noted.	
Calvin Smith 078 710 7527 Calvin.smith33@outlook.com	My name is Calvin Smith and I am a resident of Cape St Francis. Please find attached a few perfunctory comments on the environmental scoping report for the proposed coastal protection scheme in St Francis Bay.		
	1. Page 47 paragraph 2: "Estimates for the total amount of sediment moving around Cape St. Francis from west to east vary between 50 and 100 thousand cubic meters	Noted.	

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	per year. Illenberger (2001) estimates a range of 80 – 100.000 m^3 per year while the Entech (2002) report gives a wider range of 50 – 100.000 m^3 per year. Of this total amount, the transport is divided between wave driven littoral transport along the coast and around the headland, and wind driven (aeolian) transport across Cape St. Francis through the headland bypass dune systems. It is believed that the largest fraction of the total sediment transport across the region is through aeolian processes moving sand through the dune fields (ASR Ltd, 2006)."		
	a. The volume of sediment moving around the cape stated above is possibly too high. May these volumes rather refer to the sediment transported from the now defunct Oyster Bay, Thysbaai and Santareme Dune systems in the past (circa. 1960)? Only the Shark Point headland by-pass dune field is currently in operation and according to McLachlan *et al*. (1994) it transports 7000m^3/y only although Illenberger (20??) gives a value of 8000 m^3/y.	The total sediment budget reported in the Scoping Report is derived from previous studies. The EAP understands that the 50 000 m^3 to 100 000 m^3 refers to the transport of sediment due to wave and aeolian transport.	Responded to and incorporated at scoping phase.
	b. I guess there will be future studies to verify the volumes in the reports/papers above and establish a relatively accurate sediment budget. There should be a need to determine the volume of sediment longshore drift transports around Shark Point as it may impact future nourishment efforts.	Noted.	Studies of sediment budget informed the preliminary design. Monitoring during the operational phase of the project will determine how much sediment is entering the nourished area and how much is moving past the scheme and further north.
	2. Page 47 Paragraph 3: "The net shoreline retreat along the St Francis Bay beach has been approximately 30 m to 50 m over the past 30 years. This has resulted from	Noted.	Yes. What this means is that the beach is

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	increased sediment carrying capacity within the lower reaches of the Kromme Estuary, resulting in less sediment available to accumulate on the St Francis Bay Beach."		retreating by 1m a year. This is very significant. The worst case scenario for sea level rise is about 1cm per year, which would equate to centimetres of retreat.
	a. On page 46 paragraph 2 the report states that longshore drift transports sediment to the east along much of the coast. How much sediment, if any, is the Kromme estuary expected to supply to the St Francis Bay beach in the south west considering the longshore drift direction? I presume that the spit close to the river mouth would benefit.	The contribution of sediment from the estuary to the longshore drift through natural processes is expected to be low. This is due to the estuary being flood tide dominant with sediment moving into the estuary rather than out. Sediment is likely to move out of the estuary during heavy rains / flooding events. Under the flood tide dominant conditions sediment is likely to accrete near the sandbank at the mouth of the estuary.	Responded to and incorporated at scoping phase.
	b. Multiple workers have attributed beach erosion at St Francis Bay to the stabilisation of the Oyster Bay, Thysbaai and Santareme Dune systems. According to McLachlan et al. (1994) less than 10% of the pre-stabilisation sand is now reaching the beach. I feel it is necessary to state that the primary cause of beach loss was due to the	Noted.	The comment is scientifically accurate and confirms that the system has been

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	stabilisation of the headland by-pass dune fields unless evidence is provided which strongly argue otherwise.		altered due to the dune stabilisation, based on published information. Thus, we are now dealing with a modified system that requires active management intervention.
	i. See extract from Appendix F: Advisian preliminary design report: "The sandy beach at St. Francis Bay has suffered from significant erosion events over the past few decades which can be attributed to the stabilisation of large headland bypass dune-fields during the 1970's and 1980's. This has led to a reduction in sediment supply to the beach which resulted in a rapid retreat of the shoreline."	Noted.	
Norman Dyer dyerndd@gmail.com	I note the KJRC is not registered as above? I have always thought it to be sufficient to be part of the SFPO application, would it not be good practice to register ourselves anyway? Your thoughts please.	The Kromme Joint River Committee (KJRC) has been added to the list of Interested and Affected Parties (I&APs) and will thus be informed as the EIA process progresses.	Responded to and incorporated at scoping phase.
	Thank you for this, kindly add Louis Fouche and Ken McGregor, copied herein as Exco members of the KJRC NPC to future distributions. We will respond in due course with our detailed motivation to support the initiative. Good luck in your endeavours.	Noted	Responded to and incorporated at scoping phase.
	Please find attached a letter confirming our full support for the above scheme. Kindly acknowledge receipt of this communication. Thanking you and good luck.	Noted	Responded to and incorporated at scoping phase.
	We write as custodians, on behalf of the Kouga Local Municipality (KLM) of the Kromme and Geelhout Rivers as vested in us by virtue of the MOA signed between the KLM and the KJRC NPC dated September, 2016.	Noted.	Responded to and incorporated at scoping phase.

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	The KJRC is comprised of representatives of all registered estates/communities, the names of which appear at the foot of our letterhead abutting the Kromme and Geelhout Rivers and in some instances indirect representation of some of the independently owned properties. The number of property owners directly represented amounts to 185 home owners whilst those independently owned amount to a further approximately 20 properties. Having attended all of the presentations and having read the Draft Scoping report as presented at the public participation meeting held on 27 August in St Francis Bay we wish to record our full commitment and support of this urgently required initiative. We compliment CES on the very thorough and detailed report complied and made available for comment. Whilst we understand there will be 'mechanical' challenges in the implementation of the sand sourcing requirement which can and will be overcome we place on record that the Kromme/Geelhout properties and the KJRC itself have already initiated financial provision for the function of sand removal from the lower reaches of the Kromme. We wish to add how EXTREMELY urgent the matter of 'dredging' the navigable channels of the river are presently, as in certain sections, particularly at low tide the river is not only un-navigable but has become extremely dangerous for boating (some 1400 craft are registered annually for permission to use the Kromme) and swimmers alike. The draft scoping report, 6.8.4. Socio-Economic value refers. The Kromme River not only represents a major capital investment in the Kouga area but most significantly the Kromme Estuary is in itself a major tourist attraction - boating, angling, commercial tourist cruises, etc. The narrowing and silting of the navigable channels, we recognise is a result of historical human interference in the natural structure and flow of the river i.e. construction of dam(s), the creation of the canal system, rerouting of the sand river, the development of the village of St Francis Bay itself and adjacent Santereme residential area, etc have all contributed to the crisis we face now. These factors are irreversible and therefore the necessities re-nourish the beach as proposed in the 'Coastal Protection Scheme' and to source the sand required from the Kromme River is of paramount and urgent need.		

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	We sincerely hope that your endeavours regarding this EIA application receive favourable support from both Governmental Authorities and those registered as I&AP's in order to proceed with this project as soon as is possible and assure you and as we will do for the contractor, when appointed of the full support of the Kromme Joint River Committee as reconfirmed and recorded in the minutes of our meeting held on 16 September, 2019.		
Maggie Langlands maggielanglands@gmail.com	PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY: COMMENT Having read the background information document, the draft scoping report and the estuarine impact assessment, as well as attending the public meeting held on 27 August in St Francis Bay, the Kromme Enviro-Trust is satisfied that the process being followed is a sound one and that a thorough and professional approach is being adopted. We recognise the need to retard and reverse the erosion of sand from the beach and spit, and our preliminary evaluation is that responsible dredging of sand from the river is acceptable, with mitigation. We reserve our response regarding environmental impacts, as it is too early in the process for us to comment, except in the case of the estuarine impact assessment. We note the mitigation measures recommended by the specialist and strongly support these measures, particularly with regard to: • Identification and avoidance of sensitive habitats • Removal to the beach of only the correct size material and only the required volume • Restriction of access to the foredunes We record, in addition, our support for a walking route along the length of the frontage along the beach and estuary.	Noted.	Responded to and incorporated at scoping phase.
Patrick Billson 082 552 4099 patrick@billsontrucks.co.za	We as the members of the Riverglades Homeowners Association NPC (RGHOA) which represents 20 homeowners fully supports the proposed dredging of the Kromme river in an effort to preserve the natural tidal flow of the river and to ensure the safety and navigability of the river.	Noted.	Responded to and incorporated at scoping phase.

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Simon Picton-Tubervill 042-294 0079 admin@sfbra.co.za	DRAFT ENVIRONMENTAL SCOPING REPORT PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE DEDEAT REFERENCE NUMBER: EC08/C/LN2/M/42-2019 We refer to the abovementioned report as well as the public meeting held in St Francis Bay on the evening of 27 August 2019 when this report was presented. The St Francis Bay Riparian Homeowners Association as the custodians of the " St Francis Bay canal system" have a vested interest in the "Proposed Coastal Protection Scheme" which will have a beneficial impact on the protection of the canal system, in particular "The Spit", which at the same time provides a valuable public amenity. We note that the Draft Scoping Report addresses environmental aspects associated with both "The Spit" as well as "The Beach" and we wish to record our support for this project in its entirety. We further note that the St Francis Bay Riparian Homeowners Association have committed to make funding for this project, have already made financial contributions and will continue to do so.	Noted.	Responded to and incorporated at scoping phase.
Linda Evans Lndevans5@gmail.com	Attached, please find the letter with reference to the above from the Kromme-Geelhout Conservancy. Any queries may be directed to myself.	Noted.	Responded to and incorporated at scoping phase.
	We write in full support of the initiative to renourish the St Francis Beach and more specifically the need to obtain sand, as required, from the Kromme River. Our conservancy, registered as 'a protected environment' represents twelve property owners who have river frontage to their properties of some ten kilometres of the upper reaches of the Kromme and Geelhout rivers. The need to dredge the river is an issue needing urgent attention as at low tide especially the river has become unnavigable in places and certainly poses a serious safety risk to craft and its occupants should: a) boats collide in attempting to navigate very narrow and shallow channels b) we are unable to access the lower reaches of the Kromme at low tides.	Noted	Responded to and incorporated at scoping phase.

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	Further as a result of the now restricted tidal flow we, of the upper reaches have observed that silting is affecting the depth and width of the rivers adjacent to our properties. We congratulate you on the very professional approach to this most sensitive matter, assure you of our full support and cooperation if required and hope that this application reaches a positive conclusion as a matter of urgency.		
Harry Millson hacmillson@telkomsa.net	Attached herewith are my comments regarding the CES presentation of the proposed Coastal Protection Scheme at St Francis Bay. You have my contact details should you wish to revert back to me regarding the foregoing.	Noted.	
	PROPOSED COASTAL PROTECTION SCHEME, **ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE.** COMMENTS ARISING FROM MEETING ON Tuesday, 27th August 2019. I submit herewith several comments and observations during and arising since the CES presentation of the "ENVIRONMENTAL SCOPING REPORT". I am a property owner being a retired Civil Engineer and resident in St Francis Bay for 15 years, and as such have registered with CES as an Interested Party.	Noted.	
	1. **Presentation.** I consider the CES reports on the proposed project to be extremely professional and the Public meetings conducted in like manner. The reports are bulky as a result of the extensive coverage of the project and this makes it difficult for the public to read and digest. As a result the answers to several queries from the floor were to be found in the documents. Your presenters were very patient in handling such and all queries in the meetings to date.	Noted.	Responded to and incorporated at scoping phase.
	2. **Project need and Desirability.** In my opinion the Project need is understated in your report. St Francis Bay was founded on the support for the beach and adjacent Kromme River as an attractive destination for holiday makers, initially a fishing camp in the fifties. Over the years with the development of the Canals, upgrading of the Humansdorp access road including a bridge over the Kromme River, the construction of the Port, and recently the development of the St Francis Links Estate, has led to the present small vibrant town with a growing resident community.	Noted. This will be amended in the EIR.	Responded to and incorporated at scoping phase.

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	Sadly both the beach and the Kromme River have lost the initial attraction. As a result of erosion only a very narrow strip of beach is available at low tide, plus silt deposits has led to the river being barely navigable at low spring tide. Residents can no longer enjoy the walk to and return from the river mouth as there is no longer a continuous beach. Further, there is a very real possibility of the so-called spit along the northern section of the beach being breached which would result in massive damage to the Canals infrastructure and many up-market houses. There is now a **real need** to **urgently** address the foregoing, and this need has been recognised by the community for many years.		
	3. **Revetment structures.** I must record that I am not in favour of rock revetments – specifically in the form of dumped rock faces. The existing revetments were constructed immediately above the high water level as a protection of properties fronting the eroding beach, and have proved a reasonable "quick-fix" protection. However, these structures of dumped rock were not founded on a reasonable base, are settling, and will need regular maintenance and possibly reconstructed every 5 to 10 years. Further, they are considered to be extremely dangerous as young children regard climbing up the face as a challenge and if trapped under a sliding boulder could have serious consequences. This brings a sense of urgency to the matter. The proposed permanent solution to face the existing structure with layers of "rock armour" and/or Geotextile Sand Containers - is a designed structure that will be partially covered with sand. However, it would appear that the crest will be protruding above the sand level and I consider this to be very unnatural – hopefully there will be sufficient sand to cover as much of these structures as possible. I note covering with sand could lead to lower maintenance costs in the future – it will certainly protect the GSC fabric from both vandalism and degradation due to exposure to UV light. Hopefully the growth of a suitable vegetation cover will also be encouraged.	Noted. The rock (if the revetment is constructed of rock) will be placed in accordance with Advisian's design, and the work will be overseen by Advisian. The levels of the beach and revetment are shown on Advisian's drawings. Covering the revetment with sand is an option which can be considered during the EIA.	Section 3.3.2 of the EIR provides a summary of the options considered for the revetment. Appendix F provides more engineering detail. The visual and ecological impacts of the scheme are presented in Section 7.2. Appropriate mitigation measures are also presented in Section 7.2 and the EMPr.

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	4. **Stub groynes – not an environmental comment!** Any rock structure built on sand into the sea will settle with time leading to maintenance and costs thereof being required to maintain the designed crest level. During the PEM intervention several lines of tubes were inserted into the sand at regular intervals for the full length of the beach. **Is there any record of the depths inserted??** Specifically, is there any record of resistance to insertion of the tubes as a result of the presence of a rocky or similar layer that could provide a suitable base for the proposed groyne structure?? Besides at the Kromme River mouth, I understand an under-water reef is also present approximately 200m east of the Aldabara road car park. If this can be confirmed, surely it would be an obvious site for a stub groyne?? Has any exploratory work been carried out in this regard??	Noted. More detail will be provided during the EIA phase.	The detailed design will ensure that the groynes will be constructed in such a way that their integrity and design parameters will be maintained. This includes limitation of the "settling" of rock material. While there may be a requirement to maintain the structures the groyne integrity is anticipated to last for the duration of the design life. In 2020 Advisian collected additional data to inform a second coastal modelling activity on the refined design. These reports are contained within Appendix F of the EIR.
	Finally, Once again, Congratulations on your presentation and we look forward to the speedy implementation of the proposed coastal protection scheme.	Noted.	
Peter Long plong@global.co.za	As a share holder of the Kromme River Mouth Share Block (pty) Ltd, may I record my support for this scheme. There are a total of 30 share holders in our block.	Noted.	

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Daan Botha 041-03634668 daanbotha@harvest.co.za	In my capacity as chairperson of the Kromme River Mouth Share Block (PTY) Ltd, will you please register us as an Interested and Affected Party to the above proposals. You will note that one of the existing IAAP's is recorded as Mr Andre Jensen, but Mr Jensen sadly passed away at the beginning of 2017. He was our representative on this project.	Noted.	Responded to and incorporated at scoping phase.
	I represent the Kromme River Mouth Shareblock (PTY) Ltd, a duly registered Interested and Affected Party to the above mentioned Environmental Impact process. Please note my e-mail dated 18 June 2018 below as confirmation. I have read the Draft Scoping report and have two concerns that need to be noted.	Noted. The impact assessment has and will retain your concern as a potential impact. The impact being that, should the river channel be confined to the northern bank of the estuary, there is potential for scour and, should there be a flood, it could result in the mouth shifting to the north placing the northern bank at risk.	
	1. The report, for obvious and practical reasons, assumes that the current extent of the sand spit situated between the Eastern Canal of the St Francis Bay Marina and the ocean extends to the mouth of the Kromme River. This is not historically accurate as there is a particular marker where the original spit was legally allowed to extend to, which is a few 100 metres back along the sand spit towards the south. The gradual increase of the extent of the spit has been due to natural and human shoring up efforts, but is something that has caused us some concern over the years. In fact, we enclose some of the original letters from our previous chairperson, Mr Andre Jensen, confirming the concerns and the reasons for objections to the extending of the Sand spit to its current dimensions. Our objections are still valid and need to form part of our concerns which we are again formally lodging in this regard. Please see the attached original letters sent by our then attorneys, Rushmere, Noach and Partners and their correspondence with Mr Jensen.		Section 7.2 of the EIR includes the impact for the potential scour along the northern bank of the estuary. The assessment was based on Advisian's updated coastal and estuarine model (Appendix F of the EIR). The estuarine model in particular ran a pre- and post-dredging scenario to understand the hydrodynamic change to the estuary. They conclude that very small current velocity changes will be experienced within the estuary. The most notable change will be at the mouth of the

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			estuary where velocities increase immediately following the dredging. They normalise as the bathymetry "flattens" out.
	2. With regard to the sourcing of sand from area A, the sandbank close to the Kromme River Mouth, this sand bank is directly opposite our property which is situated on the northern side of the mouth. You mention certain fish species and differing degrees of potential harm that could be caused by harvesting sand from this area, but whilst some worm species are mentioned, no mention is made of prawn species that I can find. This bank is well known for an abundance of sandprawn, bloodworm and pencil bait and we believe that it is vital to do a proper assessment of potential harm that could be caused by harvesting of sand from this area.	The EIR will provide more detail. The intention is to limit the removal of sand from the sand bank and use more from the channel. Some of the sand bank may be used and the EIR will provide an assessment on the significance of the loss of those bait species.	The revised sand sourcing approach is to utilise approx. 30% of the material available in the sand bank referred to (Refer to the Sand Sourcing Specialist Report in Appendix I of the EIR). Section 6.9.3 of the EIR describes the faunal species found in the Kromme Estuary (informed by the Estuarine and Dune Ecology Specialist Report – Appendix J of the EIR). Section 7.2 of the EIR discusses the impacts to these species as a result of the dredging as well as the potential impact to bait harvesting.

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	This serves to confirm that the KROMME RIVER MOUTH SHAREBLOCK PTY LTD is a duly registered Interested and Affected Party to the above process. As current Chair of the Board of Trustees, I attach a copy of our e-mail addressed to Nicole Wienand of CES on 11 April 2019 with attachments. Please note that whilst we are in principle in favour of the proposed dredging process for improvement of navigation of the Kromme Estuary, we still register the concerns as per our e-mail of 11 April as set out below and explained in the attachment hereto. We look forward to hearing from you in due course.	Noted	The impact assessment has been updated to include your concern as a potential impact. The impact being that, should the river channel be confined to the northern bank of the estuary, there is potential for scour and, should there be a flood, it could result in the mouth shifting to the north placing the northern bank at risk.

	RUSHMERE NOACH & PARTNERS Attorneys, Notaries, Conveyancers & Administrators of Estates [illegible] Mr [illegible] 131 Forest Road Peppermint Grove [illegible] [illegible] West Australia Our ref: [illegible] [illegible] April [illegible] Dear [illegible] **RE: [illegible] RIVER [illegible] (PTY) LIMITED** Herewith a copy of a letter received from the [illegible] Services Council, for your information. Yours sincerely [illegible] Airmail Encl. [illegible]		

	ALGOA [illegible] Mr Muller [illegible] Messrs [illegible] & Partners PORT ELIZABETH [illegible] Dear Sirs [illegible] Please note that the Divisional Council of [illegible] was [illegible] and has been incorporated into the Algoa Regional Services Council with effect from [illegible]. Without prejudice to Council's rights in the relevant [illegible], receipt of your letter dated [illegible], the contents of which are noted, is acknowledged herewith. Yours faithfully CHIEF EXECUTIVE OFFICER [illegible]		

	RUSHMERE NOACH & PARTNERS Attorneys, Notaries, Conveyancers & Administrators of Estates [illegible] [illegible] Our ref: [illegible] [illegible] 1988 Dear [illegible] **RE: [illegible] LIMITED** Enclosed herewith copy of letter forwarded to the [illegible] Divisional Council for your records. I will communicate with you further in due course. Yours sincerely [illegible] [illegible] [illegible]			

	RUSHMERE NOACH & PARTNERS Attorneys, Notaries, Conveyancers & Administrators of Estates **The Secretary** Humansdorp Divisional Council P O Box [illegible] ST FRANCIS BAY [illegible] Attention: Mr [illegible] Our ref: [illegible] Your ref: [illegible] November [illegible] Dear Sir **RE: MR A A JANSEN : KROMME RIVER MOUTH SHARE BLOCK (PTY) LIMITED** We write to you on the instructions of our client Mr Andre [illegible] Jansen the beneficial owner of a share block in Kromme River Mouth Share Block (Pty) Limited and as such the holder of the right of use and occupation of a site adjacent to the river bank in the vicinity of the Kromme River Mouth on the northern side of the river. Our client has instructed us to point out that the growth of sand dunes parallel to the sea stretching northwards from the Kromme River Mouth cover an area which was previously flat beach which was at all times covered by the spring high tides in the early [illegible]'s. It is relevant to note that our client's father occupied the same property on a lease basis with effect from [illegible] until approximately [illegible] and that our client occupied the property on the same basis from [illegible] until [illegible] when the Share Block system came into effect. As a result of our client reporting the damage caused by floods in Natal our client has become aware of the potential damming effect of the dunes in the event of a major deluge. This would cause the river to erode the dunes on which our client's house has been built especially when one recognises that approximately two-thirds of the potential flood plain has been covered by the creation of the sand dunes parallel to the sea. The dunes will cause a build-up of water against the northern bank of the Kromme /2.....		

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	 - Page Two - river at a level far higher than would otherwise have been the case. The eroding effect of this water would cause subsidence of our client's foundations and damage to the river bank. If the flood is severe enough this would cause the loss of our client's property which would then become river bed. Our client draws this matter to your attention under reservation of his rights in the future. Yours faithfully		
Michael Henwick 041 363 4668	Our Shareblock is in support of the above plan; we need to confirm our support by doing so on a letterhead; more or less as on the attached.	Noted.	
	As requested, enclosed please find the letter, duly signed.	Noted.	

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yvonne@fspa.co.za	We write in our capacity as Managing Agents for Goedgeloof Aandeleblok (Pty) Ltd and enclose herewith a letter confirming their support for the St Francis Bay Coastal Protection plan.	Noted.	
	We write in our capacity as Managing Agents for Goedgeloof Aandeleblok (Pty) Ltd. We hereby confirm that Goedgeloof Aandeleblok (Pty) Ltd is in full support of the St Francis Bay Coastal Protection Scheme as proposed in the Environmental Scoping Report DEDEAT; reference ECO 8/C/LN2//M42 – 2019.	Noted.	
Helen Crosby etonplace@btinternet.com	I wish to submit the following comments on the SFB Estuarine and Dune System Impact Assessment report:	The Kromme Estuary is considered to be in a fair state of health (Whitfield, 2000) and in need of rehabilitation. According to Turpie and Clark (2007), the Kromme Estuary is listed as a high priority for rehabilitation, particularly water quality (silt), water quantity and the clearance of alien vegetation. Accordingly the removal of sediment is not anticipated to affect the ability of the estuary to function. This will be included in the EIR.	
	1. Given the inclusion of the Kromme estuary in the core set of SA estuarine systems, the use of the estuary as a source of sediment is at odds with the conservation status of the system and the estuary should not be considered as a source of sediment		Refer to Estuarine and Dune Ecology Specialist Report in Appendix J where the potential impacts of the project are included.
	2. There is no description of the proposed dredging works. The distinction between construction and operation is unhelpful; capital and maintenance dredging involve the same activities but on a different scale	The particular dredging methodology will be included in the EIR.	Section 2 of the EIR contains further information on the dredging and a distinction between

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			capital and maintenance dredging. The detailed design and engagement with contractors will provide more information on the exact process, plant type etc.
	3. The assessment (page 41) discusses 'existing impacts' but does not identify the activity that is cause thereof. There is no distinction between existing 'impacts' that constitute baseline conditions and the additional incremental impact due to dredging and pumping works - this needs to be clearly stated for the significance statement to have any meaning	This will be clarified in the EIR.	The existing impacts were included in the Estuarine and Dune Ecology Specialist Report (Appendix J). Specifically Section 8.1.1 describes the activities that have led to the impacts observed under the current conditions.
	4. There is no consideration of potential impacts on avifauna that utilise the sandbank for resting and feeding	This will be included in the EIR. Sandbanks are used by dog walkers and the disturbance of dogs on resting. feeding and roosting water birds is well documented.	Updated in Section 6.9.3 of the EIR.
	5. Monitoring is not a mitigation measure; monitoring serves to check that mitigation measures are implemented and are effective	Noted.	While monitoring is not a mitigation it is included because monitoring will inform

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			the adaptive management approach which is mitigation.
	6. The impact on estuarine functional zone is a repeat of previously identified impacts and an additional impact - alteration of nutrient dynamics due to release of trapped nutrient from sediment - but this is not discussed as an impact to water quality (existing impact 3)	This will be clarified in the EIR.	While the change in nutrient loading was identified as a possible impact, previous studies have shown that there is constant flushing of the system with marine water. Therefore, if any nutrients are released it is anticipated that these would only exist temporarily due to the tidal cycle.
	7. The 'improvement to recreational amenities' section is inconsistent. Dredging will increase the riverine area but it does not follow that increased activity in the riverine area is beneficial. The recreational carrying capacity of the Kromme is already exceeded during holiday periods due to the number of speedboats and jetskis licensed by the Muncipality and this issue also needs to be addressed in the assessment	Investigations into the exceedance of the Kromme carrying capacity for recreational activity will be included in the EIR.	The Kromme Joint River Committee (KJRC) are custodians, on behalf of the Kouga Local Municipality (KLM) of the Kromme and Geelhout Rivers as vested by virtue of the MOA signed between the KLM and the KJRC NPC dated September, 2016. It is therefore the responsibility of the KJRC to manage

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
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			boat licencing and traffic.
	8. If the sandbank is to be dredged, then the schedule must allow for no dredging works during breeding periods and the holiday season	This will be incorporated into the EIR based on proximity of dredging activity to known breeding locations and recreational areas.	Refer to Section 7.2 of the EIR.
	9. The assessment of visual intrusion should be supported by visualisations of the dredging equipment and pipelines *in situ*	The EIR will contain a more detailed dredging methodology following which potential visual impacts can be assessed.	Section 7.2 of the EIR contains the visual assessment.
	10. There is no information on ambient land noise levels, the dredging equipment noise levels and the estimated duration of the dredging works; this makes it difficult to assess the significance of noise impact to sensitive receptors	Noted. This will be included in the EIR.	While ambient noise levels were not recorded the anticipated noise levels from the machinery has been included in Section 2 of the EIR. The impact table in Section 7.2 of the EIR provide recommended mitigation actions to reduce the noise levels. These are replicated in the EMPr which is a document that becomes binding following a decision

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			from the competent authority.
	11. There is no consideration of the impact of underwater noise (from dredging) on fish populations within the river; given that fishing is one of the major attractions of the river	The EIR will contain a more detailed dredging methodology following which the potential underwater noise on fish species can be considered. At this stage it is anticipated that the underwater noise from dredging will be no more significant than the existing noise levels on the estuary.	Underwater noise from dredging equipment, especially in shallow water is considered to be negligible. Especially considering the existing vessel activity on the estuary. There will be no percussion activity to influence hearing and / or behavioural changes.
	12. The lack of field surveys to support the assessment is a concern; especially regarding birds. Baseline information is insufficient to understand what the impact of the dredging works will be on existing biological communities within the estuary	The baseline environment has been determined based on research material available for the Kromme, which is considered to be a well-researched system. While avifaunal species rest and feed on the sandbanks, given the existing level of disturbance on the sandbanks in particular, a desktop analysis was deemed suitable. The EIR will provide more detail.	Updated in Section 6.9.3 of the EIR with the impacts reflected in Section 7.2 of the EIR.

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	13. The deposition of sediment on the beach is not habitat creation; that would be a collateral benefit of the beach nourishment if the beach variability stabilised sufficiently to allow establishment of benthic communities	Noted.	The primary objective is not habitat creation per se - there is no mention that the nourishment is intended as an offset.
	14. There is no discussion of the risks to the long-term success of this proposal; and what the cost to the SFB economy would be if the scheme were to fail.	This will be included in an updated project need and desirability in the EIR.	The no-go alternative is covered in Section 3 of the EIR.
	15. Given my comments, I disagree with the conclusion of the assessment that there are no fatal flaws	Noted.	
	16. Additional issues: o Anecdotal evidence suggests that substantial sand has built up offshore of the northern end of the spit and the use of a cutter suction dredger based offshore depositing sediment onshore via a floating pipe must be investigated as a primary source of beach nourishment rather than the sandbank at the mouth of the river	The feasibility of offshore dredging has been investigated. Given the availability of dredgers in southern African waters and the depth of water, the offshore option is not feasible. This will be included in EIR.	Section 3.2.2 of the EIR comments on the feasibility of dredging the offshore environment as an alternative to the material coming from the Kromme Estuary.
	o The jetties in the ski canal should be removed to prevent access to the beach over the spit, given that people walk over the dunes, rather than use the broken walkways, destroying the dune vegetation and causing blow-outs	Noted. This should be unnecessary if the coastal protection infrastructure functions as expected. Nevertheless, it is something that can be done during normal dredging operations.	Responded to and incorporated at scoping phase.

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	o Stabilisation of the spit from the ski canal side should also be considered as a managed retreat strategy, in conjunction with beach nourishment and groyne construction		This should be unnecessary if the coastal protection infrastructure functions as expected.
Mr Funanani Ditinti 021 819 2499 fditinti@environment.gov.za	Please see attached comments and recommendations as per your request.	Noted.	
	SUBJECT: Comments on the draft environmental scoping report for the proposed coastal protection scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province. The Department of Environment Affairs (DEA) in its Branch Oceans & Coasts (O&C) reviewed the Draft Environmental Scoping Report. Comments and recommendations are provided below:		
	1. The applicant must take note that the Branch Oceans and Coasts in DEA has the mandate to ensure that the use of natural resources in the coastal zone and development associated with the coastal zone is socially and economically justifiable and ecologically sustainable and to ensure the achievement of objectives of the ICM Act, 2008, and guarantee that the coastal environment will be protected and conserved throughout all phases of the proposed project.		
	2. Taking into account that the proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province with it associated activities will be taking place within the coastal zone, the competent authority is advised take into account the objective of the ICM Act, and further adhere and implement Section 63 of the ICM Act by taking into account all relevant factors, including how the proposed Coastal Protection Scheme will impact the marine environment and to ensure that proposed mitigation measures will safeguard the conservation and protection of the coastal zone.	Noted. While this is directed at the competent authority (DEDEAT), CES will provide the information required for a decision in the EIR.	Updated in EIR. Specifically see Section 7.2 for detailed impacts.
	3. To ensure that the proposed Coastal Protection Scheme, St Francis Bay adheres to ICM Act objectives, the applicant must ensure that the construction footprint in the coastal zone is limited to the construction area. The Contractor shall restrict all activities, materials, equipment and personnel within the area specified or restrict activities to areas that are necessary to undertake the works. It is a recommendation of this Branch that disturbed areas rather than pristine or intact landscape areas should preferably be used for storage and temporary construction camps to avoid further disturbance. This Branch recommends that the EMP to be develop for the	Noted. CES will ensure the EMPr includes these suggestions.	Updated in the EMPr.

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	Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province clearly identifies no go areas that need to be avoided, protected and conserved within the coast, the competent authority must ensure that these conditions forms part of the approval.		
	4. As part of technology alternative, the reports states that "the suitability (size, shape and material) of the revetment material will be verified and validated at an appropriate time during the design phase". Taking that into consideration, DEA: O&C will provide comments when data is available during the next public participation process.	Noted. The EIR will contain more detail on the preferred design and materials.	Updated in EIR. The emergency works, carried out by the Kouga Municipality in 2020, will have an influence on the type of material used in the spit revetment during the detailed design. It is likely that similar material (rock) be used to ensure the structure is compatible with the existing material.
	5. The applicant is advised to take into account the natural processes and climate change effects that take place within the proposed site (flooding, natural flow, erosion, sand accretion, strong winds and waves and storm surges). The structure plan and design should take such processes into consideration and ensures that sufficient mitigation measures are put in place to address them should they arise. The EAP is requested to provide information data (assessment and findings) on how wind will impact the proposed Coastal Protection Scheme, St Francis Bay and the surrounding areas within the site location and the surrounding areas of the proposed project during implementation and in the future.	Noted. The EIR will include a discussion regarding wind and its potential impacts on the design and surrounding areas.	Advisian's Preliminary Design Report discusses the physical environment as parameters for design. These will be taken into account during the detailed design phase which is anticipated following the completion of the EIA process.
	6. The EAP must provide information in relation to Sand sourcing alternatives to include an additional feasibility assessment (motivation with advantages and disadvantages)	Noted. This will be prepared for the EIR.	Advisian has, on Page 78 of their report in

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	of sand sourcing from local areas (outside the identified alternative places) currently experiencing high sand accretion or that have enough sand needed to achieve the project.		Appendix F, estimated the cost of sand pumping (read dredging) to be R58-85/m^3. Escalated to current costs this amounts to approximately R65/m^3. Trucking sand from Oyster Bay will cost in the order of 25 km @ R15/m^3.km which equates to a transport cost alone of R375/m^3. Trucking sand from Paradise Beach (Jeffrey's Bay) will cost in the order of 22 km @ R15/m^3.km which equates to a transport cost alone of R330/m^3.
	7. The EAP is advised to provide a detailed information on the type of technology alternatives (advantages and disadvantages) to be used to source the sand (dredge) from the estuary.	Noted. This will be prepared for the EIR.	Section 3.2.2 of the EIR discusses the technological alternatives.
	8. The sourcing (dredging) of sand from the Kromme estuary have potential of causing long term direct impact. The EAP must provide a detailed assessment report that stipulates the consequences of each proposed sand sourcing alternatives on the estuarine dynamic post construction impacts (impacts on sedimentation, water quality, saltation, depth and width of the estuary).	The specialist report titled "Estuarine and Dune Ecology" covered the potential impacts of the scheme on sedimentation, water	The Estuarine and Dune Ecology Specialist Report (Appendix J) contains the potential impacts for the proposed sand

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		quality and the potential changes as a result of the change to the hydrodynamics. This will be included in the EIR.	sourcing locations. Through the study the alternatives were modified based on the findings of the various specialist studies.
	9. From the information provided, O&C is of the view that more detailed information is needed (EAP to provide) on how the proposed protection structure (for all alternatives identified) will have cumulative impact (positive and negative) on the estuarine ecosystem and the coastal zone as a whole.	It is the intention that the alternatives will be revised to propose one preferred option. The preferred option will then be assessed for its potential impacts, including cumulative to the existing impacts.	This is included in Section 7 of the EIR.
	10. The EAP is requested provide data that indicate the status of the beach (width and length) of the beach area that falls within the project scope.	Noted. Engineering studies will be appended to the EIR with the appropriate beach profiling data.	Updated in EIR. Specifically, Appendix F which contains the engineering reports. The engineering report documents the historical erosional environment, reports on the beach profiles and provides the subsequent preliminary design.
	11. The proposed project will be implemented in a phased approach, should the first implemented phase (phase1) show a negative response (failing to address the erosion), is there any other resort that the applicant has considered, outside the scope of this current EIA application for the proposed Coastal Protection Scheme, St Francis Bay.	This will be addressed during the EIA phase.	Adjustments can be made to the groynes, such as the placement, spacing, length, angle, etc. Or off-shore breakwaters can be

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			considered, or any of the options reported in previous engineering studies.
	12. The beach nourishment, will it be done to elevate or regenerate the beach area?	The nourishment will be to regenerate the beach which will also result in beach elevation. This clarification will be included in the project description in the EIR.	Responded to and incorporated at scoping phase.
	13. The impacts and suitability of sourcing of sand will be assessed by O&C once the Sand Material Sourcing Study is completed and distributed.	Noted.	Refer to Sand Sourcing Specialist Report (Appendix I) and specifically Section 6 which describes the potential impacts.
	14. From the list of activities to be triggered by the proposed project, the report states that listing notice 2 Activity 23 will be triggered, "part of the sea will be reclaimed by the proposed development". The applicant must contact DEA: OC NTonjeni@environment.gov.za for the process to be followed when one intends to reclaim land in terms of Sec 7B ICM Act (Reclamation of land for state infrastructure).	Noted.	Responded to and incorporated at scoping phase.
	15. O&C takes note that the applicant is the Kouga Municipality, therefore an ORV permit will not be required for the implementation of the proposed project. Should the competent authority decides to grand a positive environmental authorization, the applicant must notify DEA: OC NTonjeni@environment.gov.za before commencement of driving within the coastal zone.	Noted.	
	16. It is a recommendation of this Branch that the applicant must not undertake activities that have not been assessed that requires authorization from the competent authority (either in support or not of the proposed project) to avoid causing adverse effects on the marine environment. Failure to adhere to the	Noted.	

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
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	legalities may result in statutory enforcement measures being taken against the applicant.		
	17. Officials within DEA O&C responsible for EIA is Ms. Funanani Ditinti fditinti@environment.gov.za And Mr Xolani Myanga XMyanga@environment.gov.za.	Noted.	
	The Branch Oceans and Coasts reviewed the Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province, and recommends for the comments provided to be taken into consideration and implemented in order to achieve the objective of the ICM Act. DEA: O&C will provide more comments during the next Public participation phase. These comments must be sent to the competent authority for consideration and implementation, and send this office proof. Kindly note that the department reserves the right to revise our initial comments and we may request further information based on any additional information that might be received. All future correspondence and documentation (hard copy and an electronic copy) must be submitted to our office for the attention to the Funanani Ditinti/ Xolani Myanga Directorate: Coastal Conservation Strategies using the following contact details: Physical Address: Department of Environmental Affairs (DEA), Branch: Oceans and Coast, 2 East Pier Building, East Pier Road, Victoria and Alfred Waterfront, Cape Town, 8001.	Noted.	
Mr Andries Struwig / Ms Nicole Gerber DEDEAT Nicole.Gerber@dedea.gov.za (Comments received from the Competent Authority)	The DSR does not contain any A3 maps or layouts. The FSR must include all maps, layouts and diagrams included at an appropriate scale, as A4 or smaller in most instances is not suitable;	Noted. The FSR will be submitted to the DEDEAT with A3 maps and layouts.	
	It is noted that modelling will be done at detailed design phase. The Department requires that this is made clear in the FSR and that an indication of whether a design can be ensured with respect to impacts on the northern beaches is taken cognisance of and discussed in the FSR and subsequently, the EIR;	The EIR will incorporate impacts to the coastal zone together with detailed mitigation measures to avoid any further coastal erosion being derived as a result of the proposed scheme. In addition, Advisian will be	In 2020 Advisian refined the preliminary design of the groynes and sediment nourishment. This required a revision to the coastal modelling which was extended to incorporate impacts

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		required to report on the projected transport of sand northwards past the proposed coastal protection scheme as derived from their modelling, and an assessment will be made on the impacts of the scheme on beaches north of the scheme.	on beaches to the north. Section 6.7 of the EIR contains a summary of the changes to the coastal hydrodynamics as well as the changes to the long-shore transport of sediment and assesses the impacts in Section 7.2. A summary of the changes are included in the Specialist Reports (Appendix I & J) with the engineering reports in Appendix F containing the full detail.
	The adverse impacts of possible acceleration of erosion must be addressed, as well as mitigation measures and ongoing monitoring;	As above.	In 2020 Advisian refined the preliminary design of the groynes and sediment nourishment. This required a revision to the coastal modelling which was extended to incorporate impact on beaches to the north. Section 6.7 of the EIR contains a summary of the changes to the

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
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			coastal hydrodynamics as well as the changes to the long-shore transport of sediment and assesses the impacts in Section 7.2. A summary of the changes are included in the Specialist Reports (Appendix I & J) with the engineering reports in Appendix F containing the full detail.
	The Sand Sourcing Study must be included in the FSR if completed, but otherwise in the Draft EIR (DEIR) as a minimum requirement;	The Sand Sourcing Study will be made available for formal PPP during the EIR phase.	Refer to Appendix I in the EIR for the Sand Sourcing Specialist Report.
	Please note that some of the copies of responses received from I&AP's in Appendix B have not copied so well and are not legible and also quite small (notably pages 132 — 145) - kindly ensure that all copies of such responses are legible in the FSR; and	All comments and responses received from I&APs have been made legible in the FSR.	
	The Estuarine and Dune System Assessment should also include a section which addresses possible impacts of the proposed coastal protection scheme on areas northwards of the area proposed for the groynes, specifically addressing any potential accretion/erosion of the northern beaches/coastline.	Noted. The EAP suggests that the Coastal Ecology section of the EIR consider the effects of the coastal protection scheme on areas northwards of the area proposed for groynes rather than the Estuarine Specialist Report since these	In 2020 Advisian refined the preliminary design of the groynes and sediment nourishment. This required a revision to the coastal modelling which was extended to incorporate beaches to the north. The

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		habitats are not strictly estuarine habitats.	Estuarine and Dune Ecology Specialist Report (Appendix J) has been updated accordingly.

Table 3 Comments received after the Final Scoping Report was accepted by DEDEAT (25 October 2019)

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
Comments received after the Final Scoping Report was accepted by DEDEAT (25 October 2019)			
Mr Andries Struwig / Ms Nicole Gerber DEDEAT Nicole.Gerber@dedea.gov.za (Comments received from the Competent Authority)	1. Refer to the Final Scoping Report (FSR) dated and received on 25 September 2019, together with the Draft Estuarine and Dune System Impact Assessment and the Beach Nourishment Source Material Study, submitted in support of the application to undertake listed activities as contained in the 2014 NEMA EIA Regulations, as amended. 2. The Department has reviewed the FSR and hereby notes the following: a. The comments made by the Department on the Draft Scoping Report (DSR) have been considered and adjustments done in the Final Scoping Report (FSR); b. Comment from the National Department of Environmental Affairs, Oceans and Coasts Sub-Directorate were received and included in the FSR; c. Other comments from registered I & AP's have also been included and responded to. It is trusted that these comments will be further addressed in the EIA Phase, particularly addressing the requirements of the Integrated Coastal Management Act, 2008 and Local Government Municipal Systems Act, 2000;		Noted Noted Noted Noted

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	d. It is noted that Appendix G includes an archaeological report dated 18 December 2006 from Geological and Environmental Services. In light of the sensitivity of the area, as well as the interest of local I & AP's, the Department requires that this report is updated and/or the findings confirmed by a suitable archaeological specialist during the EIA phase, as well as obtaining any comment from SAHRA or ECPHRA; and e. The Plan of Study includes the Source Material Study as well the Estuarine and Dune Impact Assessment. 3. The FSR is hereby accepted and the Plan of Study is approved taking cognizance of the above. You are thus to proceed to the EIA phase as per the provision of Section 23 (A) of the NEMA:EIA Regulations as published in GN R982 of 14 December 2014, as amended. You are reminded that Final EIR is to be submitted within 106 days from the date of signature of this letter, i.e. by the end of business on Monday 02 March 2020. An environmental impact assessment report must contain all information set out in Appendix 3 to these Regulations or comply with a protocol or minimum information requirements relevant to the application as identified and gazette by the Minister in a government notice. 4. The Environmental Assessment Practitioner is require to notify and inform the application in writing that the activity may not commence prior to an environmental authorization being granted by the competent authority.		The Archaeological and Heritage assessment was updated by a qualified expert. Comments were obtained from SAHRA and specifically the marine unit responsible for projects in the coastal zone (Refer to Appendix G of the EIR). Noted Noted
Mr Ryan Donnelly 076 011 3347 ryazion@gmail.com	I grew up surfing the beach since a teenager and I'm now 47. I have witnessed the beach changes since 1985. I have an intimate knowledge of the local beach conditions and what conditions makes those special waves work because I surfed these waves often since 1985 till now. I was also behind the Artificial Reef Company. I researched an alternative and presented this technology to the local committee and they then arranged to fly ASR out here and I spent a lot of time with the ASR guys on the beach project. I have a good understanding and background in the beach project and what it might take to preserve the local waves. When I saw that input	The Scoping Report (this is the initial step in the EIA process) underwent formal public participation from the 20th of August 2019 until the 18th of September 2019 and has now been submitted to the	In 2020 Advisian refined the preliminary design of the groynes. This resulted in the relocation of a number of groynes and importantly their orientation in relation to the shoreline (Refer to the engineering reports in Appendix F). The relocation of the groynes is to avoid well-known surf breaks while the orientation of the

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	from the local surfers is wanted I became encouraged to make contact with the engineers. I also noticed one of the potential groyne layouts and felt that if in fact the surfers had given input that it does look like there is an oversight if the intention is to preserve the wave at Ann Avenue. In any event I have invested a lot in the passed in this project and feel that it would be a wrong of me to not offer my input to the benefit of this projects objectives which is to my knowledge is to solve the beach erosion issue and hopefully also preserve the waves for the surfing community and industry. I am not represented by his surfing community representative. I am also not a member of the surfing community or organisation from Cape St Francis so at this point it appears the best way for me to participate is to submit a formal comment to you for the St Francis Property Owners NPC Proposed Coastal Protection scheme. Here is my comment: There appears to be a number of groyne options many of which will have an impact on our surfing environment. In some ways potentially positive and in others ways potentially negative. In order to participate in a meaningful way and make and informed comment for this project I would need a final plan to look at. My understanding is that the plan can be changed by the engineers after the approval of the EIA process. This makes it impossible to participate meningfully and make an informed comment for this project and upcoming EIA process. How these structures will affect the waves for the surfers will depend on where the groynes are placed. Waves are a part of the environment and they are tied to our surfing industry, surf culture, pleasure, recreation and sense of place in st Francis bay . The final locations of the groynes are needed and the engineers should be held accountable to their final plan. If the engineers change their plan and location of the groynes after the approval of the EIA we will need the approval of the EIA to be null and void and the EIA reopened for further	Competent Authority, the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT). The DEDEAT will determine if the EIA process may continue, after which the Draft Environmental Impact Assessment report (EIR) will be compiled and made available for public review. CES is aiming to have the Draft EIR ready in early November and therefore the next public review process, which may include a public meeting, will likely take place in mid- to late-November 2019. Because your comment has been submitted outside of the formal process, it must be sent directly to the DEDEAT who will then include it in their project file. I have thus forwarded your comment to the DEDEAT for consideration.	groynes (i.e. perpendicular to the shoreline) is to facilitate the potential development of new breaks. This was as a result of the engagement with The Seal Point Boardriders Club and surfers outside of this club.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	public comment process before final approval of this EIA. This is if we wish to make an informed comment for this project and EIA process. The latest groyne map and locations shows a groyne at Ann avenue which has a significant impact on a much valued world class surfing wave called Ann Avenue**.**	In addition, you will be added to the list of Interested and/or Affected Parties (I&APs) for the project and will thus be informed as the EIA process progresses.	
Mr Rod Suter 042 294 1627/082 880 7344 rod.suter@gmail.com	Please could you sent me a legible copy of the attached presentation slide which forms part of the Scoping Report.	Apologies for the delayed response. Please find attached the slide requested. Please note that this is the slide that was presented at the time of the public meeting and is subject to change depending on the outcome of the Final Scoping report submitted to the DEDEAT.	Noted
	Please could you assist and point me in the right direction to get a copy of one of the reference documents : ASR. (2006). ST FRANCIS BAY BEACH PROJECT: Investigations into the Application of MultiPurpose Reefs at St Francis Beach for Coastal Protection and Amenity Enhancement. SR Ltd Marine Consulting and Reseach.	Please find attached the reference document as requested.	Noted
Xolani Myanga **Department of Environment, Forestry and Fisheries: Oceans and Coasts** +27 (0)21 819 2424 XMyanga@environment.gov.za	The estuary is already experiencing issues of erosion as well as sedimentation. The Applicant should ensure that dredging does not worsen the current situation in and around the estuary.		In 2020 Advisian used bathymetry data collected in 2020 to run a model that simulated the hydrodynamics of the estuary before and after dredging. These reports are available in Appendix F. The effect of the change reported in the engineering report was considered in the Sand Sourcing Specialist Study (Appendix I) and the Estuarine and Dune Ecology Specialist Report

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			(Appendix J). A summary of the changes and the resultant impacts are contained in Sections 6.7, 6.9.1 and Section 7.2 of the EIR.
	We are of the view that dreadging will possible widen and deepen the channel and this may have negative impacts on the biota. The Applicant is requested to provide an assessment report and findings on how dreadging will have impacts on the biota both in the channel and along the estuary margins.		Refer to the Sand Sourcing (Appendix I) and Estuarine and Dune Ecology (Appendix J) specialist studies.
	The Kromme estuary is already under stress due to reduced flow. Therefore, we are concerned that dredging will possibly increase the amount of seawater entering the estuary resulting in a further reduction in saltmarshes which require a balance between salt and freshwater. Will an appropriate balance be maintained?		Refer to the Estuarine and Dune Ecology Specialist Study (Appendix J).
	Furthermore, the EAP is requested to clarify whether the introduction of considerable extra sand in the area of the threatened sandpit, together with revetments and groynes is appropriate to provide sustainable protection of the St Francis marina area for a reasonable time into the future from a physical oceanography and coastal vulnerability perspective.		The design life of the structures is 50 years. Refer to Section 2.4 of Advisian's PED Report (Appendix F). A design event with a return period of 100 years has been selected for design. This event has a probability of occurrence of approximately 40% during the structure design life.
	According to the Final Scoping Report there are other sites in the estuary that are similar to the ones that will be affected and that the fish can go to those areas? Has any thought been given or investigated as to why the fish prefer their current sites?		The FSR does not mention that the sandbanks are the current preferred sites, it merely suggests that fish in the area will have access to similar habitats in other parts of the estuary (Refer to the Estuarine and Dune Ecology Specialist Report in Appendix J of the EIR for further information).
	The Final Scoping Report also states that benthic invertebrates will recolonize the area at some point in time. The EAP is requested to elaborate on what will happen to the fish that feed on them during the intervening period.		The FSR states that some benthic species would be lost from specific and discreet areas. It is anticipated that this impact will have low significance given the small percentage of the overall

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			available habitat (See Section 7.2 of the EIR). Therefore, the effect on fish is expected to be of negligible (Refer to Appendix J).
	The EAP is requested to elaborate on whether any modelling or specialist study have been conducted of coastal circulation in the areas regarding the long term effects of the proposed revetment? For example, from studies of the rock revetment at the strand along the southern section at Greenways Golf Estate, the findings actually show the rock revetment actually deflects energy northwards directly to the main beach which increased the wave energy and impacts of the waves on the coast, particularly during storm event.		The intention with the groynes is to retain the sand material placed on the beach. The nourished beach will provide the necessary protection. Therefore, if the beach behaves as anticipated the beach will not refract / deflect the waves but absorb them as it would have done under natural conditions (Refer to the preliminary design report by Advisian in Appendix F of the EIR). The existing scenario, where the revetments along St Francis Bay are exposed, has the deflection effect. This would be the same in a future scenario should all the nourished material on the beach disappear. Given the planned maintenance of the beaches this is extremely unlikely.
	The wave power atlas by Rautenbach and Williams show that for all seasons and regarding the total annual average wave power, the beach falls into the "extremely sheltered" category. This means that wave power output at the 7m isobaths is less that 10kW/m i.e. very low. This was then checked for each season with the same result. Information published as GIS shapefiles and can be downloaded: Wave power atlas: https://search.datacite.org/works/10.15493/deff.10000003; Wave power exposure: https://search.datacite.org/works/10.15493/deff.10000004. This low wave energy leads to the question the Final Scoping Reports view about wave energy being the culprit: What was considered to draw this conclusion?		It is the EAPs understanding is that the longshore drift, created by waves, has transported sediment to the north. This together with the lack of replenishment of sediment has led to the current state. This is exacerbated through storm events and local circulation. For a more detailed understanding of the hydrodynamics please refer to the Preliminary Design Report in Appendix F of the EIR.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	• Was it perhaps rather a few extreme storm surges that removed the sand thereby reducing beach width? • Alternatively, is there some localized circulation in the bay that could be removing sand?		
	Furthermore, the wave power findings above, the 7m isobaths is roughly 1km from the coast. Unless there is some type of shelf which we are not picking up. It is our assumption that the slope is gradual which would further support the low wave power output.		It is the EAPs understanding is that the longshore drift, created by waves, has transported sediment to the north. This together with the lack of replenishment of sediment has led to the current state. In 2020 Advisian repeated their coastal model with the refined project layout. This report summarises the offshore/coastal conditions experienced. Please refer to these reports in Appendix F of the EIR.
	The EAP is advised that even though the Branch OC has no objection to the proposed development of the coastal protection scheme, it continues to advocate for the implementation of the comments previously submitted to the Applicant.		Noted.

Table 4 Comments Received During the Public Review Period for the Draft Environmental Impact Report (5 February 2020)

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
Rod C Suter rod.suter@gmail.com	Thank you, noted that we now have a second PPP meeting, with slightly more notice. However, the period of 1 week after the meeting until the closing of the Comment period seems insufficient.		Thanks for your time last week it was good to get a bit more context behind your original comments and your current concerns.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	I suggest it should be extended to at least 3-4 weeks - seeing that this post-meeting period was planned to be about 7 weeks after the first PPP meeting on 19 Dec.		CES are confident that, with two meetings for the Draft EIR and the fact that we have significantly extended the mandatory PPP period, Interested and Affected Parties have all had sufficient time to review the documentation and to provide comment. The EAP will record your comment below in the Issues and Response Trail which will form part of the Final EIR so that the Department are aware of your request. Let me know if you have any additional comments.
	Thanks for the additional meeting last night - I think the number of attendees shows it was necessary, and some the inputs from the floor were of value. Unfortunately, it was apparent that a large number of the attendees had not bothered to properly read and understand the report - and in spite of the total number number of pages, the core info is probably no more than 100 pages at most. A suggestion in light of the discussions - it would seem to be invaluable from an information dissemination and public support perspective to set up (very soon) a PPP-type public meeting with the Advisian Engineering report as the topic, obviously with Advisian attending to explain/defend their engineering report and design. I don't know how this would fit into the formal EIA framework, if at all, but I think it is very necessary; and I believe SFPO would probably support this suggestion as well. I would also again support Ryan's proposal that the PPP period is extended beyond 5 Feb.		Email received – thank you. Your comments will be recorded and responded to as part of the Issues and Response Trail in the subsequent round of documentation. That documentation will be made available in due course with notifications sent out.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	Very disappointed that you have apparently decided not to accede to the request for a public meeting including Advisian - I think this is a mistake which could lead to delays and appeals later in the process, which is hardly desirable.		Noted. It is the intention that time for engineering related questions will be scheduled for the next round of PPP. Advisian will be present to respond accordingly.
	PROPOSED COASTAL PROTECTION SCHEME ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE DEDEAT REFERENCE NUMBER: EC08/C/LN2/M/42-2019 Comments by RC Suter My earlier Comments in the EIA Process, as recorded in the IRT, are referenced. I submit that the Mandatory Public Review process for the Draft EIR and Environmental Management Programme is flawed and has not been performed as required in terms of the relevant norms, legislation and regulations. The motivation for this opinion is: 1. Notification was issued of the Mandatory Public Review process on 18 December 2019, principally by e-mail. This notification advised that (1) the PPP period for comments and inputs would close on the 5 Feb 2020, and (2) that there would be one public meeting held on 19 Dec 2019 – i.e. giving 1day notice. This PPP period covered the annual year-end holiday period in South Africa; this is the time of the year when many St Francis Bay residents are away from home and thus unable to attend the meeting – The reasoning behind this timing has not been forthcoming. After objections and interactions between interested parties and the EAP, a further meeting was grudgingly arranged by CES on the 29 Jan 2020 (i.e. well after the end of the holiday period). The fact that the first meeting was attended by some 20 people, and the second meeting by more than 80 people, indicates the level of interest from local community.		Dear Mr Govender. Thank you for your email of 6 February. I have provided our response below based on Mr Suter's points. Item 1 - being related to PPP and the time allowed to I&APs to provide comment. Item 2 – related to an understanding of the scheme from an engineering point of view. 1. PPP CES requested that the department (DEDEAT) consider that the PPP period for the Draft EIR be extended to cover the holiday period as many of the owners of the properties are not permanent residents. The primary purpose of extending the review period to 6 weeks and to hold it over the Christmas period as this is the time that many non-resident St Francis Bay homeowners are in the town for the holiday period. Confirmation was received from DEDEAT on the 9th December 2019. Notifications of PPP commencement (as mandated by the legislation) and public meeting on the 19th December:

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			• Were placed around St Francis Bay (St Francis Bay Spar, Municipal Offices, Small Boat Harbour (outside and inside the office building), SFPO offices, St Francis Community Library, Bruces Ocean Museum and Sea Vista Community Library) on the 17th December 2019 along with notification during the SFPO AGM on the 17th December (204 Attendees); • Sent out via email (18th December 2019) to all registered I&AP's; • Sent out via email from the SFPO newsletter desk to all members on their data base on 18th December 2019; and • Published in the press (Herald 18th December, Kouga Express 19th December), as prescribed in the legislation; Hard copies of the report were made available in the Municipal Offices and SFPO offices on the 19th December 2019 and electronically from the CES website on the 19th December 2019.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			The presentation on the 19th December 2019 summarised the information contained in the documentation. It covered the Project Description, Alternatives, Need for EIA, Baseline Environment (incl. Specialist Reports), IA methodology, Potential impacts of the scheme, Recommendations for mitigation and monitoring (EMP), Questions and information on where to send comments. The main difference between the EIR and Scoping Presentations were the inclusion of the specialist studies and the environmental impact ratings. The engineering design was the same as that presented in the Pre-Application meeting (Public Meeting held on 15th April 2019) and the Draft Scoping Report (Public Meeting held in August 2019). Thus, IAPs have had the period from (29th March 2019) to 5 February 2020, a period of ten months, to read and understand the technical aspects of the proposed scheme. The documentation referred to above included: • The Draft EIR (including Draft EMPr);

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			• The preliminary engineering design report (released on 29th March 2019 during the Pre-Application PPP); • The Estuarine Specialist Report (available from 20th August 2019 as part of the documentation from the Draft Scoping phase); • The Sand Sourcing Specialist Report (available from the 19th December 2019 as part of the Draft EIR); and • The Archaeological Specialist Report (available from the 19th December 2019 as part of the Draft EIR). CES together with the SFPO considered the request for a second meeting outside of the holiday period to include local residents who may have been away. This, as confirmed by Mr Suter below, was well outside the holiday period to accommodate local residents. Thus, we have held meetings to include residents, holiday makers and non-resident homeowners.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			Notifications of a 2nd meeting on the 29th January 2020: • Were placed around St Francis Bay (St Francis Bay Spar, Municipal Offices, Small Boat Harbour (outside and inside the office building), SFPO offices, St Francis Community Library, Bruces Ocean Museum and Sea Vista Community Library); • Were sent out via email (16th January 2020) to all registered I&AP's; and • Published in the press (Herald 17th January) and local posters (including St Francis Bay Facebook pages). The presentation was very similar to that presented on the 19th December 2019. According to the register, the meeting on the 19th December was attended to by 22 people. Previous meeting registers indicate that there were: • 30 people present during the initial public meeting held in December 2018; • 25 people present during the Pre-Application meeting held on the 15th April 2019;

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			• 19 people during the Draft Scoping PPP (August 2019); and • 66 people in attendance on the 29th January 2020. CES consider that there has been significant opportunity for interested and affected parties to be involved in the project and to provide comment: • Non mandatory 30 day comment period for Pre-Application Phase (April) including 1 public meeting; • Mandatory 30 day comment period for Scoping Phase including 1 public meeting; • Mandatory 30 day comment period for the Draft EIR extended by 18 days to accommodate holiday makers, including 2 public meetings; and • As the department are aware, comments have been submitted outside of the formal commenting periods which we have accommodated in the IRT.
	2. At the meeting on 29 Jan 2020, there were many questions from the floor concerning the fundamental concepts and details of the Engineering Design Report – authored by Advisian. Mr G Shaw from the EAP, CES, stated he was not an engineer, and was thus unable to respond to these questions. He undertook to forward them to Advisian, but how the responses were to be circulated was unclear.		Engineering design The engineering design report was first presented during a meeting held in December 2018. The document has been available since 29th March 2019 in all EIA related activity as well as permanently on the SFPO website.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	As Advisian engineering concepts and designs are key to the definition, execution and success of the proposed scheme, this serious deficiency in the PPP process is unacceptable and could lead to delays and appeals at later stages in the EIA. The EAP was approached with the suggestion to extend the closing date of the Mandatory Public Review process, and to then arrange a further public meeting on the engineering aspects of the scheme with Advisian in attendance. These approaches were rejected by the EAP. Accordingly, the Competent Authority (DEDEAT) is requested to intervene and instruct that the proposed public meeting with Advisian is put in hand by the EAP and included in the PPP prior to DEDEAT undertaking their review of the EIR for this scheme.		During the initial meetings there was more time spent on the problem at St Francis Bay and why an intervention is required, together with the proposed approach to solving the problem (including alternatives). Questions were answered based on the information contained within the report. Questions that couldn't be answered were provided to the engineers and included in the issues and response trail (IRT) as part of the EIA process. During the meeting for the Draft EIR in 2020 the scheme and design was still included but emphasis was placed on the resultant impacts associated with the scheme, and what mitigation was recommended to ensure the impacts remained as low as reasonably possible. At the start of the meeting the EAP mentioned that it would be impossible to cover every element of the project in the time allowed (2 hours) and therefore did require that the documentation be read to gain further detail.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			In the notification sent out to the I&APs for the meeting on the 29th January 2020 CES recommended that I&APs read the documentation and come to the meeting with specific comments. During the meeting it was clear that many had not read the documentation (confirmed by Mr Suter himself in an email dated 30th January which will be included in the IRT). Nineteen attendees raised questions and/or made comments. CES was able to answer most of these questions. Questions of an environmental and EIA process were answered and engineering related questions raised that could answer (based on the engineering report) were answered. For those where CES could not be sure (either of the answer or whether it appeared in the report) the CES facilitator (Mr Gregory Shaw) mentioned that he wasn't an engineer.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			Nineteen attendees spoke at the meeting. Questions of a strict engineering design nature came from four attendees, and the questions which CES could not answer were whether permeable groynes were considered, whether enhancing existing off-shore reefs has been considered and a question regarding the founding of the groynes. CES believe that these questions can be easily answered by Advisian, without arranging a meeting for them to do so. Direct engagement with the proponent, outside of the formal EIA process, on the engineering design has been available to IAPs should they have been interested. This has taken place, for example with the Seal Point Boardriders Club. CES are confident that the impacts associated with this scheme can be determined based on the information available in the engineering reports available, and where necessary the confidence in which the impacts can be determined. It is CES' opinion, based on our extensive engagement with IAPs, that only a small number of individuals share Mr Suter's view which, in some

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			cases, have not been informed by the documentation (engineering and EIA reports) and presentations to date.
Les Noah. LFN1@vodamail.co.za	We attended the meeting for the EIA for the proposed construction of the groynes to the Saint Francis Bay beaches, on 29 January 2020. There were some points and questions which were put to you, and you were unable to answer at the meeting, as you stated each time ''I am not an engineer''. These questions are important questions, and remain unanswered. We need a further meeting, and we request that an engineer be present, who can answer the questions and the concerns put forward by the public participants, and give us the answers, and be able to explain it to us, as we too are not engineers. Please can you also furnish us with any other EIA on groynes that your company has been involved with along our coastline. As a result of this last EIA meeting, it has brought up more questions than answers. We need a fully comprehensive understanding of the proposal before any informed decisions can be made. For this reason, we request an extension of the deadline for the EIA, for a further 60 days, for us to do more research, and to understand that the EIA covers all the questions that are extremely important before submission to the next relevant authorities. A further request is that the minutes of the previous two meetings be available.		Comments received – thank you. More information on our previous work can be found on our website http://www.cesnet.co.za/company-profile Please note that your comments will be recorded and responded to as part of the Issues and Response Trail in the subsequent round of documentation. That documentation (which will include meeting minutes, presentation, etc.) will be made available in due course with notifications sent out.
Ryan Donnelly ryazion@gmail.com	Here with is my comment for the St Francis beach EIA process. 1. With regard to the feasible Alternatives. Gregory Shaw said that enhancing existing offshore reefs has not been considered or investigated.		In 2014 WorleyParsons reviewed previous studies and investigations and they assessed potential remedial options. They have, inter alia, also reviewed the ASR report.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	2. The draft makes mention that the surfers input has been sent to AVISAN for the next design phase. I am a local surfer of 27 years and was involved in the Save the Beach committee. I researched and presented the ASR technology to the Save the Beach committee, attended the meetings and lived with the ASR costal engineers during their visit. My input comes with a meaningful and educated background in the save St Francis beach project and it has not been considered, captured or sent to AVISAN. Dion of SFPO said to me that the surfers input is invited AFTER DEDEAT approval of the project.		• Problems were experienced with three reefs developed by ASR, namely the Taranaki Reef and the Mount Maunganui Reef in New Zealand as well as the Boscombe Reef in the United Kingdom. • ASR went into liquidation in 2012. • Deon Pienaar of SFPO NPC did not say to the I&AP that the surfers' inputs will be invited after DEDEAT approval. He said to the I&AP that the detail design will be carried out after DEDEAT approval. SFPO NPC had meetings with members of the surfing community on various occasions during 2019 and 2020, and information received from the surfers was passed on to Advisian. This I&AP was asked whether he would like to submit his surfing comments together with the other surfers, but he said that he would rather submit his comments separately. Surfer inputs were consolidated during a meeting held with surfers on the beach on 9 January 2020 and the outcome of this meeting was also passed on to Advisian. In 2020 Advisian refined the layout of the preliminary design to accommodate the surfing community's concerns. The coastal modelling to accompany the design change are detailed in Appendix F of the EIR.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	3. Roberto a CESNET EIA consultant said to me over the phone that the project is not ready for the public EIA process and that the draft wording allows for far too much leeway for change after DEDEAT approval.		• The CES colleague who was involved in this project mentioned that his decision to leave CES was not linked to this project. Similarly, he would not have offered his own personal opinion on the project since his role as an EAP is to provide an objective representation of the facts. • The current EAP's aim is to provide a balanced and objective summary of the project and the impacts associated with it.
	4. ASR costal engineers reminded me that the groyne structures will not work in st francis bay. Dion of SFPO said that he thinks the groyne's will work. With the permanent financial consequences to our small village involving an independent costal engineer is likely a responsible thing to do.		Please refer to the first comment regarding peer review from Rodney Suter: • Neither the SFPO NPC, nor Advisian are opposed to a peer review. This is normally undertaken during the detail design stage. During the preliminary design stage the concept of a groyne field and beach nourishment was developed. During the detail design stage the scheme will be developed in greater detail (e.g. exact placement of groynes, groyne lengths and angles, stone size, mass and shape, etc.), and at this stage a peer review may add more value.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			• Publicly available information reported on problems experienced with three reefs developed by ASR, namely the Taranaki Reef and the Mount Maunganui Reef in New Zealand as well as the Boscombe Reef in the United Kingdom. • ASR went into liquidation in 2012.
	5. There was mention by Wayne Furphy of the SFPO about above groyne developments at the second last public meeting and that they are looking for investors for this. Information in the draft about the intended above groyne developments is non-existent.		This application does not include for any development on top of the groynes. What is being submitted for approval is presented in Section 2 of the EIR
	6. Where are the minutes of the last two meetings?		Please see Appendix B of the EIR
	7. The drafts predicted beach profile is NOT consistent with a groyne structure. This is misleading to the public. The predicted beach profiles in the draft are consistent with submerged groyne's, permeable groyne's and offshore reefs.		A salient shoreline response would be expected for an offshore breakwater as presented in Section 5.3 of the Preliminary Design Report in Appendix F. Sediment build-up updrift of the groynes are expected due to longshore sediment transport. The groynes are short and will allow some sediment to by-pass the groynes, reducing erosion on the downdrift side of the groynes (i.e. jagged beach response). The updated engineering reports in Appendix F show the indicative design profile of the beach nourishment. It is recognised that the hydrodynamic conditions will naturally rework the sediment which may alter the profile between maintenance activities.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	8. With regard to beach nourishment. Where in the Draft can we find plans of the pump stations their positions and outlets? How have the impacts on the roads been looked at for sand nourishment and project build?		It is anticipated that no permanent structures (i.e. pumps, pipelines) will be constructed. Given that sediment has to be transported from various locations all pumps and pipelines will need to be mobile and in temporary locations. The EIR provides an indication in Section 9 regarding areas to avoid during the construction phase of the project. Contractors will need to avoid placement of equipment in these areas due to the sensitivities identified (environmental and social).
	9. Gregg Shaw said at the last meeting that there has been no study or survey to establish where the bedrock is in the bay. This survey has the potential to change the design, cost and location of the groyne structures in a significant way. This survey should be done before close of public participation.		The presence or absence of bedrock does not influence the design. Refer to Appendix F for the engineering reports and further detail.
	10. In light of there currently being only 2 days left of public participation for this IEA, with so many grey areas, un answered questions, with many SFPO mentioned updates and changes to the draft still in store, the recent new above groyne development information pertaining to this project and a lack of crucial information, I herby formally request an extension to the public EIA process. That there be key stakeholder focus group meetings with all relevant persons including the engineers, all with the agenda to look at the grey areas, deficiencies in information, to help avoid oversights, improve the integrity of the project and work together toward solutions where needed. To update the draft so the public can be in a position to make an informed comment for this EIA process.		See Section 8 of the EIR which details the extent of public engagement for this project. The opportunity for public comment on the Draft EIR was between 19th December 2019 and 5th February 2020 and included 2 public meetings.
Helene Loon 084 8114327 helene_loon@yahoo.com	Comments on the St Francis Bay Coastal Protection Scheme Draft EIR		The aim of the EIR is to assess the impact of the project on the receiving environment. The Kromme Estuary is well-researched and relevant information has been included to contextualise the impact. Generally

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	I would like to submit comments on the Draft EIA document as an I&AP who has grown up close to the Kromme River estuary, and witnessed how the ecological and physical nature of this fragile river system has been altered significantly in the past few decades, as a direct result of human interference. These impacts include the construction of two dams in the catchment area, a canal system significantly impacting the functioning of the sensitive river mouth, a bridge crossing the river and effecting sand movements, to coastal housing developments covering once mobile dunes that used to be an integral part of the natural sand movements replenishing the St Francis Bay beach. I am writing as someone who would prefer not to see even further degradation to a system already on the edge. The Kromme River estuary is regarded as one of the most important estuarine systems in South Africa. The Draft EIA document covers in detail the incredibly valuable ecological role that the salt marshes, reed beds, as well as the intertidal sand and mudflats play as integral components of the estuarine environment. It recognises the vital role that estuaries play as nurseries and feeding grounds for numerous fish species, and that a wide diversity of invertebrates species inhabit the estuarine substrate. Local bird species as well as numerous Palearctic migrants rely on the rich pickings on the mudflats and sandbanks. The document also realistically acknowledges that even with mitigation processes in place, it is just not possible to carry out the proposed coastal protection scheme without some loss or damage to the integrity of the estuarine system during the dredging process, and gives a detailed and thorough analysis of the potential impacts to the system – both negative and positive. While it is very reassuring to know that the EIA document reflects a comprehensive understanding of the potential impacts at stake, there are a few questions that I would like to put forward for clarification.		ichthyofaunal will move away from areas of disturbance. The activity of dredging (and nourishment) is relatively slow and will allow mobile species to move out of the area. The areas targeted for sand nourishment are those areas associated with the river channel and sand banks. While sandbanks offer habitat to benthic organisms it isn't necessarily considered sensitive habitat for ichthyofaunal. Those sensitive areas (i.e. nursery areas) are likely to be associated with eelgrass beds and smaller channels away from disturbance. These areas have been mapped and included in the EIR (see Section 6.9). Less mobile species are unlikely to be able to avoid the dredging activity and the loss of individuals is expected. However, the sandbanks in the Kromme Estuary are extensive and the species present are numerous and common within the estuary and along the South African coastline. Therefore, the impact is unlikely to result in significant impacts to species on a wide scale. Dredging activity can be fairly accurately undertaken and therefore there is limited possibilities of collateral damage or loss. Suspended sediment from the dredging operation is anticipated but again the impact is

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	It was encouraging to read that should the development proceed, a regular monitoring programme would be put in place to track the ecological well-being of the ecosystem over time, as well as the fact that regular beach profiles would be taken at St Francis beach and in the river, that sediment discharge quantities and changes to hydrodynamics would be monitored - and that this would be done pre-dredging, during dredging and post dredging. Based on this, my questions would be : 1) Is there sufficient ecological baseline data from which to measure subsequent changes and compare results over time? For example, in the EIR it states that 'There is a significant lack of recent literature concerning the ichthyofaunal composition of the Kromme Estuary'. This leads me to question whether enough research has been done on fish recruitment in the estuary prior to dredging, to know whether the impacts of dredging are affecting the nursery areas used by young fish, and to gauge their survival rates? And do we know enough about seasonal variations in fish numbers? How will we know whether suspended sediment from dredging is smothering macrobenthic communities and negatively affecting their biology, e.g. the filter feeders? And how will disruption to the estuarine substrate and sandbanks effect creatures such as bloodworms, pencil bait, sandprawns and numerous other crustaceans? How will the change in hydrodynamics effect the system as a whole? One can speculate based on knowledge of the ecosystem, but is it enough to justify the risk involved? Severe negative impacts on even one species could have repercussions for so many others.		expected to be very localised to the area immediately around the dredger. Estuaries by their nature are dynamic systems and organisms that exist within them have strategies to deal with smothering or periods of higher suspended sediments. On very windy days the turbidity of the Kromme can be very high. Hydrodynamics are likely to change. These changes have been modelled (Refer to Appendix F of the EIR) and for the most part a negligible change is predicted. The largest difference in current velocity is expected at the mouth of the estuary and only occurs immediately following dredging in that area. The ecological impacts associated with the changes have been described in the Sand Sourcing Specialist Report (Appendix I) and the Estuarine and Dune Ecology Specialist Report (Appendix J). Section 7.2 of the EIR summarises the impacts.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	2) Most importantly, if significantly negative impacts to the environment ARE detected during the ongoing monitoring process in either the beach or estuarine environments - despite the numerous mitigation measure put in place – will the beach nourishment activities of the St Francis Bay coastal protection scheme be halted, and who would be in a position to make this vital decision ? I would like to be assured that measures are FIRMLY in place to stop further developments should the coastal environment be significantly compromised, before irreplaceable loss of sensitive habitats and biodiversity takes place. I feel that this is urgent given that the operation phase of the development is predicted to continue into perpetuity.		The EMPr accompanying the EIR is a document against which the project will be monitored. Monitoring reports would need to be submitted to the authorities. These reports would need to report on, amongst other parameters, whether the impacts assessed as part of the EIR are still true. DEDEAT would review the documentation and are able to revoke their authorisation should it be necessary. A benefit of the design and approach is that the project can be phased. This would allow for appraisal of the environment as the project develops. Equally it allows for the project to be halted/adjusted should any significant adverse impacts be identified that were not anticipated. The natural longshore drift will continue and therefore if the scheme is not continued for any reason the sand placed on the beach will continue to move to the north as it currently does. Some of the sand will find its way back into the estuary while some will continue northwards. While expensive and complex, groyne structures can be removed if necessary.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	3) Would experts be able to advise on what time-span is needed before such a cut-off decision is put in place? I feel that it is vital to be able to recognise the point at which further degradation would be irreversible, and halt activities in order to prevent long-term damage. While I really do respect the economic importance of promoting and sustaining tourism in the area, I am just so aware that dredging activities and the artificial manipulation of estuarine mouths are known to have potentially disastrous impacts on estuaries. It would be wonderful to be able to avoid further impacts on this valuable and beautiful area. Thank you very much for the efforts that you are putting into this important consultation process.		A benefit of the design and approach is that the project can be phased. This would allow for appraisal of the environment as the project develops. Equally it allows for the project to be halted/adjusted should any significant adverse impacts be identified that were not anticipated.
	I am not sure whether you are aware of the critically endangered gecko species, the Salt Marsh Gecko (*Cryptactites peringueyi)* that inhabits the Kromme River salt marshes. It is endemic to the Eastern Cape, and according to The Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland, it is known from only 2 small populations. The first is near Cape Recife, while the second population is restricted to the salt marshes of the Kromme River estuary and in habitats adjacent to the coast at Cape St Francis. We have been fortunate to see it on a number of occasions on the Kromme salt marshes, and are hoping that the habitat of this critically endangered species will not be compromised.		The salt marsh has been identified as a sensitive habitat. The mitigation measures included in Section 7.2 emphasize that dredging avoid salt marsh areas. The dredging has also been designed to retain sand bank features in areas fronting salt marsh to ensure they remain intact. In addition, the result of the modelling of the effect of dredging on the estuary shows that the change to the current velocities are negligible. This suggests that the system would behave in a similar manner to what it does currently.
Dr David Comyn 0832618037 djcomyn@gmail.com	IN OPPOSITION TO THE PROPOSED PLAN TO REPLENISH THE BEACH AT ST FRANCIS BAY Whereas replenishment and nourishment of the beach is the priority, the current proposed plan is impractical and unacceptable for the following reasons. This paper follows two meetings to discuss its environmental impact on the Kromme River and the beach.		Noted.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	1. The entire project was conceived by a narrow group whose stated purpose is to "preserve the value of their properties", not the greater good of the community. This is evidenced by the plan to make the "spit" the first priority in preference to the main beach. The reasons given for this environmental priority were poor and evasive. By far the greater good to the community would be to rectify the beach. Indeed the environmental plan acknowledges that the northward continental sand drift will favourably impact on the "spit" in time anyway. There is a widely held view that as soon as the "spit" is protected at the completion of phase one, the driving force behind this project will dissipate. If the "spit is breached the canal entrances can be protected by maintenance dredging as happens right now, at a fraction of the cost. Thousands of visitors have voiced their disappointment at the condition of the beach and this poses the real danger to the town as a popular resort.		Revetments have been installed along the most vulnerable portions along the St Francis Beach, except for the Spit area. The Spit area has suffered more aggressive erosion than the rest of the St Francis Beach (refer to the Advisian report – Appendix F). In 2020 the spit breached on four occasions leading to the implementation of emergency rock revetment by the Kouga Municipality. The major part of the project entails coastal protection, comprising groynes and beach nourishment, for the entire length of the St Francis Beach.
	2. The plan is flawed. A. It is incomplete. At both the recent meetings the main gist of many of the questions, which reflect the uncertainty of the community, concerned the engineering plan. It has not been fully explained. To answer "I am not an engineer" is just not good enough. Understanding the engineering plan is key to understanding the environmental impact. The rate and levy paying residents deserve more detail. To impose a regulatory time frame for evaluating an incomplete plan is not the best way to encourage the wider community to accept it.		During the initial meetings associated with the EIA process there was more time spent on the problem at St Francis Bay and why an intervention is required, together with the proposed approach to solving the problem (including alternatives). During the later meetings the focus shifted to the potential impacts associated with the scheme since the meeting was aimed to only provide a summary of the documentation available. Questions were answered based on the information contained within the report. Questions that couldn't be answered were provided to the engineers and included in the issues and response trail (IRT) as part of the EIA process.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	B. It has not been fully costed and there is no definite plan as to where the money will be sourced. This is pertinent to permanent residents who will bear the burden for many years.		A cost estimate for the coastal protection infrastructure has been prepared by Advisian. Refer to Section 6.6 of their preliminary design report. Also refer to Section 5.8 of Advisian's report on the spit revetment for their cost estimate for the three revetment options. Additional reports were produced in 2020 to serve as an update based on the refined design. Appendix F of the EIR contains the reports and updated cost estimates for the works proposed. Funding for the project are obtained from the SRA levy, other entities such as the St Francis Riparian Home Owners Association and the Kromme Joint River Committee, possible public funding and further private funding opportunities.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	As a member of the community with property between the bridge and the Sand River delta I view the current dredging plan to be flawed from both an environmental and loss of amenity perspective. The environmental plan is confusing because sections of this area are variably described as sensitive and non-sensitive at the same time. To accept the environmental plan I need to understand this. The proposed dredging of the north bank to create a new channel will seriously impact on the salt marsh as boat wake action will erode the bank. This is an important habitat for Kromme River estuarine flora and fauna. The greatest damage to this area was done when the Sand River disgorged thousands of cubes of sand into the river. Old photographs will show that the original channel hugged the south bank. The most favorable sand removal by dredging or road will be to re-establish the original river course. Geophysical examination will confirm the river course. The river frontage of these properties is a playground for young children and adults alike. Long standing sporting traditions will be impacted. The biggest value of dredging will be to open the original channel by making it wider and deeper thereby making it safer and easier to navigate.		The EIR summarises the ecological sensitivities of the estuary in Section 6.9. This is informed by the Estuarine and Dune Ecology Specialist Report (Appendix J of the EIR). The EIR goes on to identify the potential impacts associated with the scheme in Section 7.2. In Section 7.2 it is recognised that some sensitive vegetation will be impacted by the scheme and goes on to quantify the loss (in terms of area) and provides the impact significance. There is also the provision of mitigation measures to ensure that the impact is to a discreet section of the habitat. Section 7.2 also includes the impact to the amenity of the estuary. Section 9.6 presents the sensitivities and dredging locations and provides recommendations for no-go areas. Therefore, some areas deemed sensitive may fall outside of the no-go area delineated in Section 9.7.
	Conclusion. I propose the least damage for the most good, environmentally, financially and in the interests of the wider community (visitors and permanent residents) will be to concentrate all available energy and finances to restore the beach by fully planning and costing revetment protection and sand replenishment and nourishment. I also propose a rethink of the dredging plan immediately below the bridge.		Noted. Appendix F of the EIR provide a detailed description of the previous solutions presented for the frontage and presents the proposed layout and orientation of the groynes and beach nourishment. The Sand Sourcing Specialist Report (Appendix I of the EIR) presents the most suitable sand resource and the Estuarine and Dune Ecology Specialist Report (Appendix J) presents the potential impacts.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
Anthony P Smith +27 42 294 0660 Apsmith@westnet.com.au	I have read the St F Bay Draft Scoping Report with Appendixes and attended the above mentioned meeting. The report, in my opinion, has some anomalies that when raised at the meeting you were not able to explain or clarify. The main problem being with what was being stated in the EIA section and what remedy/options were being proposed in the Engineering reports. This has raised more questions than answers. This makes it very difficult to make an informed decision based on the report and I therefore request that deadline for the application be extended for a further period of between 30 and 60 days. This will allow for an additional meeting to be held which can then include the people responsible for the Engineering report, to be present and able to answer the questions that were presented by the public at the last meeting. As a last request would it be possible for you to send me the presentation slides that you presented, as these summarised the contents of the report extremely well.		The presentation is included in the Final EIR (Appendix B). Specific engineering questions were tabled with the engineers and responded to as part of the Issues and Response Trail (Appendix B). Significant details are contained in the engineering reports in Appendix F of the EIR and summarised in the EIR.
Frank Silberbauer infinity@iafrica.com	Please refer to Table 5 below for comments specifically from this I&AP representing the Kromme Properties Share Block		
Mr Andries Struwig / Ms Nicole Gerber **DEDEAT** Nicole.Gerber@dedea.gov.za **(Comments received from the Competent Authority)**	1. The Draft Environmental Impact Report (DEI R), which is inclusive of the Draft Estuarine and Dune System Impact Assessment Report, as well as the Draft Beach Nourishment Source Material Study, and a separately bound Environmental Management Programme (EMPr) dated 06 January 2020 and received on 07 January 2020 for the above project refers. 2. Refer also to the acceptance of the FSR letter dated 25 October 2019. The Department has reviewed the DEIR and hereby provides the following comments: a. The DEIR does not contain any A3 maps or layouts. The FEIR must include all maps, layouts and diagrams included at an appropriate scale, at least in A3;		Noted Noted These will be included in the FEIR.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	b. It is noted that the concerns raised during the PPP at Draft Scoping Phase have been addressed and these are captured in the I&AP Issues and Responses Trail. However, there is no register of I&APs, no copies of I&AP correspondence and public meeting minutes, as well as no copies of the Department's letters in relation to the project, and particularly the letter accepting the FSR and POSEIA included in Appendix B. Such must be included in order to fulfil the requirements of the Department;		These will be included in the FEIR. Refer to Appendix B.
	c. The EMPr is lacking in terms of operational management. The Department requires that a maintenance management plan for the required actions envisaged in the operational phase is drafted and included in the EMPr to be included in the FEIR;		The EAP agrees that a maintenance management plan is required. This is recommended as a condition of the Environmental Authorisation. A maintenance management plan requires specific details of the dredging plant, dredging areas, approach and timing. This therefore, can only be developed following engagement with a contractor and based on conditions in the estuary and beach prior to construction.
	d. The adverse impact of possible acceleration of erosion, particularly regarding the northern banks of the Kromme River mouth and the northern beaches has not been satisfactorily addressed – the impact assessment, Section 7, Table 7.2 only briefly address this by indicating that the banks must remain intact. The method of doing so as well as mitigation measures and ongoing monitoring must be specifically addressed. The few bulleted points contained in the EMPr also do not give sufficient information besides monitoring being enacted; and		Advisian undertook additional modelling during 2020, using updated bathymetry and topographical surveys, and they produced two reports:

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
	e. The Estuarine and Dune System Assessment, dated August 2019, has not, as per the comments in the acceptance of the FSR dated 25 October 2019, addressed possible impacts of the proposed coastal protection scheme on the areas northwards of the area proposed for the groynes, specifically addressing any potential accretion./erosion of the northern beaches/coastline.		• A report on their hydrodynamic modelling study of the estuary. Their findings were that the currents outside the main channel (i.e. near to the banks, and in particular on the northern bank close to the river mouth are low (up to 0.2 m/s) and the dredging does not lead to any significant change in the currents in this area.

I&AP DETAILS	COMMENT	EAP RESPONSE (FSR)	EAP RESPONSE (DEIR)
			• A report on their supplementary shoreline modelling. The findings of that report were that the proposed groyne scheme in combination with beach maintenance will provide a continuous supply of approximately 28,000 m3 per year that will be transported to the northern coastline when the complete solution is implemented, and that it is considered to be more beneficial to the northern coastline than allowing the St Francis Beach to erode to the extent where negligible sediment transport can occur which would result in the northern beaches experiencing accelerated erosion.

Table 5 Comments Received During the Public Review Period for the Environmental Impact Report (5 February 2020) from Mr F. Silberbauer

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
27	**5**	Is the horizontal dry beach width of 40m to be measured at low or high tide? We presume this measurement is to be estimated at high tide?	Beach	Nourishment size	This is measured from high tide
31	**15**	Excuse the comment, but the procedure described for the filling of GSC containers sounds just too simple and easy, but in reality it is another whole issue with its own set of impacts?		The procedure of filling GSC containers is complex and its impact with regard to equipment and function should be discussed. Environmental variables must be taken into account.	It is a fairly simple process, comprising placing the geotextile container in the required location, fit the dredger's delivery pipe to the dedicated filling mechanism in accordance with the geotextile container supplier's instructions, fill the container with dredge slurry, the water drains through the permeable geotextile, the sand remains and the structure is in place.
31	**16**	In most instances at present and in the future plant & machinery cannot be stored on the beach due to the current absence of the beach at different times of the year. It would be appropriate to note that machinery could be stored at the nearest carpark but again logistical issues arise during peak season being December and Easter. Impacts and their mitigation need to be noted	Beach	Beach access and logistics as a result of beach conditions relating to beach size and access.	The contractor will be responsible to ensure they have adequate access to the construction areas and storage of equipment. Plant will not be stored on the beach. Possible available areas that could be used for storage of equipment will be identified for the contractor such as open areas on disturbed land. It may, or may not, be a car park. It should be noted that the project will most probably be phased. To try and identify these areas for any particular phase is at the moment premature. This will be done at tender stage for each phase.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
107	**72**	A feel good statement not really based on any fact?	Beach	Statement regarding the improvement of the current surf break which is not backed up with any supporting information. Provide details please?	In 2020 Advisian refined the design, considering the comments made by the surfing community with regards to the location of the groynes and their orientation. Refer to Appendix F of the EIR.
110	**76**	Misleading - should read: The projected project aims to slow down the rate of beach erosion, and assist in the possible prevention of damage to backshore infrastructure.	Beach	Just commenting on the statement that this project will 'prevent erosion' which could be construed as misleading?	The sentence in the EIR mentions to protect the St Francis Bay beach from further erosion. The placement of additional sediment along the frontage would become a beach which in turn would be maintained.
124	**98**	The bathymetric study should be done prior to the presentation of this EIA, as was the case in the previous study in 2006.	Beach	These studies will allow for more confidence in the viability of what has been presented in this study?	In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The findings have been considered in the specialist reports and the EIR. Detail of the modelling can be found in Appendix F of the EIR with the associated specialist reports in Appendix I & J.
32	**18**	The use of mechanical equipment will require input from the engineers and the timing of such works vs the core activities carried out by both permanent and temporary residents of St Francis Bay. These impacts and mitigatory steps so that the estuary is open for permanent residents are to be noted?	Dredging - Equipment	No description or proposal relating to the type of equipment and its impact upon the residents of the Kromme Estuary. Details are necessary?	Section 2.5.1.2 of the EIR presents the information known. At this stage no contractor has been appointed and therefore estimates have been provided based on experience and published information.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
107	73	As there is absolutely no information as to what the physical characteristics of the dredger or dredgers will be, and secondly we have no idea as to the infrastructure associated with these machines (pipes, cables, anchors, moorings). Again a further point, excavators come in many shapes and sizes we dont know what is in stall so we cannot really comment on this impact?	Dredging - Equipment	This query was put at a public meeting and we were referred to the Joint River Committee who's representative could not enlighten us on this subject? At this stage this question seems to not have been thought through.	Section 2.5.1.2 of the EIR presents the information known. At this stage no contractor has been appointed and therefore estimates have been provided based on experience and published information.
109	74	As already noted if one has some idea as to the type of noise expected then comments relevant to the noise problem can be made. At this stage we have not a clue as to what we are commenting upon?	Dredging - Equipment	Ditto as above comment	Section 2.5.1.2 of the EIR presents the information known. At this stage no contractor has been appointed and therefore estimates have been provided based on experience and published information.
643	135	NOISE DISTURBANCE: It must be noted that Kromme Properties Shareblock has permanent and semi-permanent residents and as this area is to supply 50% of the dredging material the noise and disturbance factor will be onerous. The canal users are screened from the river and therefore dont have 'in your face' machinery for possibly 50% of the dredging time on the Kromme. It gets even worse as one notes that the delta area is to be removed and again due to the nature of these sediments/deposits excavators and TLB machinery will be active during day time hours. Mitigatory steps in this instance are not feasible.	Dredging - Equipment	In the past the presence of Chokka boats adjacent to Kromme Properties was a continuous both day and night. Pollution was a factor and breakins were experienced. One understands that conditions can be applied to the dredging, but by its very nature and the nature of the works issues such as programming, weather, breakdowns etc. all make a regulated environment difficult to maintain. Kromme properties has experienced this before and really are not happy go down this road again.	To clarify, the Kromme Properties Shareblock represents 9 properties on the southern bank of the Kromme River, immediately downstream of the R330 road bridge. The dredging area in front of the Shareblock will supply less than 15% of the sediment required for the project.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
47	**25**	The desire to dredge the Kromme Estuary is noted, however the desirability of a deeper estuary, the greater movement of water (stronger tides), facilitating larger boats and easier access at all times can and will of of benefit to those who only use the estuary for recreational purposes - however the impacts of such have not been viewed from the point of view of landowners on the estuary and those not confined within the canal system, such as bank erosion, scouring, removal of recreational sandbanks, the depletion of estuarine fauna and flora, and general amenity loss.	Dredging - Impact	Viewpoint of those who are resident on the estuary such as Kromme River Properties who's property has 610 meters of estuary frontage. Impacts such as sea level rise, increased mobility of boats on the estuary over tide changes, damage to existing shoreline, increased threat of accident due to increased access, the continued safety of swimming of children, possible increase in large power boats, pollution and general amenity degradation are all potential impacts which are possibly irrelevant to those who visit St Francis annually, but are real issues to Kromme Properties which is inhabited on a semi-permanent basis.	As mentioned in Section 7.2 and in response to these questions that have been raised previously. It is recognized that activity (motor boat, paddle boat, swimming) levels are likely to increase. The impacts have been included and there is recognition that management of the activities requires consideration. This is particularly relevant to motor boats. Currently the Kromme River Joint Committee (KRJC) been mandated to ensure that this activity is managed appropriately and safely. This remains their mandate and the EIR re-enforces it. This includes no wake zones, demarcated channels, adequate signage and speed limits.
					To clarify, the KRJC represents 185 property owners who have been supportive of this initiative. Refer to Norman Dyer's response in the IRT.
					The EAP has taken an objective approach in their consideration of the affected persons and does not favour any particular group.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
103	**52**	The impact of the removal of sediment from the river is claimed as 'can be effectively mitigated/reversed without much difficulty or cost.' - IMPOSSIBLE	Dredging - Impact	No comment on this one?	This is in relation to hydrodynamics where it is possible to mitigate the effect of the change in hydrodynamics to those areas identified as being sensitive. In this case there is reference to the northern bank of the estuary and the estuary mouth. The results of the 2020 Advisian modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR).
557	**105**	Statement - Regular bathymetric surveys of the lower Estuary area should be undertaken pre-dredging - This aspect should have been done prior to this scoping report.	Dredging - Impact	ditto as per previous comments on this issue.	In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The findings have been considered in the specialist reports and the EIR. Detail of the modelling can be found in Appendix F of the EIR with the associated specialist reports in Appendix I & J.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
560	**109**	It is noted that the REVERSIBILITY of the IMPACTS of dredging is listed as 'DIFFICULT' TO 'VERY DIFFICULT'. This is of great concern and should set off alarm bells on the long term viability of dredging large quantities of material. Is it probable that if the proposed works were modeled with up to date data, could the outcomes as presented here change? One understands that this EIA has been done on a low budget, but the data is just not convincing and the possible damage to the whole	Dredging - Impact		While the reversibility and mitigation column is an important consideration, the reader should note that this has been taken into consideration in the impact significance.
561	**110**	Cumulative Impact Dredging to Kromme Properties Shareblock (Pty) Ltd which extends along the south bank of Priority area 2 will have a severe long term high impact that could lead to the possible reconfiguration of the channel (both downstream and upstream of the bridge), This may in turn lead to significant erosion/scouring of the banks of the estuary which may pose ricks to infrastructure (i.e.. the bridge, and riverside properties) - there is no mitigation measures offered for this area.	Dredging - Impact	Potential accelerated erosion and scouring of the banks of the estuary	In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). Section 7.2 has been updated accordingly.
588	**120**	STATEMENT - The species that will be directly lost (benthic organisms) as a result of the dredging activity are not sensitive species and while their abundance may be reduced initially it is expected that these species will return and inhabit newly dredged areas - In 2011 large areas benthic organisms were lost when they were covered by up to 1,5m of sand, debris and bridge rubble covering an area of 54,000m2. It is presumed that all benthic fauna in this area was lost as a result of this flood event. Today this area is vegetated with salt marsh and pioneer species.	Dredging - Impact	Loss of areas of benthic fauna in 2011 and now potentially due to dredging?	The loss of individuals of various benthic species will be as a result of the mechanical removal of the substrate. While there may be localised smothering of benthic species it is unlikely that there would be smothering impacts outside the work area.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
637	**129**	MPACT ON ESTUARINE VEGETATION Reed & Sedge communities - No loss.Intertidal Areas - Loss 16%Zostera capensis - Loss 10%Are these figures a result of a field study or desktop analysis?	Dredging - Impact	How were these figures calculated?	Figures were calculated on the mapping carried out as part of the Estuarine and Dune Ecology Specialist Report (Appendix J).
639	**131**	It looks as if no matter what one does dredging will reduce the faunal communities as there is no way that any contractor will implement systems to prevent such damage as that level of application just does not exist in this financially restricted proposal.	Dredging - Impact	impact on faunal communities.	The impact to the faunal communities referred to here is through direct loss due to the mechanical dredging operation. There is very little mitigation for separating/extracting fauna from the material prior to dredging.
640	**132**	STATEMENT: Overall, there will be a 10% reduction in Zostera habitat, a 16% reduction in intertidal areas, and a 33% reduction of sandbank habitat A further reduction of habitat, and whether mitigation happens or over the next 20 years habitat will be lost. There is no guarantee that these habitats will recover?	Dredging - Impact	impact upon flora communities	The reduction in habitat is based on a precautionary approach assuming that all areas disturbed directly through the dredging activity will initially be lost. The EIR maintains a MODERATE adverse impact as the nature of dredging and disturbance of the substrate cannot be mitigated fully.
642	**134**	STATEMENT:dredging is likely to reduce the level of the sandbank which may result in it becoming a subtidal feature Loss of areas of recreation at low tides.	Dredging - Impact	Those who live an enjoy the Kromme will have a reduced area to paticipate in low tide activities such as fishing, walking, games, sunbathing etc. which are all common at low tide. The Kromme Shareblock Community will loose this feature as all sandbanks adjacent to these properties will be lowered.	The sandbanks that fall within the priority and secondary dredging areas will be reduced by 2 m and 1 m respectively. The area designated for dredging in front of the Kromme Shareblock Community is mostly aligned with the current channel which is currently the deepest part of the estuary in this area and unlikely to be dry at low water.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
643	**136**	DEEPER CHANNELS DUE TO DREDGING: Yes it will be beneficial to boat owners and those who come down for peak periods but those who live on the estuary will have a continuous movement of traffic up and down the channel which is not the case at present as the low tide restricts the larger boats from traversing low areas of the estuary. It also gives fishermen the chance to fish without continuous disturbance from speed boats.	Dredging - Impact	comment on a proposed beneficial impact for dreding?	The benefit of dredging the channel will allow for passage of vessels through more states of the tide and specifically low water. It is also seen as a benefit to other users as the vessels will stick to the marked and dredged channel rather than seeking alternative routes. The KRJC are mandated to manage vessel numbers and behavior on the estuary. This is understood to already take place. The amenity and recreation opportunities are considered beneficial since the estuary is freely accessible by all members of the public.
644	**137**	The proposed mitigation steps are good but their enforcement even without dredgers etc. will be limited as their implementation will push the costs for dredging to unacceptable levels.	Dredging - Impact	comment on cost of recommended mitigatory steps added to dredging costs?	These measures are proposed to ensure safety to both contractor and general public. Safety should be considered as essential and factored into the budget regardless of the cost. Most contractors would implement these mitigation measures as part of their operations.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
644	**138**	BANK EROSION - The 9 properties of Kromme Properties Shareblock will be most affected as a result of bank erosion and jetty damage.	Dredging - Impact	comment on increased bank erosion.	The EIR recognizes that the vegetation along the banks of the Kromme bind the sediment and provide resilience to the banks from erosion. This has resulted in the targeting of the main channel and adjacent sandbanks as the source for the beach nourishment material. Very few locations along the length of the estuary propose dredging directly of the estuarine banks. In those areas it is proposed due to the volume of suitable sand material available with little to no vegetation. An increase in vessels has been identified as an impact, specifically the potential for erosion of the banks via the effect of wake. The KJRC have the authority to declare no wake zones and are aware of the potential issues related to the use of the estuary by motorized vessels, The KJRC are I&APs in this project and are aware of the potential impacts associated with the increase in vessel movements. It is also recommended that the The Kromme Properties Shareblock raise their concerns with the KJRC regarding the impacts to jetties. Should wake be kept to a minimum the impacts to the jetties is unlikely to be significant.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
645	**139**	For the residents of the Kromme Properties Shareblock (Pty) Ltd the estuarine impacts will be increased due to the close proximity of the properties to the estuary. This proximity is magnified as the property is occupied on a semi permanent basis. In the past this property endured the presence of several large chokka boats moored in the river, and experienced continued house break-ins, damage to property, and continued human waste, diesel, and slop pollution. In addition area under the Kromme Bridge became a loading zone for the catch and diesel bowzers.Despite assurances from the Algoa Regional Services Council, the Chokka boat owners, and Local Council nothing was done to alleviate the impact of this industry upon the river and Shareblock. So moving into the future pleqse indicate as to whether the mitigation measures mentioned in this study will be honored? The writer can from personal experience state that the answer will be NO!	Dredging - Impact		The mitigation measures are enforced through the adoption of the Environmental Management Programme as a requirement of the Environmental Authorisation. Part of the recommended monitoring and election of an Environmental Control Officers would be to report to DEDEAT on the compliance of the contractor/proponent with those measures included in the EIR. The risk to the contractor/proponent would be revoke of the EA should the authority deem necessary. It is also likely that local conservation and interest groups would be monitoring the activities either formally or informally and raise any concerns at the earliest opportunity.
653	**141**	STATEMENT: it is expected that these species will return and inhabit newly dredged areas. Will the same fauna occupy areas that are up too 1 meter deeper, dont bloodworm need a low tide and other bait species need a low tide? If yes then the loss of 175,000m2 area for bait species is expected?	Dredging - Impact	The proposed works are reducing the available areas for species return to the area. It should be required that each species that inhabits areas to be dredged be studied and their ability to re colonise these areas be made known. It is important to know this information as dredging is a destructive process to all that inhabit the dredged material. We need more information on this vital point?	Many of the benthic species are found on both intertidal and subtidal sand bank habitat. This means that they are tolerant of dry periods but don't require them. The EIR identifies that these species will be impacted but will recover over time. Since areas of sandbank will remain intact these will provide a source of recruitment to inhabit the newly dredged areas.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
					With dredging depths of between 1 – 2 m these habitats will remain similar to those present in the estuary currently.
105	**65**	Again further careful investigation of this delta in order to assess the viability of these deposits is recommended.	Dredging - Sandriver	comments on the proposed dredging of the Sand River delta.	The Estuarine and Dune Ecology Specialist Report includes locations of samples tested for similarity with the St Francis Bay beach sand. The sand is compatible. It has been reported that there is a possibility of debris both at the Sand River delta and in proximity to the road bridge. At this stage sufficient sediment is deemed to be available even if these areas don't yield the full quota.
653	**142**	STATEMENT:sand bank that are vegetated with dune vegetation do occur within the estuary and within those areas expected to be dredged. Since this vegetation is indigenous, and exhibits a clear successional gradient, its loss will result, despite the fact that it has established as a result of altered flow regimes in the Kromme Is this a reference to the Sand River Delta area?	Dredging - Sandriver	We find this statement confusing as areas adjacent to Kromme Properties which have been defined as sensitive, which could impact upon the wellbeing of the area which in turn could have a negative impact upon Kromme Properties?	Yes, the section identified is referring to the Sand River delta. While the vegetation is indigenous it does not contain any vulnerable or protected species. The vegetation is referred to as primary vegetation which are generally species which colonise new areas as is evident in this location and likely as a result of the flood in 2011.
103	**54**	On what basis is this statement made. Is this an admission that things could be better or worse with the preferred alternative over time or what. All very uncertain?	EAP	No certainty in decisions.	The statement is identifying that sediment is likely to migrate back into the estuary from the beach over time. It has been included in this section to facilitate the understanding that the sediment taken from the Kromme is not lost to the estuary completely. Therefore, the returning sediment would result in the formation of features similar to those in its current state.

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103	**56**	As noted before these impacts must be subject to scrutiny by a specialist as this assessment is primarily based on studies performed over a decade ago.	EAP	Old information which decreases the ability to make a concerned decision.	In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR.
118	**86**	As already noted this EIA is built around information presented over a decade ago which in a sense has no current application as there is no current data to compare and prove the stated views by the EAP on the impacts. There is no certainty in this study.	EAP	It would assist if the informaion presented could be current and up to date. This would help in the relevance of the project stated project impacts?	The data and information used to develop the report is based on a number of sources (i.e. scientific literature, publically available documentation, previous reporting, specialist input). Historical data can be used together with expert knowledge to predict impacts associated with a project of this nature. While each system (estuarine in this case) can be complex the principles of how a system reacts to disturbance are well understood and the relationship between dredging and changes in hydrodynamics are well known.

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					In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR.
118	**88**	INCREASED VESSEL TRAFFIC - This is a very real issue as we have already lived through chokka boats in the river during the 1980's and the situation became very unpleasant for residents living close to the estuary.	EAP	This impact needs to be explored with respect to the further negative impacts and the administration of the policing of this impact. By opening up this estuary are we not adding another admistrative layer in the form of policing and overburdening the local authorities who have other priorities?	The KRJC are mandated, by the local authority, to perform the management of vessels on the Kromme Estuary. The KRJC are currently undertaking this function.
118	**89**	All the incidents noted over the 2019-20 season in the Kromme estuary could be tied to issues such as human behavior, lack of competency of skippers, boat speed, power, limited policing and human aggression, which is seriously scary. Making the channels more navigable is not the prime factor to increase safety, this is just a poor justification for removal of sand from the estuary.	EAP	refer to above comment.	Noted.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
118	**90**	We wish to remind you that Phase 1 of the upgrading, and the implementation of new revetments are still in place which if managed correctly would provide protection to the backshore infrastructure.	EAP	The presence of rock revetments on the backshore of the beach if constructed in accordance with the appointed engineers design criteria would offer a 15 year protection window. Sadly due to circumstances this has not happened and several revetment sections have failed.	There is clear recognition in the existing Environmental Authorisation that the revetments authorized are deemed to be temporary and there is clear instruction to investigate a more permanent solution. Refer to Advisian engineering report which comment on the previous studies for this frontage. Appendix H contains the previous Environmental Authorisations applicable to this project.
125	**100**	We view the EAP's closing statement regarding the Estuary as 'a cover statement' for any problems occurring at a later date. It also reinforces our view that the materials presented in this study are insufficient and incomplete and in all probability resulting in a negative Authorisation.	EAP	refer to above comments on this subject.	The emphasis on the monitoring in this section is recognition that the Kromme Estuary contains sensitive habitats and confirms that due care needs to be exercised in a project of this nature. The EAP is committed to ensuring the project is executed in the most appropriate manner and is including recommendations to ensure that.
165	**102**	*Statement - The Phase 1 Authorisation for Rock Revetments is a temporary:* The rock revetments designed by PRDW have a 15 year life span, and yes in a way it is a temporary solution. It would be appropriate to ask the engineering specialist to give some indication as to the engineering life span of the proposed groynes?	EAP	Life span of the proposed groynes?	This information is available in Section 2.4 of Advisian's Preliminary Design Report (Appendix F) – 50 years.

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556	**103**	Different era and different volumes which does not match as to what is actually going to happen, Inferences from old data and different situations is a risk.	EAP	ditto as per previous comments on this issue.	In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR.
557	**104**	We are talking about a potential impact, however how that without following scientific due process and using secondhand material nothing stated here gives a feeling of confidence?	EAP	ditto as per previous comments on this issue.	The data and information used to develop the report is based on a number of sources (i.e. scientific literature, publically available documentation, previous reporting, specialist input). Historical data can be used together with expert knowledge to predict impacts associated with a project of this nature. While each system (estuarine in this case) can be complex the principles of how a system reacts to disturbance are well understood and the relationship between dredging and changes in hydrodynamics are well known.

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					In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR.
562	**111**	Again where is the up to date current information?	EAP	Up to date information.	See comment above.
562	**112**	STATEMENT - On a broad-scale, an unacceptable change is considered to be significant erosion of the inter-tidal areas as well as any subsequent catastrophic damage to existing infrastructure - Is this is a real possibility?	EAP	What would the impact be on Priority Area P2.?	This is a qualification of what would be considered to be an unacceptable change to the estuarine system as a result of the dredging. Based on the current proposal this is unlikely. Restricting the dredging to the channel and portions of the larger sand features retains the integrity of the intertidal areas and habitats along the banks of the estuary.
564	**113**	Why is area P2 excluded as an influence to the tidal prism above the bridge?	EAP	Query?	P2 doesn’t extend above the bridge. Based on the updated information from Advisian (Appendix F of the EIR) the tidal prism will result in a lower water level (at low water) than experienced currently. This will also be experienced above the bridge should the full volume of sediment be extracted.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
565	**114**	Is this an admission that the existing modelling needs to be updated in order to gauge the significance of the proposed works?	EAP	Query?	In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR.
565	**116**	STATEMENT -No fatal flaw has been identified - How can a 'FATAL FLAW' be identified when less than adequate information is at hand.	EAP	The question is: If further current studies were undertaken on those items mentioned above as requiring further information - would it be possible that a 'fatal flaw' would develop?	It is unlikely that a fatal flaw would be identified with further investigation. Further investigation would lead to possible refinement of dredging areas and the dredging methodology. The studies carried out in 2020 have provided the EAP with information that has allowed for refinement and additional confidence in the assessment of impacts.

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632	**125**	Noted and agreed. This situation has been ongoing since the first dam was built in 1942 and has become progressively worse since 1982 when the Impufu dam was completed. This situation is not going to change. However it is also noted that several flood events have occurred over the above period where flushing might have occurred and due to the length of the Kromme estuary (14km) most flood waters loose their energy over this distance and flushing is diminished. Focus is always upon the two large dams upstream and if one views the estuary there are many other freshwater contributors to the system that just have not been notices or monitored?	EAP	A flood from the Churchill (50km upstream), the Impufu (4km above the tidal reach which is some 14km from the mouth), would have to be of momentus preportions to have the energy to pass over not only the the present day Wattle infested river valley, the various agricultural impoundments, and then over a 14km stretch of river, sandbanks, open valleys etc. to the lower Kromme and have the required energy to lift sand banks and take them out to sea?	Flooding would have the potential to move sediment. Depending on the magnitude, sediment from upstream would be transported to the lower reaches.
637	**128**	Monitoring and reporting are interesting mitigatory steps and over time these steps become a cost factor and are usually discontinued after an initial start. The success of monitoring by experience has been poor as the applicant and contractor usually ignore all monitoring recommendations due to cost and non compliance and thus these proposed mitigatory steps are likely to be unsuccessful.	EAP	statement on the viability of suggested mitigatory steps.	The mitigation measures are enforced through the adoption of the Environmental Management Programme as a requirement of the Environmental Authorisation. Part of the recommended monitoring and election of an Environmental Control Officers would be to report to DEDEAT on the compliance of the contractor/proponent with those measures included in the EIR. The risk to the contractor/proponent would be revoke of the EA should the authority deem necessary. It is also likely that local conservation and interest groups would be monitoring the activities either formally or informally and raise any concerns at the earliest opportunity.

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650	**140**	STATEMENT: Baseline data needs to collected prior to construction - including Sediment contamination testing; Bathymetry; Groundtruthing. - One would expect that the baseline data would be collected prior to Authorisation	EAP	It is recommended that further baseline data is necessary for a competent decision.	The collection of baseline data prior to construction is to inform the subsequent monitoring effort during the construction and operation of the scheme. The EAP is confident that sufficient information on the baseline is available for decision making.
88	**37**	The present estuary ecological status of 'largely modified will with this project be 'totally modified' after the project. Will the Importance Score remain and could we ever become 'a desired protected area'? The ecological sensitivity and ecological importance are both high. The proposed project must avoid all areas of high sensitivity. Areas considered to be of moderate sensitivity could withstand some loss, however this should be avoided as far as practical (page 41)	Estuary Status	It is understood that the Kromme Estuary has been modified from its original form with the blame been placed on the two dams the first of which is approx 14km upstream from the estuary. In a sense one understands that the present status quo is partially a result of this but there have been momentus changes to the enviroment of the area since 1982 when the last dam was completed. The point here is that the current status quo which is is now going to be altered to the extent that our sense of place and being is going to be impacted yet again as it was when the estuary was used by the Chokka boat fleet. Will the Kromme ever reach the status of 'a desired protected area'	This scheme will provide modification but the system will still operate naturally. There is no hard engineering associated with the dredging activity. Similarly, once the construction phase is complete, small volumes of material will be required – likely to be taken from the mouth area. There is likely to be modification to some habitats. However, the estuary will retain its ecological function.
89	**39**	What about the floods in 2006 -7, and wet periods during 2009 culminating in the 2011 floods.	Estuary Status	It is noted that the current state of the Kromme estuary is a result of the lack of fresh water flushing. It is noted that we have had several floods which have altered the estuary and the impacts of these have yet to be studied and published. The status of the estuary to day is just not known.	Estuaries are dynamic by nature and are influenced by natural and anthropogenic factors. Section 6.9 describes the ecological characteristics of the estuary based on the Estuarine and Dune Ecology Specialist Report (Appendix J of the EIR).

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89	**41**	One can understand that the direct freshwater inflow from Kromme river and tributaries in the past has diminished due to the two large dams, and farm water extraction but there are numerous other fresh water sources, such as streams, wetlands, ground water and floods (4 in the last decade) which are not even noted. These fresh water entities all contribute a continuous flow of surface and ground water into the system. As these do not seem to be recorded or even their existence acknowledged it is possible that although studies seem to have focused on the major impediments to freshwater flow such as dams and bridges, no one has looked at the	Estuary Status	We require up to date information on the Kromme estuary in order to make a decision to dredge.	The reduced freshwater reported is confirmed through the presence of submerged macrophytes who inhabit the intertidal and supratidal areas of the estuary. The vegetation is an indication of the physical conditions including the salinity. The open exchange with the sea corroborates the observations.
90	**42**	During peak periods of boat activity on the Kromme the impact of this activity is somewhat exacerbated to an extent by the tidal cycle which allows for boat access at high tide with restriction at low tide due to sand banks. This restriction at low tide has a positive impact upon this salt marsh as slower boat speeds at points close to the marsh allow for a minor generation of wake size. The impact and mitigation of boat wake impacts on the salt marsh as a result of the proposed dredging requires attention. Please note despite several notices requesting a drop in speed by boats at these points the opposite affect is observed which is to go faster in order to break through. These points cannot policed 24/7.	Estuary Status	The point here is despite the restrictions existing in the estuary today, there is a positive side to these as it allows for both the river and those who live and play along its banks time to recover from the influx over the holiday season of large power boats moving up and down at great speed.	This is recognized in the EIR and the recommendations for the mitigation of the impacts include no-wake zones and enforcement of them. The KRJC have a responsibility to manage the activity on the Kromme and it is imperative that this take place even in the absence of this project.
90	**44**	Another impact not noted in this study on the health of the Kromme are illegal dams wellpoints and boreholes both in the canal system and on properties adjacent the Kromme. Sea front properties in the canal system within 100m of the HWM of the sea have access to water via well point. This provides an indication as to the importance of ground water to the estuarine system.	Estuary Status	The importance of ground water to health of the estuary is underestimated.	The project is not anticipated to have an influence on groundwater. There will be no hard engineering in the estuary and the groynes are unlikely to have an effect on groundwater given their orientation and depth of construction.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
					The vegetation observed is a reliable indication of the physical characteristics of the estuary which suggest that the system is influence by sea water.
91	**46**	Mudprawn – Upogebia Africana, Wonder worm under the decomposed shale beds,	Estuary Status	Kromme Properties Shareblock shore line is primarily shale with Zostera sp. & to the south Salt marsh at the mouth of the Creek river.	The mudprawn has been included in the description of the species present (Section 6.9.3 of the EIR) and Appendix J Estuarine and Dune Ecology Specialist Report). It is noted that wonder worm, a common bait species, occurs in the Kromme.
95	**47**	It would make sense to review and update the impact from a tourism point of view the opening up of river channels which would allow for unhindered access for boating in the Kromme estuary. As the last plan on the Kromme estuary was done 20 years ago it would be appropriate to update prior to the proposed works. One could then get a clearer picture of the impact as a result of the proposed works on the estuary on future tourism opportunities. As it stands the Kromme estuary and surrounds is totally oversubscribed during peak holiday periods being December and Easter.	Estuary Status	Again asking for more up to date information so as to make a decision relating to dredging.	Vessels using the Kromme Estuary need to be registered to operate. This registration is mandated to the KRJC. Information provided by KJRC shows that the number of vessel licenses issued for the Kromme River has been fairly stable for the last 6 years, and has been slightly declining since 2017/2018. KJRC confirmed that they are constantly striving at improving safety and policing the river. Powered vessels are just one user type considered here. The EAP also considered the increase in non-powered vessels, canoes, stand-up paddle boards, etc.

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103	**53**	The mitigation offered here will presumably protect the shale band along the lower reaches of the Kromme and further up the salt marsh below the bridge. What about the shale band coast along the southern bank of the Kromme opposite the salt marsh and the salt marsh on the southern bank further up the Kromme? This statement is misleading and requires direct clarification?	Estuary Status	Pointing out shale bands that are present elsewhere along the estuary which seem not to receive any attention at all?	Those areas sampled as part of the Sand Sourcing Specialist Study took place in areas where sand was anticipated to be taken from. The samples taken at depth did not encounter the shale material. As mentioned and indicated by the dredging areas, the banks of the estuary, certainly where there is sensitive habitat are not expected to be significantly impacted.
103	**55**	Surely the impact possible change in Hydrodynamics of the Estuary should be passed to a specialist who can assist in the possible mitigation of this impact? As the river was last modeled over a decade ago a new study is warranted?	Estuary Status	why cant this information not be available now?	The data and information used to develop the report is based on a number of sources (i.e. scientific literature, publically available documentation, previous reporting, specialist input). Historical data can be used together with expert knowledge to predict impacts associated with a project of this nature. While each system (estuarine in this case) can be complex the principles of how a system reacts to disturbance are well understood and the relationship between dredging and changes in hydrodynamics are well known.

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					In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR.
103	**60**	The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs. One can understand that it would be 'difficult' to reverse these negative impacts but it is believed that the dredging of the Kromme Estuary will just hasten this process. Maybe these issues must be dealt with prior to further works on the estuary?	Estuary Status	once dredging has started there will be no going back to the present statis quo in the estuary.	The presence of marine sand in the estuary and the development of sand banks in the estuary over time is due to the flood dominant estuary characteristics meaning that the dominant tide is the incoming one and this imports material into the system. While the morphology of the estuary may change it is anticipated that marine sand will continue to be imported into the system.
103	**57**	Noting that the influx of boaters increases primarily during statutory holidays, it is also noted that with the increase of permanent residents and in St Francis Bay and surrounds the river is a focus of an increase for small to medium boating during the year. We have just experienced a Christmas where there was a massive increase in boats, jet skis, jet boats, sups, kite boarding and general beach activities. The river officials one can state were stretched to the limit and the total disregard and arrogance of boaters to both the officials, general	Estuary Status	The estuary seems to have exceeded its carrying capacity at peak times.	Information provided by KJRC shows that the number of vessel licenses issued for the Kromme River has been fairly stable for the last 6 years, and has been slightly declining since 2017/2018. KJRC confirmed that they are constantly striving at improving safety and policing the river.

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		public and 'rules of the road' was witnessed. More accidents occurred over this period than ever before, and regretfully two people died in boating related incidents. The river seems to have exceeded its 'carrying capacity' over this period what will the affect be when the river is navigable at both tides but large engined boats? PS the present signage on dangerous sections of the estuary seemed to be in most instances ignored during the season.			According to KJRC there have been no fatal injuries during the holiday season 2019/20. Two people were injured.
103	**48**	We cannot view this estuary as 'now' and 'then', as it is a dynamic system one cannot influence the present by stating that the conditions in the past 'may' be better than the present - the fact is we dont know and will never know. We are dealing with the impacts on the present and PLEASE look very carefully to the future. That is what is required.	Estuary Status	Kromme Properties Shareblock has been around since 1949. This property has experienced the effects of impediments of both dams, the building of the Kromme Bridge, drought, the building of the marina system, and having the chokka fleet parked on the opposite bank of the estuary. We are very reluctant to experience another impact such as the dredging especially as the information provided is not convincing at all.	The modification of the system through the development of the dams has led to its present state. This is well researched and documented. Prior to modification the system would have been in a more natural state. Under the natural state the flushing of the system would have occurred regularly and that would have kept the estuary clear of macrophyte growth and excessive sediment build-up. The present state is one that is modified leading to an increase in habitat deemed to be sensitive.

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103	**50**	The previous study was performed over 14 years ago and for whatever reason was not submitted for Authorisation, so it should not be used to highlight the present study which is within a totally different decade,	Estuary Status	The use of possibly out of date information to make such as momentus decision is not accepted.	Historical data can be used together with expert knowledge to predict impacts associated with a project of this nature. While each system (estuarine in this case) can be complex the principles of how a system reacts to disturbance are well understood and the relationship between dredging and changes in hydrodynamics are well known. In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR.

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105	**64**	This impact will be exacerbated by the difficulty of removing the debris laden deposits which make up the greater portion this delta. Since 2011 the delta has decreased in size as the incoming and outgoing Kromme tides erode the delta along the Kromme estuary. The Kromme channel is almost reached its 2011 position. In addition the prevailing winds have allowed for the formation of foredunes along the canal homes to the south. These dunes in some instances block north west views from these properties, but more importantly provide a wind shadow to these properties from the prevailing westerly wind. To the west of the delta the Sand River still runs as this is the lowest point. Salt marsh vegetation has established itself, as there are seeps and weeps from the Sand river and the adjacent wetlands. It must be noted that with the 2012 flood and formation of the delta, all the Bloodworm, Pencil Bait, Pink Prawn and Mud Prawn populations were covered with up to 2m of deposit and these populations were lost. It is noted that there was a statement made that the Kromme Estuary had the largest Pencil Bait population in South Africa, with the 2012 flood these organisms were to a large extent decimated (this is subject to validation).	Estuary Status	comments on the proposed dredging of the Sand River delta.	The Sand Sourcing Specialist Report (Appendix I of the EIR) includes locations of samples tested for similarity with the St Francis Bay beach sand. The sand is compatible. It has been reported that there is a possibility of debris both at the Sand River delta and in proximity to the road bridge. At this stage sufficient sediment is deemed to be available even if these areas don't yield the full quota.
105	**63**	Prior to the St Francis Port the chokka industry used the Kromme Estuary as a port and at that time there seemed to be a 'marinisation' of the lower Kromme estuary with the appearance of Sea Urchins along the shale band shore in great numbers and Red Bait, octopus, mussel and cuttle fish.	Estuary Status	comment and note.	Noted

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106	**69**	As a result of the 2011 floods large areas of sand river delta was covered with sand resulting in a consequential loss of major bait populations (blood-worm, pencil bait, mud and sand prawn). With subsequent erosion of this delta resulting in the deposition of sand to the east and west of the delta which now is a new home to populations of blood-worm, pencil bait and sand prawn.. The loss of the biggest bait populations on the Sand river delta in 2011 was a blow and now the new populations are a target for dredging. As there is no monitoring of these bait species at this time, one would at least expect some sort of census for this estuary so as to establish whether the net impact of dredging will be on this resource? Impacts cannot be measured without actual ground data.	Estuary Status	The removal of sand banks will result in loss of major bait collecting areas within the estuary.	The smothering of bait species and subsequent re-establishment at the sand river delta is evidence that these species recover. The proposed sand take from the Sand River delta is not to extract material from the entire area but will leave sufficient habitat to facilitate re-establishment of the newly dredged areas. Note that bait species are present at numerous points along the length of the estuary.
106	**68**	This is the crux of the proposed project as we are not only changing the ecology of the estuary but are now limiting the present accessibility to recreational areas of the estuary. The short term nature of the dredging as stated here cannot be true as the disruption of parts of the estuary during dredging with machinery and pipes etc will be a factor. These pipes will cross channels and need to be dismantled at peak times and the requirement for top-up nourishment will be ongoing for years?	Estuary Status	The presence of excavators / dredger may result in some areas of the estuary having restricted access for public safety	The safety zone around the dredger is likely to be 100 m. The piping is unlikely to have safety zone and with a diameter of less than 300 mm is unlikely to limit the use of the beach/sandbank etc. There is a recommendation that dredging will not take place during peak holiday periods, as is presently the case with the canal dredging.

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107	**70**	Yes this will be a big plus for those boaters who have large power boats up to 6.4m. The jet boats dont necessarily follow the designated channels as they can operate in 0.4m of water and have become a problem for boaters and fishermen. For those who live alongside the estuary this is a problem as power boats seem to be oblivious of swimming, paddlers, canoes, dinghy fishermen and sailing craft. This is a disaster waiting to happen - as the river authorities are abused and threatened by these aggressive boaters. It just not fun anymore, is unsafe and poses no recreational value to anyone!	Estuary Status	Noting possible negative impacts relating to the removal of sand from within the channels.	As mentioned in Section 7.2 and in response to these questions that have been raised previously. It is recognized that activity (motor boat, paddle boat, swimming) levels are likely to increase. The impacts have been included and there is recognition that management of the activities requires consideration. This is particularly relevant to motor boats. Currently the Kromme River Joint Committee (KRJC) have been mandated to ensure that this activity is managed appropriately and safely. This remains their mandate and the EIR re-enforces it. This includes no wake zones, demarcated channels, adequate signage and speed limits. The EAP has taken an objective approach in their consideration of the affected persons and does not favour any particular group.
115	**79**	Sand compatibility is only one aspect of this study there are several other more pertinent studies such as hydrographical/hydrological which are critical to the dredging source.	Estuary Status	this refers to a previous comment on the issue of sand compatibility?	The data and information used to develop the report is based on a number of sources (i.e. scientific literature, publically available documentation, previous reporting, specialist input).

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
					Historical data can be used together with expert knowledge to predict impacts associated with a project of this nature. While each system (estuarine in this case) can be complex the principles of how a system reacts to disturbance are well understood and the relationship between dredging and changes in hydrodynamics are well known. In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR.
119	**91**	These impacts could irrivocably change the Kromme estuary as it is known today and without current survey data and modeling which could provide a much closer view of the listed impact?	Estuary Status	The proposed dredging of the estuary is a drastic measure and will irreversably alter the current status of the estuary. We request further up to date information to back up this planned project so as to provide a greater level of confidence in the proposed works.	In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change

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					significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR. The impacts identified and presented in the EIR do not suggest that the change will be detrimental.
123	**96**	The volumes of sand primarily occurring in the lower estuary in accordance with the tidal cycle from the Kromme mouth. Natural floods from the source are infrequent and their contribution is limited in this section of the Kromme estuary. However the Sand River can provide sand material as evidenced in 2012 when alterations to a existing river course occurred.	Estuary Status	Potential sand source. It would be appropriate to explore the Sand River below the R330 bridge as a potential sand source.	A portion of the Sand River is targeted for dredging. See Section 2 of the EIR.
124	**97**	Is the statement that the existing modeling is not sufficient to quantify the significance of dredging required - Is this an admission that the evidence presented to date on the dredging cannot be used to quantify the significance? If so why has this not been done as a matter of course and presented for comment in this study.	Estuary Status	Is this an admission that the figures as presented in this EIA could change, and if so what are the potential impacts relating to a decrease or increase in sand source?	The data and information used to develop the report is based on a number of sources (i.e. scientific literature, publically available documentation, previous reporting, specialist input). Historical data can be used together with expert knowledge to predict impacts associated with a project of this nature. While each system (estuarine in this case) can be complex the principles of how a system reacts to disturbance are well understood and the relationship between dredging and changes in hydrodynamics are well known.

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					In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR.
124	**99**	Same again 'Ground truthing the distribution of habitats - Again one makes the point this should form part and should be made a requirement as part of this EIA. Nobody can make a decision based on the material presented?	Estuary Status	refer to above comments on this subject.	The ground truthing is to inform the subsequent monitoring of the construction and operational phases of the scheme.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
558	**107**	The normal impoundment statements relating to two dams, the last completed in 1982, are given as the cause for all our estuary problems. However, one must realise that flood events of the size and nature to move shift sand from the lower estuary are rare and do not occur often, and it is doubtful if they will have the energy to move built up sediments on the scale to clear the lower estuary? Several recent good rain years (2006, 2007, and 2012) are noted and in each instance the lower estuary has increased in volume, size and the whatever flow observed was directly affected by the nature of the incoming and outgoing tides. It is these tides that seem to determine the amount of erosion along the lower estuary. During the 1982 flood, where the Impufu dam filled up in 5 days and overflowed into the Kromme, The size, volume and colour status of the lower Kromme in 1982 was no different to the more recent floods mentioned above. The exception was the 2011 flood which dumped a considerable volume of sand into the Kromme estuary via the Sand River tributary. This was a result of the opening a dune slack that had filled with water on the St Francis Links. At that time it was estimated that the deposit of sand was in the region 180,000m3. This sand mass effectively covered a large tidal area of the Kromme estuary which supported populations of mud, sand prawn, and bloodworm. These populations were decimated as a result of this flood event. In spite of the presence of the impoundments the lower Kromme estuary is very much tidal dominated with 'seasonal' freshwater input from upstream, tributaries, wetlands, groundwater and the many salt marshes adjacent this estuary. Most of these sources are not as yet documented.	Estuary Status	Just a different view on the impoundment issue.	Noted.

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559	**108**	The cause and comment on the deviation of the main estuarine channel are noted. It been observed that there have been changes in the alignment of the main estuarine channel(s) in the past as is evident from aerial photos of the lower Kromme area since 1942. Would it not be possible to map the existing and compare to the past so as to provide a measure of leeway in dredging planning? Or alternatively is it possible to model the present river state and view the likely result by introducing changes? A estuary mouth open to the sea and able to provide safe passage is important?	Estuary Status	a need for detail and understanding of the dynamics of the present day estuary.	The Sand Sourcing Specialist Report (Appendix I of the EIR) together with the Estuarine and Dune Specialist Report (Appendix J) contain information describing the current characteristics and future scenarios. The Kromme is characterized by an open mouth which is an important feature of this estuary. This is likely to remain the case as a result of the project. In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR.
565	**115**	Dredging has the potential for significant changes to the hydrodynamics of the of reaches of the Kromme estuary, but the beneficial impacts are increase navigability and increase capacity for water based activities.	Estuary Status	Positive impact - noted.	Noted

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
587	**117**	STATEMENT - The Sand River's contribution the the freshwater inflow into the Kromme system is negligible - This statement is misleading since 2006 the Sand River could be rates as a major contributor of fresh water to the lower Kromme system.	Estuary Status	noted comment.	The Sand River is an intermittent contributor of freshwater into the Kromme. Even though there may also be large flooding events effect of the freshwater on the system is temporary.
613	**121**	STATEMENT - Sand River (approximately 2 km upstream from the mouth). This tributary deposits a small amount of sand into the estuary on the southern bank, which is then spread upstream and downstream in the estuary by the tidal currents.- On one event in 2011 where it is estimated that the Sand River dumped approx. 180,000m3 sand, and other flood debris into the Kromme. It is obvious that the specialists are not aware of the 2011 event and its impact on the estuary?	Estuary Status	Correction relating to assumptions regarding the impact of the Sand River on the Kromme estuary?	There may have been a considerable once off contribution of sediment to the estuary. However, in the context of the entire estuary and the infrequent nature of the flooding this has not been considered a consistent source of material.
632	**124**	Please refer to areas of heavy wake erosion from boats which have to cross the estuary from one channel to the other. Slide XX Appendix A. Where the main estuary channel passes close to salt marsh area, boats at speed with large wakes will progressively damage the salt marsh. There are two known areas in the lower estuary which require mitigation.	Estuary Status	There are two areas where wake erosion has impacted in both cases on the wellbeing of the adjacent salt marshes. The deepening of the channel which increased boat speed as a result of dredging could accelerate erosion in these area and initiate others. It would be appropriate for mitigatory measures relating to these areas be recommended on these sites and others as policing all year round is just too costly?	Mitigation for existing erosion along the banks of the estuary do not form part of this project. The mitigation proposed for the effects of wake as a result of increased number of vessels is through management of vessels. This is through the KRJC who are mandated this responsibility.
633	**126**	STATEMENT - reduction of freshwater in the estuarine system becoming marine dominant - Noted and observed, but after a good flush of rain some marine species dissapear from the lower reaches of the estuary.	Estuary Status	comment on marinisation.	The influence of the freshwater events are temporary in nature. The marine characteristics return quickly. This has been well researched and referenced in the EIR.

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634	**127**	The sand bars in the middle of the estuary support an abundance of benthic species. The loss due to the 2011 floods has been noted but the new sand bars as a result of erosion on the delta has provided alternative habitats for benthic species.	Estuary Status		Noted.
637	**130**	STATEMENT:Monitoring of sensitive habitats in close proximity to dredging activities must be implemented during both the construction and operational phases of the project. This will reduce impact significance to low negative. Monitoring and reporting are interesting mitigatory steps and over time these steps become a cost factor and are usually closed down. The success of monitoring by experience has been poor as the applicant and contractor usually ignore all monitoring. recommendations. Mitigation in this instance will fail.	Estuary Status	statement on the viability of suggested mitigatory steps.	The mitigation measures are enforced through the adoption of the Environmental Management Programme as a requirement of the Environmental Authorisation. Part of the recommended monitoring and election of an Environmental Control Officers would be to report to DEDEAT on the compliance of the contractor/proponent with those measures included in the EIR. The risk to the contractor/proponent would be revoke of the EA should the authority deem necessary. It is also likely that local conservation and interest groups would be monitoring the activities either formally or informally and raise any concerns at the earliest opportunity.
641	**133**	STATEMENT:A detailed management plan for water based recreational activities should be drafted, implemented and monitored to ensure safety and inclusivity. Long overdue - should be implemented prior to the commencement of any dredging activities on the Kromme.	Estuary Status	An estuarine management plan for the Kromme is important. The question here is does those in authority understand the dynamics of the all the communities using the Kromme including the same for the estuary itself?	The management of water based recreational activities is not part of this project. The KRJC has a mandate for this responsibility.

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29	**8**	It must be noted that a phased Implementation based primarily on financial consideration is crucial to the viability of such a project. The lack of necessary or adequate funding could be viewed as a fatal flaw for well-being and continuity of this project?	Funding	Phased approach due to funding.	A phased implementation of the abovementioned coastal beach protection infrastructure will most likely be required due to financial constraints. Should funding for the full scheme be available at the time of construction then the full scheme will be developed. However, the design of the scheme is such that each phase can be regarded as a standalone project, allowing for funding for additional phases to be sourced prior to their construction. As funding becomes available, each of the phases would be reviewed and revised, as necessary prior to implementation.

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29	**9**	Surely the engineers can provide more comfort to the funders of this project which at this stage include primarily ratepayers, as to the possible success or failure of the design presented in this EIA? At what cost are the desired/possible design adjustments during construction of a groyne be to the overall cost of such a project? This question places any design element made on the bases of current information suspect.	Funding	Issue relating to lack of detail at this stage of the project as the public and stakeholders are being asked to support this project with no finite details?	As is the case with any project, cost estimates become more accurate as a project progresses through the various stages of project development. A detail design cost estimate is more accurate than a preliminary design cost estimate. The final cost of a project will only be known upon completion of a project. The preliminary design cost estimate available at this stage is regarded as appropriate for the purpose of this EIR. A fairly accurate project cost will be known once tenders to carry out construction work are received. An adequate contingency amount will be allowed for at tender stage, and SFPO NPC has confirmed that no construction work on any phase will commence unless sufficient funding to complete that phase of the scheme has been secured.
38	**20**	What are the present and future implications of these Incremental Alternatives which are designed to lower potential impacts, will they have visual, financial, and or further implementation impacts on the proposed works now or at a future date? More detail explanations on these vital issues are necessary.	Funding	Incremental Alternatives which arise in order to mitigate impacts not noted in this study and the ultimate cost to the project?	For the layout alternatives, refer to Section 5 of Advisian's Long Term Coastal Protection report. In 2020 Advisian refined the location and orientation of the groynes based on feedback from I&APs and the Department. Their report can be found in Appendix F of the EIR. For the technology alternatives, refer to Advisian's Spit Protection report. For the operational alternatives, refer to Section 3.3.3 of the EIR.

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123	**92**	Funding will make or break this project as the sea is a dynamic entity which will always act upon the work area. The implications of the impacts added between phases have not been presented in this report?	Funding	This is the most critical aspect to the viability of this project.	The Preliminary Design assumes a phased approach to spread out the capital expenditure. The costs of the phases, material volumes and final configuration of each phase will likely change as the unprotected beach further erodes between the implementation of each phase. As funding becomes available, each of the phases may need to be reviewed and revised prior to implementation.
123	**93**	Note and has anyone considered the financial implications of the cost of the OPERATIONAL PHASE, as this is considered to run into perpetuity?	Funding	Again a vital aspect of this project?	Yes, the SFPO NPC, with the assistance of the KJRC and the St Francis Riparian Home Owners Association will ensure that the necessary maintenance is carried out.
123	**94**	Who is going to pay for this extensive and important monitoring program, as the Local Municipality, Provincial and National entities are not aboard for funding - one can understand that government funding is focused elsewhere at this time?	Funding	Ditto as above comment	A fairly accurate project cost will be known once tenders to carry out construction work are received. An adequate contingency amount will be allowed for at tender stage, and SFPO NPC has confirmed that no construction work will commence unless sufficient funding to complete any phase of the scheme has been secured this will include the mandatory monitoring which will be a requirement of the Environmental Authorisation.
28	**6**	The proposed groynes are structures grounded on the sea bed which in this instance one presumes to be a sand base? No mention of a grounding source such as bedrock is mentioned in this study. Experience tells us that a heavy rock structure will sink if not grounded on	Groynes	Possible subsidence & recharging	The detailed design of the groynes may take bed geotechnical characteristics into account.

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		bedrock as is happening with most of the present rock revetments along the coast. As these revetments are founded on sand they subside and need to be re-charged on a continuous basis. As the proposed design for the groynes reveals no support for the groynes one presumes that these structures will have to be re-charged on a periodic basis? Why has the important impact not been mentioned or mitigated in this study.			The report does mention that maintenance of groynes and the beach will be required. However, the maintenance of the groynes is anticipated to be less frequent than that of the beach.
30	**11**	To minimize costs it would be appropriate to drop off loads as close to the specific work areas where possible. Double handling of materials is a costly and onerous task.	Groynes	Logistics of rock loading	Double handling is costly and it would depend on the ability of the contractor to place material based on tidal conditions. It is common practice to have a stockpile available to ensure work is not held up by the lack of material. Refer to Section 2.5.1.5 of the EIR.
31	**17**	To avoid double handling of rock it is an expensive process, ensure that deliveries of rock are well planned and co-ordinated and placed immediately into their final position.	Groynes	Rock logistics and design	Double handling is costly and it would depend on the ability of the contractor to place material based on tidal conditions. It is common practice to have a stockpile available to ensure work is not held up by the lack of material. Refer to Section 2.5.1.5 of the EIR.
40	**21**	Is this Option 1B the preferred option?	Groynes	Query relating to Groyne option	Option 1B is the preferred option. Refer to Section 2.3 of the EIR.
55	**30**	The word 'slow-down' and not 'prevent' would be more appropriate word for the groyne action in this instance, as it is clearly noted that the proposed groyne system cannot prevent erosion.	Groynes	The writer disputes the terminology used to describe the effectiveness of the proposed groyne system. It is noted by the EAP that Option 1B is less effective than others in controlling beach erosion. It is felt that the word 'slow down' would be more appropriate in this instance.	The sentence in the EIR mentions to protect the St Francis Bay beach from further erosion. It would be the created beach that would erode which in turn would be maintained.

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85	**35**	Why is the position of the Umzumawethu reef approximate and not mapped, this is a critical element in the placement of the groynes? Is this reef going to be an asset or liability to the proposed works? Again we are asking for approval for unknowns?	Groynes	It is held that critical information is not available for any reasonable comment to be made on this proposal.	The reef is not a critical element in the placement of the groynes. The reef is only approximately 1 m above the adjacent seabed. The position of the reef has since been confirmed using a satellite derived bathymetric survey.
86	**36**	These photos could be of any reef? Photo when where and how?	Groynes	Ditto as above comment	These photos were taken from a previous study (ASR, 2006). The photos were considered relevant because they are characteristic of local reefs and contains species common to reefs in the Eastern Cape.
106	**66**	Moderately Beneficial: A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way.	Groynes	Comment on the following text statement: 'The construction of groynes, coupled with sand nourishment will increase the width of the beach, and to some extent restore the habitat to what it was previously.'	Statement modified to: "The construction of groynes, coupled with sand nourishment will increase the width of the beach and introduce additional substrate. Historically, there was a significant beach with significant volumes of sand. These former habitats would be restored."
106	**67**	Is it not possible to actually determine the impact of the proposed groynes on existing sea life as this is only a 'MAY' and therefore is probably a thumb-suck? Recommend a specialist study on this aspect.	Groynes	Comment on the following text statement: '**may** result in localised smothering leading to a potential loss of individuals and habitat.'	The relevant section has been changed in the EIR to reflect this comment.
110	**77**	This is an important point which leads to the question: What will the environmental impact of the proposed groynes be upon sea life, wave action, currents, backshore infrastructure, the open Kromme estuary mouth, and the stretch of coast towards Paradise beach on to Jeffreys Bay. Similarly what will the impacts be on the coast to the south of St Francis Bay?	Groynes	Little impact information regarding the groynes and their impact on the sea life? What will happen if the groynes have a major impact upon the calamari industry or totally destroys the current surf break?	The direct impacts of the scheme have been presented in the Estuarine and Dune Ecology Specialist Report (Appendix J), the Sand Sourcing Specialist Report (Appendix I) and the EIR (Section 7.2).

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					Given that the groynes will be within the breaker zone the resultant effects are anticipated to be limited. In 2020 Advisian refined the design of the scheme through the relocation of and re-orientation of the groynes. The coastal model was re-run and the effects described in an engineering report (Appendix F of the EIR). The resultant change to the coastal environment was not anticipated to result in accelerated erosion to the northern bank of the estuary or to the beaches to the North. The nourishment is expected to increase the supply of sand to the northern beaches since the supply into the bay has diminished. The reports in Appendix F provide more detail.
42	**22**	What happens if the source for this Operational Alternative proves insufficent or impractical?	Legislative	The viability of the Operational phase of this project is questioned with respect to its lack of detail and viability.	Appendix I Sand Sourcing Specialist Report identifies that there is a significant volume of sediment available for both the initial nourishment and maintenance purposes. In addition to the existing volume of material available it is anticipated that sand passing the Kromme River mouth is likely to migrate into the estuary since the estuary is flood tide dominant currently and anticipated to remain as such.
50	**26**	To this point Volume 1 of this study does not consider issues such as sea level rise (mentioned once before) and storm surges (except in general description). In terms of this the ICM Act these items are specifically mentioned as impacts that are noted as important.	Legislative	A requirement in terms of the Intergrated Coastal Management Act (ICMA of 2008)	Sea level rise and storm surge have indeed been incorporated in the design. Refer to Sections 3.4.3 and 3.4.2 of Advisian's Coastal Protection design report respectively (Appendix F of the EIR).

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					Sea level rise was not considered on the estuary / Kromme Properties Shareblock. As sea level rises it is likely that the water levels in the estuary will increase. The dredging of the estuary will have no bearing on sea level rise.
50	**27**	Can the present St Francis beach erosion be described as an intentional act or omission of that (an) organ of state or other person, been adequately motivated in terms of the ICM Act?	Legislative	A requirement in terms of the Intergrated Coastal Management Act (ICMA of 2008)	The EAP does not believe that the erosion is due to an intentional act. Section 4 of the EIR describes the need and desirability for the scheme including reference to the CMP and ICMA.
50	**28**	Has the ICM municipal requirements been fulfilled in terms of conditions stated in this act especially with regard to the Coastal Management program lodged by the District Municipality for this area, which we gather mentions this project but it is not dealt with in any detail.	Legislative	This EIA and scoping report is possibly contrary to the requirements of the ICM Act with regard to due process in that an Estuary Management Plan be put in place prior to this EIA?	This project, which will take place within Coastal Public Property, is not a programme but a specific intervention with goals aligned to the provisions of the ICMA. It is to improve access to the coastline, improve its recreational value; ensure that the coastlines coastal protection functions can continue; and assist in protecting natural and built assets from sea level rise. The project does in fact align with the policy guidelines contained in the local CMP and the District level CMP. On page 163 the Final Kouga Municipality CMP talks to various development issues and risks and highlights the inappropriate locational of developments close to the high water mark, and the resultant threats due to beach erosion.

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					It then goes on to mention under the opportunities section on page 171 that the environmental assessment being undertaken on the coastal erosion and beach nourishment scheme in St Francis bay is an opportunity. Implicit in this statement is the fact that the Kouga CMP supports this initiative, and sees it as consistent with the coastal management programme.
52	**29**	Have the residents of Sea Vista been included in the public participation of this project and voiced their opinions on the proposed works? Are there any public meetings proposed for these residents as it is noticed and advertising to date have primarily been directed at the canal and village sections of the community. Of the two public meetings held to-date were any Sea Vista residents present at these meetings?	Legislative	A requirement.	Adverts were placed in national and local papers, notices around town and in areas frequented by all community members. See Appendix B for more information on the Public Participation Process employed for this project.

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63	**31**	Has the Municipality in terms of the ICM Act drawn up a Estuarine Management Program for the Kromme Estuary and if yes, has the proposed project been included in such management program and has members of the public been invited to participate in such program as is required in terms of the ICM act?	Legislative	Similar issue as comment 50/28 above.	The ICM Act, via the prescriptions of the National Estuarine Management Protocol (NEMP), require Estuary management Plans to be prepared for the estuaries in order to create informed platforms for efficient and coordinated estuarine management. However, the role of a municipality as the responsible management agency was questioned in a recent case (Supreme Court of Appeal (SCA) judgment in Abbott v Overstrand Municipality (99/2015) (2016) ZASCA 68 (20 May 2016)). This case identified that municipalities implementing the NEMP is inconsistent with Section 156(1)(b) of the constitution and does not comply with section 156(4) of the Constitution. Section 154(1) of the Constitution places an obligation on the National and Provincial authorities to support and strengthen the capacity of local government to perform their functions. Only a small number of estuaries have an EMP developed, the Seekoei being the closest estuary.
64	**32**	This sort of answers my previous point. The question still remains are the proposed works part of this management program if not is this whole project legal? Surely a Estuarine Management Plan for the Kromme Estuary should be part or included or a prerequisite for this project?	Legislative	At this time a draft Coastal Management Plan for the Sarah Baartman District Municipality is at present open for comment. The question here is the above document legal in terms of the ICM Act to allow for these works to proceed without an Estuarine Management Plan for the Kromme?	See comments above. Note the CMP has now been finalised.
90	**43**		Legislative		See comments above.

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		All the more reason to apply the requirement of the the ICM Act and perform a Management Plan for the Kromme Estuary with the proposed project in mind.		Just a further comment about following what should be due process in terms of the legislation?	Note the CMP has now been finalised.
103	**58**	The water release requirements as set by Water Affairs for the upstream dams are not met, coupled with several illegal dam structures along the Kromme river, plus the presence of impenetrable invader species of vegetation along the Kromme fresh water sections of river leads to the conclusion that little fresh water of significance will does reach the Kromme. This has been the situation for many years and despite legislation to resolve this problem, action is limited from officialdom. A comprehensive Kromme River management plan is necessary to assist in mitigating these impacts.	Legislative	The Kromme River requires management plan prior to any changes.	The development of a management plan is not the remit of this project. See comments above for further information regarding the development of a management plan.
103	**59**	As already previously the 'other' sources of fresh water into the Kromme are numerous but not noted. Again a management plan should include these water sources and ensure that they remain at optimum flow to the estuary. These No-go Alternatives have been around for years, and should be treated as priority issues to be mitigated.	Legislative	Ditto as above comment	The management of freshwater flow in the Kromme will not alleviate the effect of erosion on the St Francis Bay beach. Similarly the responsibility for the development of the management plan is not the proponent’s. All relevant stakeholder responsible for such plans have been invited and are included in the public participation process to provide comment accordingly.
107	**71**	Tourism & Coastal development is what started St Francis Bay and was self regulated by local government with support of various interest groups who's input was heard and noted. Sadly today this is no longer and St Francis Bay is loosing its unique character of being good at public participation.	Legislative	Noting a point: Interest groups and community involvement in this project is not as previous.	Noted.
109	**75**	Will these jobs be sourced locally or will they be brought in with a foreign contractor? For the estimated costs of over R180million 30 jobs are of minor consequence.	Legislative	reference to local employment.	This is expected to be direct employment as part of the project. Given that the method and nature of the works are based on limited specialized plant and acquiring resources from existing facilities (i.e. rock) 30 jobs are considered significant. There are anticipated to be many more jobs secured and/or

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
					created indirectly through the tourism industry rejuvenated through the protection of coastal infrastructure and additional beach amenity.
115	**78**	Why are these studies not being done prior to Authorisation? We are being denied the right to comment on what a specialist(s) would say or view of the proposed works? This is the last stage of public participation.	Legislative	Again the detail supplied in several potential impacts is old and not up to date and as this is the last stage of public participation what happens if further queries arise on new found information?	The extraction of sediment is likely to result in a change in the hydrodynamics – although according to the Advisian model (2020) not significantly so. The data and information used to develop the report is based on a number of sources (i.e. scientific literature, publically available documentation, previous reporting, specialist input). Historical data can be used together with expert knowledge to predict impacts associated with a project of this nature. While each system (estuarine in this case) can be complex the principles of how a system reacts to disturbance are well understood and the relationship between dredging and changes in hydrodynamics are well known.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
					In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR.
115	**80**	The key question is ' will there be an opportunity to comment of these critical studies still to be undertaken?'	Legislative	As this study is based on study materials which are in need of updating to the current decade, is the community going to be able to comment further on these new studies?	In 2020, updated bathymetry data was obtained and Advisian performed updated modelling using the updated bathymetry data. Should any future studies result in the need to update the EIR by way of project description or the impacts, there will be an opportunity for the public to review and provide comment.
116	**81**	This negates an ongoing participation by I&AP's, stakeholders and others the right to comment on the real thing? Today all we are commenting on is 'may' 'perhaps'	Legislative	Ditto as above comment	In 2020, updated bathymetry data was obtained and Advisian performed updated modelling using the updated bathymetry data.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
		'to be confirmed' statements which is very frustrating as data used is not current.			Should any future studies result in the need to update the EIR by way of project description or the impacts then will be an opportunity for the public to review and provide comment.
116	**82**	When the current IDP was published in 2017 it must be noted that none of the 4 objectives listed as being in-line with the IDP were not noted in the IDP or even mentioned.	Legislative	this project is not specifically mentioned in the IDP	This project, which will take place within Coastal Public Property, is not a programme but a specific intervention with goals aligned to the provisions of the ICMA. It is to improve access to the coastline, improve its recreational value; ensure that the coastlines coastal protection functions can continue; and assist in protecting natural and built assets from sea level rise. The project does in fact align with the policy guidelines contained in the local CMP and the District level CMP . On page 163 the Kouga CMP talks to various development issues and risks, and highlights the inappropriate locational of developments close to the high water mark, and the resultant threats due to beach erosion.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
					It then goes on to mention under the opportunities section on page 171 that the environmental assessment being undertaken on the coastal erosion and beach nourishment scheme in St Francis bay is an opportunity. Implicit in this statement is the fact that the Kouga CMP supports this initiative, and sees it as consistent with the coastal management programme.
116	**83**	Noted however the CMP mentioned only deals with coastal issues not estuarine areas, which still have to be undertaken in terms of the ICM Act.	Legislative	The coastal management plan covers the whole district coastline and the estuaries are mentioned but not in great detail.	
117	**84**	There are those who view this project as a means to enhance the well being of a group who are already economically secure and with the low numbers of potential employment opportunities presented definitely enhances such a view? Again one wonders if such a project was really envisaged when the NDP was drawn up?	Legislative	Does this project fall into line with overall state policy?	Coastal protection by way of piers and groynes have been deployed in South Africa for some time. During the 1950s groynes were constructed in an effort to counteract the severe beach erosion on the shoreline of the Golden Mile (KZN).
118	**85**	INCLUSIVITY OF INFORMAL SETTLEMENTS - This statement is hard to believe as there has been no Sea Vista meeting or comments from such?	Legislative	Public participation?	Adverts were placed in national and local papers, notices around town and in areas frequented by all community members. See Appendix B for more information on the Public Participation Process employed for this project.
118	**87**	The implication that this project is aligned with National, District and Local Planning policies is like fitting a square peg in a round hole.	Legislative	Yes and No?	It fits with the wider objectives. This is described in Section 4 of the EIR.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
30	12	These figures relating to the rate of construction are extremely optimistic and are entirely dependent upon the size and weight of rocks. The envisaged groynes will each have to have their own access point from a higher level than the beach. At present the beach is only accessable a low spring tide and must be avoided at all costs as it is probable that the largest rock for the groyne will be in the order of 6 tons which cannot be double handled and must be loaded straight into is final position? Some serious logistic planning is required in this instance - so based on information supplied by the appointed engineers this aspect is a thumb suck. The impacts of such logistics need to be made known?	Project Implementation	Rate of construction optimistic due to ground conditions, weight, materials handling and on site conditions. Impacts need to be reviewed and published.	The tender documentation will require tenderers to submit, as part of their tender, their proposed methodology and programme. Each phase will include the construction of (a) groyne(s) as well as nourishment. Access to site will be part of the contractor's temporary works. The construction duration is considered realistic and is based on previous project experience and discussions with experienced contractors. The programme will of course be updated when the design is finalized during the next phase.
30	**13**	If one views the distances involved for the dredging of materials to the end point of the Beach, which is measured as 2,7km. The proposed dredging line along the Kromme River from mouth to 'River Tides' above the bridge is approximately 5km giving a total longest dredging line of 7,7km. To gain some comfort regarding the proposed beach nourishment and timing information from a specialist should be mandatory for such a project. The impacts of such are not directly discussed.	Project Implementation	Specialist input required as to the logistics of such a project with respect to dredging distance, trucking, site works and timing.	Section 2.5 of the EIR describes the methodology proposed for dredging and transport of material. The equipment and plant will need to be mobile and will need to set up according to the location and distance to the areas that require nourishment. The EIR (Section 9.7) provides an indication of no-go area which contractors need to avoid. Dredging from upstream of the R330 bridge to the main beach is likely not to be the most cost-effective option. Therefore, dredging lines are not expected to be 7.7 km in length.
25	**1**	It would be appropriate to understand the exact reasons as to why these three source areas were actually chosen, as it seems that this decision was only based on sand grain size?	Sand source	Reasons for choice	Please refer to Appendix I Sand Sourcing Specialist Report for detail regarding the preference of using the Kromme Estuary.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
26	**2**	If alternate sand sources outside the Kromme such as the area just south of the Sand River Bridge (viewed in 2008 as a potential source) and the area to the west of Santareme with access to the sea via the Romazini Valley or via Harbour Rd. All available sources should have been explored. The decision to dredge the Kromme seems to be a prior decision placed upon the EAP?	Sand source	Alternative sources	Please refer to Appendix I Sand Sourcing Specialist Report for detail regarding the preference of using the Kromme Estuary and the alternatives considered.
27	**3**	Note that the estimated sand contribution from Priority Area 2 is 300,000m3 which is 53% of all the required sand for beach nourishment. This is the largest contributor of sand from Priority Areas.	Sand source	from Kromme Props.	Noted. P2 extends from the entrance canal to the marinas to the seaward side of the R330 road bridge. As described in Section 2 of the EIR the dredging will be restricted to the channel and portions of the larger sand bank features.
27	**4**	One important point to note - the sustainability of the chosen sand source for recharging the beach is not dealt with in any detail? The question is can the Kromme sustain continuous dredging through time for both base and maintenance nourishment on the beach areas?	Sand source	Sustainability over time	This is considered in Sand Sourcing Specialist Report (Appendix I of the EIR). There is a clear surplus of material available in the Kromme Estuary. Sand passing the Kromme River mouth from the initial nourishment is anticipated to enter the estuary due to the flood dominant nature of the estuary. This material can then be used for the maintenance of the beach.
28	**7**	Kromme Properties Shareblock is positioned adjacent to Priority Area P2. This area will be responsible for approx 50% of sand required from Priority areas for nourishment of the beach.	Sand source	Priority area P2 & will supply 50% of nourishment.	Noted. As described in Section 2 of the EIR the dredging will be restricted to the channel and portions of the larger sand bank features. P2 extends from the entrance canal to the marinas to the seaward side of the R330 road bridge. This would result in less than 25% of Priority Areas sand and less than 15% of the total sand sourcing obtained from this area.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
29	**10**	The question here is 'Can the Kromme Estuary sustain the supply of sand required for annual maintenance' which leads to the question as to the sustainability of the Kromme as a sand source? If yes the users and residents along the estuary are going to have to live with dredgers, pump stations etc. present in the vicinity of the estuary for 'how long?'	Sand source	Sustainability over time	This is considered in Sand Sourcing Specialist Report (Appendix I of the EIR). There is a clear surplus of material available in the Kromme Estuary. Sand passing the Kromme River mouth from the initial nourishment is anticipated to enter the estuary due to the flood dominant nature of the estuary. This material can then be used for the maintenance of the beach.
30	**14**	The clearing of vegetation and or debris material from dredging spoils dredged from the Sand River mouth will pose challenges to the welfare of dredging machinery as this delta contains both rock and vegetative debris which originated from the Sand River bridge which was washed downstream in 2012. The status of materials in this instance will preclude dredging.	Sand source	redging on the Sand River Delta will be impacted severly by the debris contained within the deposits. No alternative offered in this instance	The Sand Sourcing Specialist Report (Appendix I) includes locations of samples tested for similarity with the St Francis Bay beach sand. The sand is compatible. It has been reported that there is a possibility of debris both at the Sand River delta and in proximity to the road bridge. At this stage sufficient sediment is deemed to be available even if these areas don't yield the full quota.
36	**19**	P385 - St Francis Development_Zone_Priority (A3) - 2019.12.04 this Figure shows the southern portion of the Sandriver Delta excluded and P385 - St Francis Priority Areas_V2 (A4) - 2019.11.13, also shows the same area excluded? However the Kromme Site sensitivity 20012020, shows this area as 'High Sensitivity' but is is included as a secondary dredging area B? What reasons or issue has allowed for this sensitive area to be dredged?	Sand source	Query relating to proposed dredging in sensitive areas of the Sand River delta?	The figure has been revised based on the input from the dune ecology specialist. Section 7.2 of the EIR does mention that some sensitive vegetation will be lost from the system. This is deemed to be a moderate impact.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
79	**33**	Why is Sand Source B covering an area of Salt marsh and within flow of the Sand River delta, which are in this study classified as a sensitive area.	Sand source	Again the proposed dredging of areas of Sand Source B which cover sensitive areas as noted in this study. Is this a mistake or intentional. If intentional please supply reasons as it will impact on Kromme Properties Shareblock and the Sand River Delta?	Sand Source B was the wider area within which sand was expected to be dredged. During the EIA process and based on the potential impacts, this area was refined (as were the others) to the priority and secondary areas. Section 2 of the EIR provides the refined dredging areas.
88	**38**	The attainment of any goal is dependent upon the desire or will to fix the problem, however in this instance we are being asked to downgrade the environmental integrity of the estuary for sand availability, where the whole of St Francis Bay is surrounded by massive sand sources. The argument here is why mess up an existing mess even more where there is an abundance of the necessary materials elsewhere?	Sand source	It is the view held here that the proposed use of the Kromme estuary as a sand source is problematical as the estuary is unquantifiable entity as there are just too many impacts acting one time. The information at hand is old and and the cost to update those studies to current status will be costly. The proposed dredging will alter the estuary permanently and with no real current information authorisation will be a high risk decision. It would less of a risk to look at alternative sand sources which are in abundance in the area.	In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR.
89	**40**	This sand accumulation, vegetation growth are both post the 2011 flood. Maybe the contribution from this source is underestimated?	Sand source	It seems that estuarine information relating to post 2010 until todate is not taken into account in this EIA?	The contribution of sand from the delta of the Sand River has been considered and included as a potential source of sand material (See Appendix I). The sourcing of sand from the Sand River itself was dismissed as a reasonable alternative due to the proclamation of a nature reserve.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
90	**45**	Since 2011 floods which resulted in a major build up of sand in the delta in this area.	Sand source	Emphasising the importance of the 2011 Sand river events which impacted upon the estuary.	The contribution of sand from the delta of the Sand River has been considered and included as a potential source of sand material (See Appendix I). The sourcing of sand from the Sand River itself was dismissed as a reasonable alternative due to the proclamation of a nature reserve.
123	**95**	The question here is what if the bathymetric surveys of the lower estuary find a fatal flaw or the general recommendation is that dredging from this source cannot happen? The implication is that no reasonable backup sand source has been added to fall back upon and this will require the search for alternative sources as suggested previously.	Sand source	No alternative sand source - high risk.	Physical surveys of sediment particle size (2018 and 2019) demonstrated that there was sufficient sediment available. An updated bathymetry survey was done in 2020, confirming sufficient volumes are available
163	**101**	As already stated the areas of the lower Sand River, and the dune system behind Santareme both offer alternatives sources and are actually closer to the sea than the bulk areas of the Kromme estuary.	Sand source	refer to above comments on this subject.	This is discussed in Section 3 of the report. The sourcing of sand from the Sand River itself was dismissed as a reasonable alternative due to the proclamation of a nature reserve. The sand material at the delta of the Sand River has been included as a material source.
587	**118**	STATEMENT - Sand river - substantial accumulation of sand along this 250m of river bank. This accumulation was one event in 2011 where it is estimated that approx. 180,000m3 was dumped into the Kromme.	Sand source	noted comment.	Noted
587	**119**	On the Sensitivity Map of the Kromme Estuary - Why is an area denoted as Salt marsh and sensitive to be dredged? Please give a reason for this or is it a mistake?	Sand source	noted comment.	Section 7.2 does include for impacts on sensitive habitats. These impacts have been assessed as Moderate negative.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
628	**122**	Refer Plate 7.4 - Why is this designated sensitive area being removed?	Sand source	Sand souce from a designated sensitive area is being removed - would like reasons for this decision?	The contribution of sand from the delta of the Sand River has been considered and included as a potential source of sand material (See Sand Sourcing Specialist Study Appendix I and the Estuarine and Dune Ecology Specialist Study). Section 7.2 of the EIR does include for impacts on sensitive habitats. These impacts have been assessed as Moderate negative.
631	**123**	Refer sensitivity map of Kromme The same question arises as previous - why is a sensitive area been selected for dredging?	Sand source	ditto as per previous comments on this issue.	Section 7.2 of the EIR does include for impacts on sensitive habitats. These impacts have been assessed as Moderate negative.
46	**23**	This paragraph is one of the only reference to sea level rise. Can it be clearly stated that despite the proposed intervention to protect the present coast that in time sea level rise will ultimately bury/flood/sink this project? Is sea level rise not the 'key impact' we should be focusing on, as sea level is a critical impact to the project. The choice of Option 1B allows erosion to continue, at a still to be determined pace?	Sea Level Rise	Sea Level rise its impact both on the proposed project design with regard to beach, estuary and long term viability of the current project?	The engineering report (Appendix F) clearly states that the scheme has been designed to accommodate for sea-level rise. The adaptation to sea-level rise for the wider St Francis Bay area is not the consideration of this project. The long term adaptation to sea-level rise for coastal communities is consideration for local and regional municipalities.
47	**24**	Since 1949 when Kromme Properties was established the Kromme estuary has provided a multitude of diverse/shifting channels over time and in a way these natural occurrences have become part of the essence of the estuary, now we seem to want to remove these impediments due to the desire for some to move their every increasing sized craft at great speed up and down the estuary or temporally prolong the life of a diminishing asset being the beach in the name of coastal protection?	Sea Level Rise	Two environmental processes which are very real issues not countered by the current proposal are Sea Level rise and Storm Surges. The second process is common to St Francis Bay which has experienced several of these events over the past decade	The priority material sourcing areas are associated with the existing main channel of the estuary. The anticipated approach as discussed in the report (Sand Sourcing Specialist Report in Appendix I of the EIR) is to take sediment from this channel and its sides.

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
		We will still have those storm surges which damages and floods canal and river properties as did happen previously in 2007, 2008 and 2019.		resulting in damage to both property and infrastucture within the canal system. Both these processes are covered within this proposal and it is possible that the proposal of deepening of the Kromme Estuary will allow for unintended impacts during such an event?	The dredging of the Kromme Estuary has no bearing on sea level rise. The coastal protection scheme has been designed with sea level risk in mind with the design accommodating for sea level rise and storm events.
82	**34**	It is interesting to note that the approval of this project will rely on studies done over 14 years ago. Surely up to date information is necessary for such an important decision?	Specialists	The heavy reliance on studies undertaken for this project over a decade ago and the use of this material to design and authorise such works is a risk to the ultimate viability of such a project? Just for interest the average age of the dates of references on one of the specialist reports was 1997. Further it is clearly stated that further tests, monitoring and reports are required prior to commencement of these works. If the department authorises these works on the information supplied then public participation on the additional studies is no longer available?	The data and information used to prepare this report was interrogated by specialists and deemed suitable for the determination of the impacts associated with this scheme. These same specialists have made recommendations for the collection of new data to provide a baseline against which the scheme can be monitored. The Kromme Estuary is a fairly well researched estuary (ecologically) and a review of the data suggests that the system is stable (although modified).

Page Reference	SORT:	COMMENT	CATEGORY	REMARKS	CES COMMENTS
					In 2020 Advisian modelled the estuary and the pre- and post-dredging scenarios as well as a re-run of their coastal model for the refined design. The running of these models was performed using updated bathymetry data which was collected for both environments. The results of the modelling studies for the pre- and post-dredging scenarios show that the current velocities along the banks of the estuary are unlikely to change significantly (Appendix F of the EIR). The findings have been considered in the specialist reports (Appendix I & J) and the Section 7.2 of the EIR.

APPENDIX C – THE SCOPING AND EIA PROCESS

According to Appendix 2, Section 2 (1), of the 2014 EIA Regulations (as amended), a "*scoping report must contain the information that is necessary for a proper understanding of the process, informing all preferred alternatives, including location alternatives, the scope of the assessment, and the consultation process to be undertaken through the environmental impact assessment process, and must include—*

(g) a full description of the process followed to reach the proposed preferred activity, site and location of the development footprint within the site, including—

(ii) details of the public participation process undertaken in terms of regulation 41

(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;

In terms of the South African Environmental Legislative Framework, this project will be subject to the Environmental Authorisation process, which came into effect on 4 December 2014 and was subsequently amended on 7 April 2017. This process has been implemented by South African National Government to streamline the environmental process due to the number of authorisations required for these types of projects. It is intended to save time, rationalise the management of the number of competent authorities and prevent delays due to the lack of resources and time for the review process. Based on the scope of work, this project requires an Environmental Authorisation (EA) in terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998, as amended) and the 2014 EIA Regulations (as amended). The process triggered is a Scoping and Environmental Impact Assessment report (S&EIR). All the phases including the Environmental Management Programme report (EMPr) must be prepared in terms of the NEMA and GN R. 982, (as amended by GN R. 326) and the associated activities listed under GN R. 983, GN R. 984 and GN R. 985 (as amended by GN R 327, GN R 325, and GN R 324 respectively).

The S&EIR must ensure that all parties involved are aware that the assessment is not solely focused on the biophysical environment, but is inclusive of social and economic considerations. CES's approach to the S&EIR process is to adopt a holistic and integrated view of the environment, with equal emphasis on the ecological and social components. Based on previous experience, incorporating both aspects at an early stage leads to a more comprehensive end product. In order to produce comprehensive and complete documents, the S&EIR must not only identify and evaluate the significance of environmental impacts, but also suggest ways to mitigate any negative impacts and optimise positive impacts.

Scoping and EIR Process

The process to be followed is dictated by the 2014 EIA Regulations (as amended) for projects requiring an S&EIR (Figure C1). The S&EIR process is initiated through a pre-assessment Public Participation Process (PPP). The pre-assessment process is not a mandatory requirement in terms of the 2014 EIA Regulations (as amended) but is a beneficial option for the client and EAP in order to identify key stakeholders and Interested and Affected Parties (I&APs), as well as to identify any fatal flaws, at the onset of a project.

This phase is followed by the Scoping Phase (inclusive of a notice of intent to the authorities, landowners and other I&APs and Stakeholders). During the Scoping Phase, the Terms of Reference (ToR) for the full EIA is formulated, and requirements from the authorities clarified. The Scoping process serves to bring stakeholders on board by means of consultation with relevant government departments, allowing for the identification of potential issues and concerns.

After completion of the Scoping Phase, detailed specialist studies will be undertaken in order to address issues identified during the Scoping Phase. Specialists are expected not only to provide baseline information in their particular field of expertise for the study area, but also to take this study further and identify which project activities will result in significant impacts. Specialists are also expected to suggest ways in which these negative impacts could be mitigated, to reduce their severity.

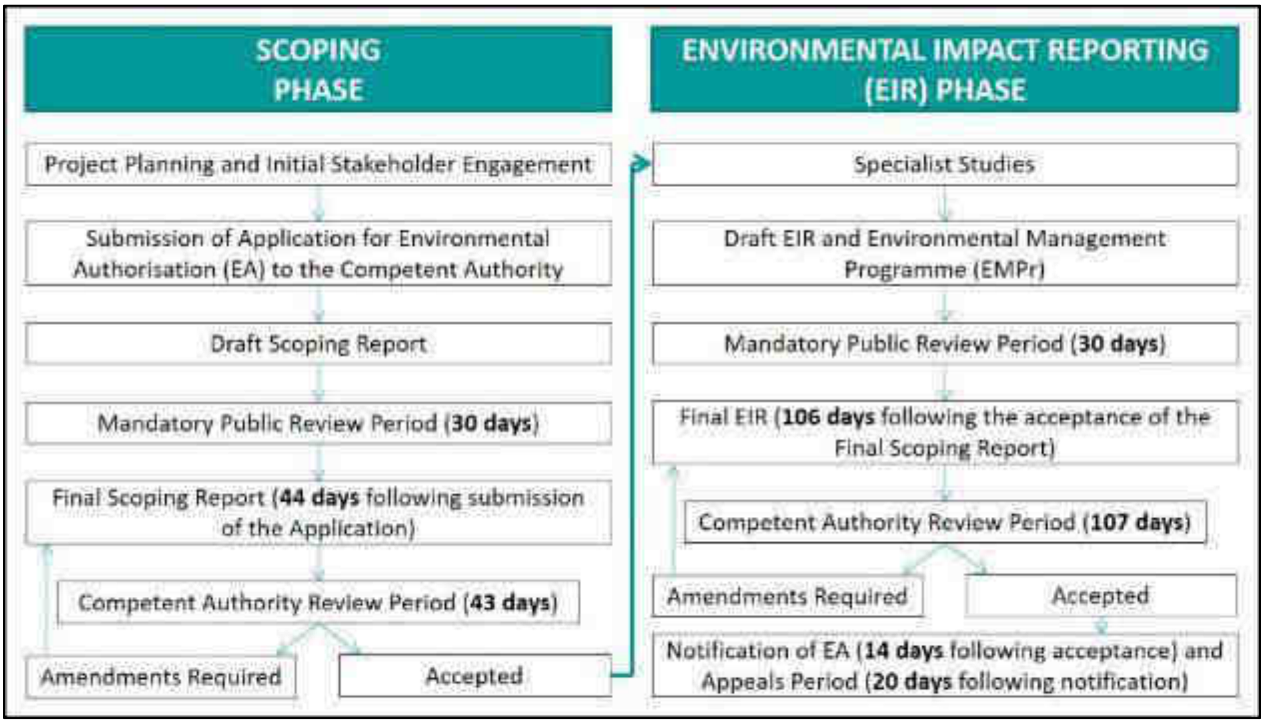

Figure C1: Scoping and Environmental Impact Assessment Process.

All draft reports are submitted for public review, which is a mandatory period of 30 calendar days, during which time CES present the key findings to all I&APs at the provincial and local levels. All comments made by I&APs are captured in an Issues and Response Trail (IRT) and, in this report, responses to all issues and concerns raised during the public review period are provided.

All recommendations cited in the EIA report must be detailed in an Environmental Management Programme report (EMPr), which defines the actions to be implemented. The EMPr is recognised as a very important tool for the sound environmental management of projects.

Scoping Phase

The Scoping Phase is outlined in GN R. 982 (as amended by GN R. 326) 2014 EIA Regulations (as amended) under Part 3, Regulation 21, as well as in Appendix 2. The process consists of a desktop review, site visit, public participation, submission of the NEMA Application Form and the Scoping Report (draft and final versions).

Desktop Review

All aspects of the proposed project are first analysed using a high-level desktop study which looks at the basic description of the project and what the initial environmental and social concerns may be. This includes background information for the project area as well as the proposed activity, details of the activity applied for according to the 2014 EIA Regulations (as amended) (the listed activities) and the type of assessment which will be required. The desktop review involves the interpretation of maps covering the proposed project area, as well as available reports and planning instruments in order to familiarise the project team with the area and the various physical and biological properties of the area. The desktop review also identifies if the project requires any additional licences in terms of water use, waste, air quality, land use or any other environmental requirements.

Site Visit

CES consultants made an initial visit to the proposed project site on the 16th of December 2018 in order to assess the site and initiate the Scoping Phase. Baseline social and ecological data was collected at a screening level.

Public Participation

Interested and Affected Parties (I&APs) play an important role in the S&EIR process, as many of their concerns and issues can be included in the project proposal, to ensure a project which is as environmentally and socially acceptable as possible. The general public, key stakeholders, landowners, adjacent landowners and government authorities at National, Provincial and Local level, will be notified of the proposed project. The means by which I&APs were notified are described in full in Appendix B.

Submission of Application Form

An application for Environmental Authorisation (EA) will be submitted to the Competent Authority (CA), the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT), as per the requirements of Regulation 16 of the 2014 EIA Regulations (as amended in 2017). The applicant, the Frances Baard District Municipality, is a municipal entity and therefore the prescribed application fee (effective as of 1 April 2014) will not be applicable.

Draft Scoping Report

The information gathered through the initial PPP phase, as well as the information from the site visit and from the client with regard to the design of the project was integrated into the Draft Scoping Report. The Draft Scoping Report will be made available to the public for a period of 30 calendar days for comment, during which time a public meeting was held. Registered I&APs will be informed of the release of the Draft Scoping Report by email. The release of the report will also be advertised in one provincial and/or one local newspaper. Hard copies of the report will made available in publicly accessible places such as a local public library, and will also be available on request from the EAP.

Final Scoping Report

Any comments, issues and concerns raised by I&APs and the authorities during the review period of the Scoping Phase are included in the Final Scoping Report in the form of an Issues and Response Trail (IRT). The Final Scoping Report will be submitted to DEDEAT, who will decide whether the main phase of the EIA can be initiated. DEDEAT will also approve, with or without amendments, the Terms of Reference (ToR) for the proposed specialist studies, and the Plan of Study for the EIA phase of the assessment, which is presented in Chapter 7 of this report. The Final Scoping Report must be submitted to DEDEAT within 44 days of receipt of the application by the competent authority.

According to the 2014 EIA Regulations (as amended in 2017), Regulation 22, DEDEAT must accept or reject the Final Scoping Report within 43 days of receipt of the report.

Specialist Study Phase

The objectives of the specialist assessments are as follows (full terms of references for each of the above mentioned assessment are available in Chapter 7, Section 7.2):

- Assist in defining possible constraints associated with the proposed project;
- Determine the potential indirect, direct and cumulative environmental risks/impacts to receptors associated with the proposed project;
- Advise on mitigation measures for identified significant risks/impacts and measures to enhance positive opportunities of the project; and
- Guide the project layout.

Environmental Impact Assessment Phase

The EIA Phase is outlined in GN R. 982 (as amended by GN R. 326), 2014 EIA Regulations (as amended) under Part 3, Regulation 23, as well as Appendix 3. This task involves the integrated writing of the Environmental Impact Assessment report (EIR). Specialist input to the proposed project will be undertaken during preparation of the Draft EIR. The report will consist of an introductory section, followed by a detailed project description, sections in which the results of all specialist reports are summarised, and an environmental impact section, where impacts are assessed and rated according to a predefined rating scale. Measures to mitigate negative impacts as proposed by the various specialists will also be included.

Draft Environmental Impact Assessment Report

The primary objective is to prepare a report that is scientifically credible but also understandable, with enough detail to deal with all the issues but not too much detail to confuse I&APs. The EIR will include a detailed Environmental Management Programme report (EMPr), which will be submitted as a separate report, for the proposed project. The EMPr will contain suggested measures to manage and mitigate impacts identified during the EIA Process, for both the construction and operational phase of the project. These measures will be informed by the findings of the EIR, and particularly by the specialist assessments undertaken as part of this process.

Environmental Management Programme

The measures presented in the EMPr will be aimed at enhancing the potential benefits and minimizing the potential negative impacts of the project. The EMPr will specify responsibilities for the implementation and monitoring of the project as well as the periodicity of the audits to be carried out. The Draft EIR and EMPr will be made available to the authorities and the public for a period of thirty (30) calendar days (mandatory). The availability of the Draft EIR and EMPr to the public will be advertised in one provincial and/or one local newspaper. A hard copy of the report will be made available as done in the Scoping Phase.

Final Environmental Impact Assessment Report

A further public meeting (as required) will be held during the public review period, to inform stakeholders and I&APs of the detailed findings of the EIA Phase, and to enable them to raise any issues or concerns. When the Draft EIR and EMPr have been updated to reflect public comments the deliverables from the entire EIA Process, the Final EIR will be prepared. This will include the additional comments, issues and concerns raised by I&APs and the authorities, provided in an updated Issues and Response Trail (IRT). The Final EIR, Final Specialist Report Volume and Final EMPr will then be submitted to DEDEAT for decision making. The Final EIR must be submitted to DEDEAT within 106 days of acceptance of the Scoping Report by the competent authority.

According to the 2014 EIA Regulations (as amended) Regulation 24, DEDEAT must, within 107 days of receipt of the Final EIR and EMPr, either grant or refuse the application by means of a positive or negative Environmental Authorisation (EA).

Environmental Authorisation Phase

Should the EA be granted, it usually carries Conditions of Approval. The project proponent is legally obliged to adhere to all conditions stipulated therein. In accordance with GN R. 982, as amended by GN R. 326, a copy of the EA must be sent to all registered I&APs within fourteen (14) days of the date of issuing the authorisation. The public can then appeal the decision, should they wish to do so. A notice of intent to appeal must be submitted to the relevant competent authority within twenty (20) days upon notice of a decision on the application.

APPENDIX D – ASSESSMENT METHODOLOGY

A. Introduction

The CES rating scale has been updated to meet the requirements outlined in Appendix 2 of the EIA Regulations (2014, as amended). This methodology takes into consideration the following criteria, and includes the new criteria for assessing post mitigation significance, by incorporating the principles of reversibility and irreplaceability:

1. Nature of impact
2. Type of impact
3. Duration (previously called temporal scale by CES)
4. Extent (previously called the spatial scale by CES)
5. Probability (previously called likelihood by CES)
6. Severity or benefits

The overall significance rating for the impact is then obtained from the above six criteria.
It is recommended that we use the terminology aligned to SA regulations i.e. Duration; Extent and Probability (as opposed to temporal scale, spatial scale and likelihood).
If required or deemed necessary, you can also define the Degree of confidence or certainty that you attach to your rating.

B. Explanation of the six impact rating criteria

Criterion 1: Nature
Negative or positive impact on the environment.

Criterion 2: Type
Direct, indirect and/or cumulative effect of impact on the environment.

Criteria 3, 4, 5 & 6: Temporal, Spatial, Likelihood and Severity Scales
These four factors need to be considered when assessing the significance of impacts, namely:

- Relationship of the impact to temporal scales - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
- Relationship of the impact to spatial scales - the spatial scale defines the physical extent of the impact.
- The likelihood of the impact occurring - the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts could occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance. In this case likelihood equates to some extent with risk. If the impact is definite, then there is a high risk that it will occur. However, likelihood and risk are not to be confused, and for certain impacts (e.g. risk of a vehicle accident) a risk assessment will be required (see Section 4).
- The severity of the impact - the severity/beneficial scale is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party. The severity of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it, and how effective the mitigation might be. The word 'mitigation' means not just 'compensation', but includes concepts of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.

Table 1 below provides definitions for Criteria 3,4 & 5, and Table 3.2 for Criterion 6.

Table 1: Temporal, Spatial, Likelihood Scales defined.

Duration (Temporal Scale)		*Score*
Short term	*Less than 5 years*	*1*
Medium term	*Between 5-20 years*	*2*
Long term	*Between 20 and 40 years (a generation) and from a human perspective also permanent*	*3*
Permanent	*Over 40 years and resulting in a permanent and lasting change that will always be there*	*4*
Extent (Spatial Scale)		
Localised	*At localised scale and a few hectares in extent*	*1*
Study Area	*The proposed site and its immediate environs*	*2*
Regional	*District and Provincial level*	*3*
National	*Country*	*3*
International	*Internationally*	*4*
Probability (Likelihood)		
Unlikely	*The likelihood of these impacts occurring is slight*	*1*
May Occur	*The likelihood of these impacts occurring is possible*	*2*
Probable	*The likelihood of these impacts occurring is probable*	*3*
Definite	*The likelihood is that this impact will definitely occur*	*4*

Table 2: Impact Severity explained

Impact Severity *(The severity of negative impacts, or how beneficial positive impacts would be on a particular affected system or affected party)*		*Score*
Very severe	Very beneficial	4
An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.	
Severe	Beneficial	3
Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.	A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.	
Moderately severe	Moderately beneficial	2
Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated. For example constructing the sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.	
Slight	Slightly beneficial	1
Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.	
No effect	Don't know/Can't know	

Impact Severity *(The severity of negative impacts, or how beneficial positive impacts would be on a particular affected system or affected party)*		*Score*
The system(s) or party(ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.	

** In certain cases it may not be possible to determine the severity of an impact thus it may be determined: Don't know/Can't know*

C. Applying the criteria to determine environmental significance BEFORE MITIGATION

The scores for the three criteria in Table 3.1 are added to obtain a composite score. They must then be considered against the severity rating to determine the overall significance of an activity. This is because the severity of the impact is far more important than the other three criteria. The overall significance is then obtained by reading off the matrix presented in Table 3.3. The overall significance is either negative or positive (Criterion 1) and direct, indirect or cumulative (Criterion 2).

Table 3: Matrix used to determine the overall significance of the impact based on the likelihood and effect of the impact

SEVERITY		COMPOSITE DURATION, EXTENT & PROBABILITY SCORE									
		3	4	5	6	7	8	9	10	11	12
	Slight	3	4	5	6	7	8	9	10	11	12
	Mod severe	3	4	5	6	7	8	9	10	11	12
	Severe	3	4	5	6	7	8	9	10	11	12
	Very severe	3	4	5	6	7	8	9	10	11	12

The **environmental significance** scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of especially a social nature need to reflect the values of the affected society.

It is clear that an impact that has a *slight severity* could be of MODERATE significance because it is permanent (4), has a regional affect (3) and is definite. This elevates it from a LOW to a MODERATE rating. Conversely, a *moderately severe* impact could be rated as LOW since it is short term (1), localised (1) and only probable (3). An impact rated as *severe* could be of VERY HIGH significance because it is permanent (4), of national importance (3) and is definite (4). For example, the impact on a frog species of conservation concern (SCC) might only be rated as *severe* as a result of the project actions, but because the loss is permanent and of national importance (it's a SCC) and is definite, we rate the significance as VERY HIGH and not HIGH. If the impact was long term and not permanent then it would be rated as HIGH.

The Significance Rating Scale is defined in Table 3.4 below.

Table 4: Description of Environmental Significance Ratings and associated range of scores

OVERALL SIGNIFICANCE *(The combination of all the above criteria as an overall significance)*	
VERY HIGH NEGATIVE	VERY BENEFICIAL
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects. *Example: The loss of a species would be viewed by informed society as being of VERY HIGH significance.* *Example: The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.*	
HIGH NEGATIVE	BENEFICIAL
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light.	

OVERALL SIGNIFICANCE *(The combination of all the above criteria as an overall significance)*	
Example: The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated. *Example: The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.*	
MODERATE NEGATIVE	SOME BENEFITS
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial. *Example: The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.*	
LOW NEGATIVE	FEW BENEFITS
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect. *Example: The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels.* *Example: The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.*	
NO SIGNIFICANCE	
There are no primary or secondary effects at all that are important to scientists or the public. *Example: A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.*	
DON'T KNOW	
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information. *Example: The effect of a particular development on people's psychological perspective of the environment.*	

D. Significance Post Mitigation

Once mitigation measure are proposed, the following criteria are then used to determine the overall post mitigation significance of the impact:

- Reversibility: The degree to which an environment can be returned to its original/partially original state.
- Irreplaceable loss: The degree of loss which an impact may cause.
- Mitigation potential: The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. The four categories used are listed and explained in Table 3.5 below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

Table 5: Criteria considered post mitigation

Reversibility	
Reversible	*The activity will lead to an impact that can be reversed provided appropriate mitigation measures are implemented.*
Irreversible	*The activity will lead to an impact that is permanent regardless of the implementation of mitigation measures.*
Irreplaceable loss	
Resource will not be lost	*The resource will not be lost/destroyed provided mitigation measures are implemented.*
Resource will be partly lost	*The resource will be partially destroyed even though mitigation measures are implemented.*
Resource will be lost	*The resource will be lost despite the implementation of mitigation measures.*

Mitigation potential	
Easily achievable	*The impact can be easily, effectively and cost effectively mitigated/reversed.*
Achievable	*The impact can be effectively mitigated/reversed without much difficulty or cost.*
Difficult	*The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs.*
Very Difficult	*The impact could be mitigated/reversed but it would be very difficult to ensure effectiveness, technically very challenging and financially very costly.*

APPENDIX E – CVS OF THE PROJECT TEAM

ANTHONY MARK AVIS
Curriculum Vitae

CONTACT DETAILS

Legal Name of Company	**Coastal and Environmental Services (Pty) Ltd**
Trading Name of Company	**CES Environmental and Social Advisory Services**
Designation	Cape Town Branch
Profession	Managing Director
Years with firm	Thirty (30) years
E-mail	t.avis@cesnet.co.za
Office number	+27 (0)21 045 0900
Nationality	South African
Professional Affiliations	**SACNASP**: South African Council for Natural Scientific Profession **EAPSA**: Environmental Assessment Practitioner Southern Africa **MRSSAF**: Member of the Royal Society of South Africa **BotSoc**: Botanical Society of South Africa **SAAB**: South African Association of Botanists **SAIE&ES:** South African Institute of Ecologists & Environmental Scientists **IAIA:** International Association of Impact Assessment
Key areas of expertise	Environmental & Social Impact Assessment Environmental & Social Management Plan preparation Terrestrial vegetation and flora specialist studies Coastal dune ecology specialist studies Integrated coastal zone management Strategic Environmental & Social Assessment

PROFILE

Dr Anthony Mark Avis

Ted Avis is a leading expert in the field of Environmental Impact Assessments, having project-managed numerous large-scale ESIAs to international standards, especially those of the International Finance Corporation (IFC). From 1997 to 2005 Ted acted was principle environmental consultant to Corridor Sands Limitada, managing all environment aspects of the US$1,2billion Corridor Sands Project, including five ESIA's, associated ESMPs, and the RAP. He has managed ESIA studies and related environmental assessments of similar scope in Kenya, Madagascar, Egypt, Malawi, Zambia and South Africa. Ted also has experience in large scale Strategic Environmental Assessments in southern Africa, and has been engaged by the IFC on a number of projects.

Between 1994 and 1996 Ted was instrumental in establishing the Environmental Science Department at Rhodes University, whilst a Senior lecturer in Botany at that time. This resulted from his experience running honours modules in EIA practice and environmental management, as well as the applied research he undertook in these disciplines. He was an Honorary Visiting Fellow in the Department of Environmental Sciences at Rhodes between 1998 and 2003. He was one of the first certified Environmental Assessment Practitioner in South Africa, gaining certification in April 2002. He has delivered papers and published in the field of EIA, Strategic Environmental Assessment and Integrated Coastal Zone Management, and has been a principal of CES since its inception in 1990, and Managing Director since 1998.

Ted holds a PhD in Botany, and was awarded a bronze medal by the South African Association of Botanists for the best PhD adjudicated in that year, entitled "Coastal Dune Ecology and Management in the Eastern Cape". Ted is a Certified Environmental Assessment Practitioner (since 2002) and a professional member of the South African Council for Natural Scientific Professionals (since 1993).

EMPLOYMENT EXPERIENCE

2017 – Present: Divisional Director and head of the Environmental Cluster at NEXTEC (part of the EOH Group). EXCO member of the Industrial Technologies Division of NEXTEC.

- 1998 – Present: Full-time Managing Director of Coastal & Environmental Services.
- 1989 – 1997: Lecturer and Senior Lecturer in Botany at Rhodes University.
- 1990 – 1997: Private environmental consultant and partner of Coastal & Environmental Services (CES, established January 1990).
- 1987 – 1988: Ecological Consultant with Loxton Venn and Associates, responsible for vegetation, soils and land surveys; veld conditions assessments and EIAs.
- 1983 – 1987: Full time post-graduate research in plant ecology, including coastal management studies and Environmental Impact Assessments (EIAs).

ACADEMIC QUALIFICATIONS

- PhD, Rhodes University, 1993
- BSc (Honours), Rhodes University, 1984
- BSc, Rhodes University, 1983

PUBLICATIONS AND TEACHING

- *Presented 29 conference papers at local and international conferences, including plenary presentations.*
- *Published 19 scientific articles in peer reviewed scientific journals.*
- *Published 6 popular articles in local journals.*
- *Published 2 chapters in scientific books.*
- *Supervised 17 post graduate students (honours (10), masters (4), PhD (3)) in plant ecology, coastal ecology and vegetation science.*

COURSES PRESENTED

Presented the following:

- *Tools of Sustainable Coastal Zone Management. Short course (2 x 1-week courses) presented on behalf of NACOMA / World Bank. (Presenter on Coastal zone management and strategic environmental assessment).*
- *Environmental training and teaching for a number of professional short courses, and at undergraduate and postgraduate level at Rhodes University, most notably as a key presenter on the EIA Short Course offered by CES since 2000*
- *Training course on the Integrated Coastal Zone Management Act. Four two day short courses presented to various Government and NGO stakeholders to introduce and explain the NEMA: Integrated Coastal Zone Management Act. Presented on behalf of DEA: Oceans & Coasts. [Study leader and lead presenter).*

CONSULTING EXPERIENCE

SELECTED LARGE ENVIRONMENTAL IMPACT ASSESSMENTS

- Principal consultant for the specialist studies for the Environmental Impact Assessments of proposed dune mining on the Eastern Shores of Lake St Lucia.
- Overall responsibility as EIA project manager for all environmental aspects of Billiton's TiGen mineral sand mining

operations in Mozambique, to produce an EIA that meets international standards.

- EIA project manager for the Corridor Sands mineral sand mining project in southern Mozambique, to produce four EIAs to World Bank standards for the project's bankable feasibility study. EIAs produced for the mine site and smelter, the 400Kv power line, the 87km rail route and a bulk cargo facility at Matola Port. All these EIAs included the preparation of Environmental Management Plans.
- EIA project manager for Tiomin Resources Inc (Toronto, Canada) for their Kwale mineral sands project in southern Kenya. Responsible for producing all six volumes of the EIA, regarded as the most comprehensive in Kenya to date.
- EIA project manager for the EIA to support the rezoning of land to special purposes for the establishment of the Coega Industrial Development Zone (IDZ).
- EIA project manager for the EIA to support the rezoning of land to special purposes for the establishment of the East London IDZ.
- Numerous small-scale Scoping Reports as part of the Environmental Impact Assessment Process and in accordance with the requirements of the Environmental Conservation Act.
- Pre-feasibility Environmental Impact Assessments, including one for BHP's mineral sand mining project in northern Mozambique, and similar projects in south-west Madagascar and Mozambique.
- Study leader for a comprehensive EIA for the World Bank funded 400Kv Mozambique Malawi Interconnector project power line, Malawi sector.
- EIA for a dedicated haul road, material handling facility and jetty near Praia de Xai Xai, Mozambique for WMC Resources, Australia.
- EIA Project Manager for the Nuclear Materials Authority of Egypt, to prepare the EIA as part of the Downer EDI Feasibility Study Team. (2007).
- EIA for a large scale resort development, including two golf courses and three hotels in the Eastern Cape, South Africa. (Ongoing).
- EIA for the Madiba Bay resort development, incorporating the development of various portions of land within a 5000 hectare site for a range of resort type facilities. (2005 – 2008).
- Study Leader for an EIA for a large heavy mineral mining project in South West Madagascar for Exxaro (2006 – 2008).
- Study Leader for an EIA for a proposed heavy mineral mine on the shores of Lake Malawi near Chipoka. (2005 – 2006).
- Study Leader for an ESIA for a proposed large scale integrated tourism resort development in the Eastern Cape (2007 – 2008).

- Environmental and Social consultants to the International Finance Corporation for the Kafue Gorge Lower Hydropower project, Zambia.
- Study Leader for an Environmental, Social and Health Impact Assessment for a proposed large sugar cane to ethanol biofuel project in Sierra Leone for Addax Bioenergy, Geneva (2009 - 2010).
- Study Leader for an ESHIA for a proposed large scale Jatropha biofuels project in Mozambique (2009 - 2010).
- Study leader for Environmental Impact Assessment for a proposed large scale copper and nickel mine in the North West Province of Zambia (2010).
- Lead consultant for an addendum Environmental Impact Assessment for the proposed expansion of a heavy mineral mining project in Nampula Province, Mozambique (2010).
- Quality control reviewer for approximately 8 EIA's for various Windfarm Projects in South Africa (2009 – 2010).
- Study leader for an ESHIA for a proposed large scale palm oil plantation in Sierra Leone (2010).
- Study leader for ESIA for a rare earths mine in Kangankula, Malawi for the Lynas Corporation.
- Study leader for ESIA for a large scale copper mine in the North West Province of Zambia for First Quantum Minerals (2011).
- Study leader for an ESIA for a proposed Cement Plant and for a proposed Limestone quarry in southern Mozambique (2012).
- Study Leader for an Environmental Impact Assessment of the Mooi-Mgeni Transfer Scheme – Phase 2, KwaZulu-Natal Province, South Africa for TCTA (2012).
- Study leader for an ESHIA for a proposed large scale palm oil plantation and estate in Liberia, compliant with international sector specific guidelines. For EP Oil (2012).
- Study leader for an ESHIA for a proposed large scale forestry plantation in Niassa Province, Mozambique for Niassa Green Resources and to be compliant with international sector specific guidelines (2010).
- Study leader for an EIA for a proposed golf course in Makana District, South Africa (2012)
- Study leader for an EIA for a proposed housing and residential estate in Makana District, South Africa (2012).
- Study Leader for an ESHIA for a heavy mineral mining project in South West Madagascar for World Titanium Resources (2013).
- Study Leader for an ESHIA for a heavy mineral mining project on the West Coast of South Africa for Zirco Resources (2013).
- Study Leader for the Tete Iron Ore project ESHIA located in Tete province, Mozambique for Baobab Resources and Capitol Resources Lda (2013 - 2016).

- Study Leader for an ESHIA for the Nicanda Hills Graphite mining project in Cabo Delgado Province, Mozambique for Triton Resources, Perth (2015 - 2016)
- Study Leader for an EIA for the proposed Riemvasmaak Hydropower Station in the Augrabies Falls National Park, undertaken for HydroSA (2015-2016).
- Study Leader for an ESHIA for the Ancuabe Hills Graphite mining project in Cabo Delgado Province, Mozambique for Triton Resources, Perth (2015 – 2016)
- Study Leader for an ESHIA for a tin mine in North Kivu province, DRC for Alphamin Resources (2015 - 2016).
- Study Leader for an EIA for a floating power plant, Port of Ngqura, Eastern Cape Province of South Africa. Prepared as part of the Independent Power Producers Programme on behalf of the Department of Energy's IPP Office and Transnet (2015-2106).
- Study Leader for an EIA to facilitate the import of Liquefied Natural Gas (LNG) at the Port of Ngqura, Eastern Cape Province of South Africa. Prepared as part of the Independent Power Producers Programme on behalf of the Department of Energy's IPP Office and Transnet (2015-2106).
- Study Leader for an ESHIA for the Balama Graphite mining project in Cabo Delgado Province, Mozambique for Battery Minerals Resources, Perth (2017 – 2018)
- Reviewer and co-author for an ESHIA for the Pilivili Mineral Mine, Nampula Province, Mozambique for Kenmare Resources (2018 - 2019)
- Reviewer, co-author and study leader for the Boulders Wind Farm EIA located at near Paternoster, Western Cape, South Africa for Vredenberg Wind Farm (Pty) Ltd. (2019).
- Reviewer for the EIA for the proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province (2019-2020).
- Study Leader for an ESHIA for a Coal to Urea project in the Highveld Industrial Park on behalf of Wison Engineering (China) and the Industrial Development Corporation (2019 – 2020).

POLICY AND STRATEGIC ASSESSMENTS

- The development of the Eastern Cape Coastal Management Plan, to be adopted as policy by the Eastern Cape Government
- Study leader for the preparation of a State of Environment Report, and Environmental Implementation Plan for the Amatole District Municipality, covering an area of approximately 25 000 km.
- Reports on ecological assessments of the damage caused to the environment by alleged illegal developments along the former Transkei coastline.

- Study leader and project manager for the preparation of a World Bank/Global Environmental Facility funded geographic Strategic Environmental Assessment of the proposed greater Addo Elephant National Park, Eastern Cape, South Africa.
- A Strategic Environmental Assessment of four land use options in the Centane district of the Wild Coast.
- SEA covering an area half the size of the Eastern Cape (former Transkei) to identify where afforestation projects could be implemented on a sustainable basis for poverty alleviation. Prepared for the Department of Water Affairs and Forestry (2006 – 2007).
- Integrated Coastal Zone Management Plan for the Buffalo City Municipality, Eastern Cape South Africa, including numerous Management Plans for estuaries, beaches etc. (2006 – 2007).
- A Sustainability Analysis of various land use alternatives to determine optimum land use for the future rehabilitation of lease areas at Richards Bay Minerals. (2006).
- State of Environmental Report and Environmental Management System for the Ukhulambe District Municipality. (2005).
- Strategic Environmental Overview for two integrated tourism anchor projects in Mozambique for the International Finance Corporation (2007).
- Study Leader of the Western Cape State of Coast report prepared for the Department of Environmental Affairs & Development Planning (2017-2018).
- Study leader for the revised Coastal Management Programme of the West Coast, on behalf of the West Coast District Municipality (2019).

ECOLOGICAL AND COASTAL

- Ecological impact assessment for a proposed Zinc and Phosphoric Acid plant in the Eastern Cape.
- Ecological specialist reports for the Coega Industrial Development Zone Strategic Environmental Assessment
- Ecological impact assessment of proposed 800km Wild Coast N2 Toll Road, Eastern Cape.
- Study leader for the ecological impact assessment of the Wild Coast Toll Road EIA, Eastern Cape and Kwazulu/Natal, South Africa (2004).
- Study Leader for Baseline Ecological Surveys of coastal lease areas in southern Mozambique for Rio Tinto exploration (2008).
- Pre-feasibility Ecological Survey of the Skeleton Coast to identify critical impacts linked to Diamond and Mineral Mining exploration (2008).
- Coordinator for ecological investigations to establish a sound baseline prior to implementing an EIA, North West Province, Zambia (2011).

- Assessment of the extent and conservation value of forested areas along the Wild Coast within the former Transkei, on behalf of the Eastern Cape Parks Board (2011)
- Study Leader for a biological and archaeological (including heritage) baseline and impact assessment study of the Lesotho Highlands Water Project – Phase II. Prepared for the Lesotho Highlands Development Authority (2013-2014)
- Study Leader for the preparation of the Nhangonzo Critical Habitat Biodiversity Assessment, Inhambane Province, Mozambique. Prepared for Sasol Petroleum Mozambique Limitada and Sasol Petroleum Temane Limitada (2015).
- Bookram Coastal Dune Specialist Study (2017).
- Coastal Dune and Ecological Impact Assessment for the proposed Mosselbankfontein Farm Housing Development near Witsand, Western Cape Province (2019).
- Strategic Environmental Overview: Development Opportunities and Constraints. Cape Agulhas Municipality: Duiker Street to Struisbaai Harbour Precinct Development Plan (2019 -2020).
- Environmental Management and Maintenance Plans for 3 sites (Gouritz; Still Bay & Witsands) in the Hessenque Local Municipality (2020)
- Environmental Risk Assessment and Revegetation Plan for the Witsands Landfill site near Scarborough, for City of Cape Town (2020).

ENVIRONMENTAL MANAGEMENT

- Project manager for a five-year rehabilitation programme of Samancor's Chemfos mine on the West Coast, which later became the West Coast Fossil Park.
- Development of an Open Space Management Plan for the Coega Industrial Development Zone (IDZ), including the demarcation of open spaces, formulation of uses within the open space, integration with MOSS principles and developing guidelines and a business plan for the management of the open space system.
- Preparation of numerous Environmental Management Programme Reports, in terms of the Minerals Act, for quarry operations in the Eastern Cape, including EMPRs for both the Eastern and Western Coega Kops.
- Study Leader for the development of two detailed and definitive Environmental Management Plans for the construction of two large bridges across rivers in the Wild Coast, as part of the Wild Coast N2 Toll Road Project, for South African National Roads Agency Limited. (2006).
- Joint Study Leader for the development of numerous Construction and Operational Phase Environmental and Social Management Plans for Tiomin's proposed Kwale mineral mine in Kenya.

- Completion of numerous (>20) Environmental & Social Management Plans as part of the EIA process and ESIA deliverables.
- Development of a range of Standard Operating Procedures (SOPs) as part of the operational phase ESMP for a large scale agricultural project.

CERTIFICATION

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes me, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

ANTHONY M. AVIS (TED) Date: 17 January 2020

GREGORY SHAW
Curriculum Vitae

CONTACT DETAILS

Name of Company	**CES**
Designation	Grahamstown Branch
Profession	Principal Environmental Consultant
Years with firm	3 Years
E-mail	g.shaw@csenet.co.za
Office number	+27 (0)46 622 2364
Nationality	South African
Professional Body	SACNASP, South African Council for Natural Scientific Profession, Professional (Pending)
Key areas of expertise	➢ Marine Ecology ➢ Environmental and Social Impact Assessment (ESIA) ➢ Environmental Management and Monitoring ➢ Project Management

PROFILE

Mr Gregory Shaw

Greg is a principal environmental consultant with more than 10 years' experience, who has carried out ESIAs for a variety of infrastructure developments in Africa and Europe. His experience is with development projects where there is creation or modification of infrastructure, via capital works and complex logistics.

He is able to engage with the full portfolio of diverse stakeholder groups and regulators via meetings, written material, face-to-face workshops, presentation events, negotiation and discussion to achieve mutually agreeable mitigation measures and solutions. As part of many of the ESIAs he has been involved in or managed he has been responsible for the development and execution of environmental surveys (and subsequent monitoring programmes), sub-contractor management (including contracting), report writing and project management. In addition, he has been responsible for developing and auditing plans associated with managing large infrastructure projects e.g. Environmental Management Plans (EMP).

Greg forms strong relationships and ensure that the team works together in an integrated way towards the clear common goal, making effective use of time and resources.

Employment Experience

November 2016 - Present:
Principal Consultant (EOH Coastal & Environmental Services)
Grahamstown, South Africa

January 2008 – October 2016:
Senior Consultant (Royal HaskoningDHV)
Peterborough, United Kingdom

January 2004 – January 2007:
Part-time consultant (Public Process Consultants)
Port Elizabeth, South Africa

Academic Qualifications

Nelson Mandela Metropolitan University, Port Elizabeth
MSc (Botany)
2005 – 2007

Nelson Mandela Metropolitan University, Port Elizabeth
BSc (Hons) (Environmental Management)
2004

University of Port Elizabeth, Port Elizabeth
BSc (Natural Sciences)
2000 - 2003

Courses

- 2013 Royal HaskoningDHV Accelerated Development Programme
- 2012 First Aid
- 2012 Handling Conflict
- 2011 Client Relationships
- 2011 Financial Management
- 2010 Report Writing
- 2010 Project Management
- 2010 Effective Communication
- 2010 Knowing Your Business
- 2010 Phase I Ecological Surveying Techniques and Taxonomy
- 2009 CIWEM Structured Training
- 2009 Project Management
- 2008 Sustainable Construction
- 2006 South African Association of Botanists - Annual Seminar
- 2005 Resource Directed Measures
- 2005 Training in Integrated Environmental Management
- 2005 Integrated Water Resource Management Workshop

Consulting Experience

Environmental consulting experience as project manager or team member is broad and covers a number of key industry sectors (ports, nuclear, renewable energy). The majority of the international ESIAs were conducted in accordance with international standards including the IFC Performance Standards and have been reviewed by international Development Finance Institutions.

South Africa

- Nirove Paint Stripping Facility [Project manager]
- Wison Coal to Urea EIA [Project manager]
- St Francis Bay EIA [Project Manager, Marine specialist]
- EOH Powerstation Feasibility Assessment [Project manager]
- Richard's Bay breakwater refurbishment [Marine specialist]
- KBK Engineers (Sanral) Basic Assessment [Project manager]
- Bayview Wind Energy Facility [Project director]
- Rushmere Noach Attorneys [Project manager and marine specialist]
- TNPA East London Quay 3 Assessment [Environmental specialist]
- TNPA Ballast Water Management Plan [Environmental specialist]
- Fairwood Estate Environmental Authorisation [ESMP author]
- Environmental Scoping Report cc. Erf 2387, Port Elizabeth. Baobab Agencies. [Environmental specialist].
- Proposed Hybrid Residential Development Scoping Report, Port Elizabeth. [Environmental specialist].
- Ingleside Development, Port Elizabeth. [Specialist Review].
- Port of Ngqura Marine Biomonitoring Programme. Coega Development Corporation. [Surveyor / research assistant].
- Construction and Operation of the Deepwater Port of Ngqura EIA. Coega Development Corporation. [Specialist review].

Africa

- Kenmare Mangrove Baseline Assessment (Mozambique) [Lead surveyor]
- Sphinx Energy Solar PV Facilities in Guider & Maroua (Cameroon) [Project manager]
- Olam Cocoa Plantation ESIA (Tanzania) [Project manager, ESIA manager]
- MCA-Malawi RAP Audit [Project Manager, Lead Auditor]
- JCM Power ESMS [Project manager]
- JCM Power Solar Power Station ESIA [Project Manager, Report Author]
- Suni Resources Traffic Impact Assessment [Report author]
- NCCL Isanye Dam EPB (Zambia) [Project manager]
- NCCL Ngoli Dam EPB (Zambia) [Project manager]
- NCCL Kasama Dam ESIA (Zambia) [ESIA manager]
- JCM Power Solar PV ESIA (Cameroon) [ESIA manager]
- Tete Iron Ore Project ESIA (Mozambique) [ESMP]
- Triton Ancuabe ESIA (Mozambique) [Specialist coordination, ESMP]
- Badagry Greenfield Port Development ESIA including management plans (Nigeria) [ESIA and marine specialist]
- Saly Coastal Protection Project ESIA (Senegal) [Marine specialist]
- Port Mole Waterfront Development ESIA including management plans (Gabon) [ESIA manager and marine specialist]
- Bulk Handling Facility ESIA including management plans (Conakry Guinea) [ESIA manager and marine specialist]
- Kamsar Container Terminal ESIA including management plans (Conakry Guinea) [ESIA manager and marine specialist]

- Port of Ziguinchor ESIA including management plans (Senegal) [Marine specialist / Reviewer]
- Eko Atlantic Shoreline Protection ESIA including management plans (Nigeria) [Marine specialist]
- Eko Atlantic Topside Infrastructure ESIA (Nigeria) [ESIA manager]
- Construction of a Jetty Facilitating Transfer of Petroleum Products from Ship to Shore (Eritrea) [Environmental Clerk of Works]

United Kingdom

- Thamesport Phase IV Quay Extension EIA [Reviewer]
- East Lane, Bawdsey Coast Defence Works [Environmental Clerk of Works]
- Kilkeel Offshore Wind Farm Feasibility and Scoping Report [Project manager]
- Wells Channel Deepening and Jetty Construction EIA [EIA and marine specialist]
- Wells Channel Deepening and Jetty Construction Environmental Monitoring Programme (2010-2016) [Project manager and marine specialist]
- Trinity III Enhancement Monitoring Programme (2008 – 2011) ([Marine specialist]
- Trimley Ecological Monitoring Programme (2008 – 2011) [Marine specialist]
- SEAs for the Eastern England Shoreline, required for Shoreline Management Plans [Marine specialist]
- River Habitat Survey, Tributary of Car Dyke [Field work and report writing]
- Hinkley Point C Environmental Impact Assessment [EIA coordinator and marine specialist]
- Harwich Haven Annual Environmental Reporting (2009 – 2011) [Project manager and marine specialist]
- Environmental Monitoring and Mitigation Plan / Habitat Regulations Assessment East Lane [Project manager and marine specialist]
- Thanet Offshore Wind Farm [Environment Manager]
- The Wash Tide Gauge [Consent advisor and marine specialist]
- Dogger Bank Creyke Beck A&B, Teesside A&B EIA [Marine specialist]
- Kentish Flats Offshore Wind Farm Extension [Consent advisor / environment manager]
- Royal National Lifeboat Institute (RNLI) Feasibility [Project manager and marine specialist]
- Bacton Gas Terminal Coast Protection Works and Offshore Borrow Area EIA [Consent and marine specialist]
- Newhaven East Quay and Port Expansion Area EIA [Marine specialist]
- Sizewell C New Nuclear Build Habitats Regulations Assessment [Project manager]
- DNV Subsea Cable Installation Guidelines [Marine and Consenting expert]
-

CERTIFICATION

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes me, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

GREGORY SHAW Date: January 2020

CONTACT DETAILS

Name of Company	**Coastal and Environmental Services (Pty) Ltd trading as CES**
Designation	Port Elizabeth Branch
Profession	Environmental Consultant / Junior Ecological Specialist
Years with firm	One (1) Year
E-mail	n.wienand@cesnet.co.za nicole.wienand@eoh.com
Office number	+27 (0)41 045 0496 +27 (0)41 393 0700
Nationality	South African
Key areas of expertise	➢ Environmental and Ecological Impact Assessments ➢ Botanical Specialist Studies ➢ Environmental Auditing/Compliance Monitoring ➢ GIS Mapping

PROFILE

Ms Nicole Wienand

Ms Nicole Wienand is an Environmental Consultant based in the Port Elizabeth branch. Nicole obtained her BSc Honours in Botany (Environmental Management) from Nelson Mandela University (NMU) in December 2018. She also holds a BSc Degree in Environmental Management (Cum Laude) from NMU. Nicole's honours project focused on the composition of subtidal marine benthic communities on warm temperate reefs off the coast of Port Elizabeth and for her undergraduate project she investigated dune movement in Sardinia Bay. Nicole's key interests include marine ecology, botanical specialist assessments, GIS Mapping, the general EIA process, Public Participation Process (PPP) and Ecological Impact Assessments. Since her appointment with CES in January 2019, Nicole has undertaken a number of Ecological Impact Assessments under the guidance of Dr Greer Hawley and Tarryn Martin.

EMPLOYMENT EXPERIENCE

Environmental Consultant, CES
07 January 2019 – Present

- Basic Assessment Reports
- Ecological Impact Assessments
- Environmental Audit/Compliance Monitoring
- GIS Mapping
- Public Participation

ACADEMIC QUALIFICATIONS

Nelson Mandela University, Port Elizabeth
BSc Honours Botany (Environmental Management)
2018

Nelson Mandela Metropolitan University, Port Elizabeth
BSc Environmental Sciences
2015-2017

CONSULTING EXPERIENCE

Basic Assessments

- Duyker Island Prospecting Right, North West Province – Assisting Report Writing
- ZMY Steel Traders (Pty) Ltd. Steel Recycling Plant, Zone 5 of the Coega SEZ, Eastern Cape Province – Basic Assessment Report;
- Fairview Sand Mine near Port Alfred, Eastern Cape Province – Basic Assessment Report;
- Kareekrans Boerdery Agricultural Development near Kirkwood, Eastern Cape Province – Report Writing; and
- Sitrusrand Dwarsleegte Farm Citrus Development near Kirkwood, Eastern Cape Province – Report Writing.

Ecological Assessments

- ZMY Steel Traders (Pty) Ltd., Steel Recycling Plant, Zone 5 of the Coega SEZ, Eastern Cape Province;
- Kareekrans Boerdery Agricultural Development near Kirkwood Eastern Cape Province, Ecological Impact Assessment and Report Writing;
- Sitrusrand Dwarsleegte Farm Citrus Development near Kirkwood, Eastern Cape Province – Ecological Impact Assessment and Report Writing;
- Uitsig Boerdery Trust Citrus Development near Kirkwood, Eastern Cape Province – Ecological Impact Assessment and Report Writing;
- Mosselbankfontein Coastal Dune and Ecological Impact Assessment near Witsand, Western Cape Province – Ecological Impact Assessment and Report Writing;
- Nomzamo Citrus Farm Development near Kirkwood, Eastern Cape Province – Ecological Impact Assessment and Report Writing; and
- Mangrove Forest Survey for the Kenmare Biodiversity Management Plan, Topuito, Mozambique.

Environmental Auditing

- Khayamnandi Extension on Erven 114, 609, 590 and 24337, Bethelsdorp, within the Nelson Mandela Bay Municipality;

- Aberdeen Bulk Water Supply Phase 2, Dr Beyers Naude Local Municipality, Eastern Cape Province, South Africa;
- The Milkwoods Integrated Residential Development, Remainder Erf 1953, Victoria Drive, Walmer, Nelson Mandela Bay Municipality, Eastern Cape Province;
- Fishwater Flats Wastewater Treatment Works Refurbishment, Nelson Mandela Bay Municipality, Eastern Cape Province;
- The Refurbishment of the Kwanobuhle Wastewater Treatment Plant, Nelson Mandela Bay Municipality, Eastern Cape Province, South Africa; and
- Driftsands Sewer Collector Augmentation (Phase Ii), Within the Nelson Mandela Bay Municipality, Eastern Cape Province.

Geographical Information Systems (GIS)
- ZMY Steel Traders – Basic Assessment Report and Biophysical Mapping;
- Duyker Island – Prospecting Area Mapping & Biophysical Mapping;
- Fairview Sand Mine near Port Alfred, Eastern Cape Province – Biophysical and Layout Mapping;
- St Francis Coastal Protection Scheme – Kromme Estuary Functional Zone Mapping; Biophysical Mapping; and Sand Source Area Mapping;
- Kareekrans Boerdery Agricultural Development – Biophysical and Layout Mapping;
- Nomzamo Citrus Farm Development near Kirkwood, Eastern Cape Province - Biophysical and Layout Mapping;
- Siyahluma Citrus Farm Development near Addo, Eastern Cape Province – Biophysical and Layout Mapping; and
- Sitrusrand Dwarsleegte Farm Citrus Development – Biophysical and Layout Mapping.

Public Participation process
- Duyker Island Prospecting Right, North West Province St Francis Coastal Protection Scheme;
- Fairview Sand Mine near Port Alfred, Eastern Cape Province;
- Kareekrans Boerdery Agricultural Development near Kirkwood Eastern Cape Province;
- Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province; and
- Sitrusrand Dwarsleegte Farm Citrus Development near Kirkwood, Eastern Cape Province.

Social Auditing
- Malawi Millennium Development Trust – Resettlement Action Plan Implementation Auditing.

CERTIFICATION

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes me, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Nicole Wienand **Date: January 2020**

APPENDIX F – ADVISIAN DESIGN REPORTS

Advisian. 2020. St Francis Bay Estuary Hydrodynamic Modelling Study. C00729-01-PMT-PRE-0004. 70pp.

Advisian. 2020. St Francis Bay Beach Long-Term Coastal Protection Phase 2. Supplementary Shoreline Modelling Report. 154pp.

Advisian. 2018. St. Francis Bay Beach Long-Term Coastal Protection Phase 2. Preliminary Design Report 22/02/2018.

Advisian. 2019. St. Francis Bay Beach Long-Term Coastal Protection Phase 2. Spit Protection: Preliminary Design Report 04/02/2019.

St. Francis Bay

Estuary Hydrodynamic Modelling Study

C00729 - 01-PMT-PRE-0004

St. Francis Property Owners NPC

10 Nov 2020

C00729

Advisian

advisian.com

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Company details

Worley RSA (Pty) Ltd.

Melrose Arch
39 Melrose Boulevard Melrose Arch
Johannesburg 2176
South Africa

T: +27 11 218 3000
F: +27 11 218 3100

PROJECT C00729 - 01-PMT-PRE-0004: St. Francis Bay - Estuary Hydrodynamic Modelling Study

A	Issue for Client Review	Arya Rathish/ Chiranjeevi Ambati	Tim Chesher	Francois Smit	22 Oct 2020	
B	Re-issue for Client Review	Arya Rathish/ Chiranjeevi Ambati	Tim Chesher	Francois Smit	10 Nov 2020	

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Acronyms and abbreviations

Acronym/abbreviation	Definition
MSL	Mean Sea Level
CD	Chart Datum
LAT	Lowest Astronomical Tide
HAT	Highest Astronomical Tide
Q	Flow Rate
UHSLC	University of Hawaii Sea Level Centre
PE	Port Elizabeth

1 Introduction

1.1 Project Background

St. Francis Bay beach lies on the southern shores of the greater St. Francis Bay, stretching between the Cape St. Francis headland in the south and the Kromme River mouth in the north as shown in Figure 1. The sandy beach at St. Francis Bay has undergone significant erosion over the past few decades, which can be attributed to the stabilization of large headland bypass dune-fields during the 1970's and 1980's. This has led to a reduction in sediment supply to the beach which resulted in a rapid retreat of the shoreline. The erosion problem was worsened by the construction of Impofu dam upstream of the Kromme River mouth (completed in 1983) which limited the supply of sediments that would be flushed out during floods and deposited on the adjacent beaches.

Figure 1: Location Map – St. Francis Bay

Several studies have been conducted into the erosion and possible protection measures for the beach. WorleyParsons (Advisian) developed a preliminary designed of a long-term protection scheme for the Bay comprising groins and beach nourishment (WorleyParsons 2018 and WorleyParsons 2019). Sourcing of the sand for beach nourishment was analyzed and the shallow riverbed / sand bars inside the estuary were found to be promising sources. However, estuaries are environmentally sensitive areas and it is necessary to ensure that there will not be any adverse effects on the environment due to the dredging works. Hence, St. Francis Property Owners (The Client) requested Worley (Advisian) to carry out the hydrodynamic study for the estuary to assess possible variations in estuary hydrodynamics after the proposed dredging works as part of an ongoing EIA study (Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province, EC08/C/LN2/M/42-2019) . The results of this study are to be provided to the regulatory body (DEDEAT).

1.2 Scope of Work

The present study is aimed at assessing the impacts on estuarine hydrodynamics due to riverbed /sandbars dredging for beach nourishment.

The Worley scope of work was limited to estuary tidal hydrodynamics and it includes the following:

i. Develop a hydrodynamic model for the Kromme River estuary.

ii. Simulation of estuary hydrodynamics for pre- and post- dredging scenarios.

iii. Assess the variation in estuary hydrodynamics due to dredging of riverbed/sand bars to provide a high-level assessment of the potential impact of the works on the tidal environment.

The location of interest for the present project is shown in Figure 2.

Figure 2: Project Site

1.3 Parameters/ Units

The parameters and the units used throughout this report are listed in

Table 1: Parameters/ Units

Parameter	Unit
Dimension	Metres (m) Kilometres (km)
Volume	Cubic Metres (m^3)
Discharge	Cubic Metres per Second (m^3/s)
Current Speed	Metres per Second (m/s)
Direction	Degrees with respect to True North (deg.)

1.4 Reference Systems and Projections

1.4.1 Units

The SI System of Units has been used.

1.4.2 Coordinate System

All coordinates are in UTM Zone 35 South and are based on the WGS84 spheroid unless otherwise indicated.

1.4.3 Vertical Reference Level

All elevations are in meters and referenced to Chart Datum (CD) unless otherwise noted. MSL is 1.04m above CD.

1.4.4 Time Reference

All data related to time are given in the local time zone, which is GMT + 2 hours.

1.4.5 Direction Convention

Flow: Direction towards which flow occurs, always given clockwise with respect to north in degrees.

2 Overview of Existing Data

2.1 Bathymetry

Bathymetry data utilized in the present study includes:

- Bathymetry of the estuary surveyed by AAM Geomatics (July 2020)
- Topography of the estuary surveyed by AAM Geomatics (July 2020)
- Satellite delivered bathymetry by EOMAP (February 2020).

The combined bathymetry data from the above sources is shown in Figure 3.

For areas where bathymetry data were unavailable, interpolation and interpretation based on satellite imagery were applied to fill in the gaps.

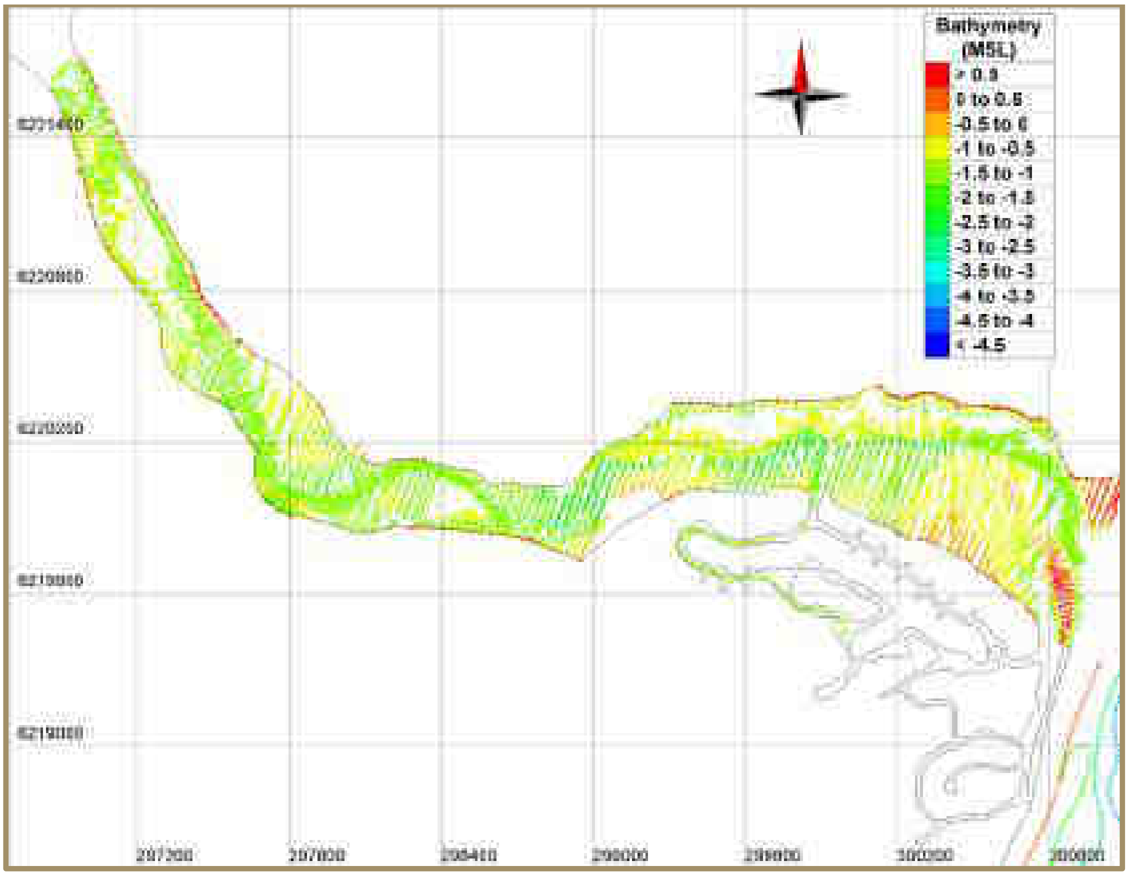

Figure 3: Bathymetry Data for St. Francis Bay/Kromme River Estuary

2.2 Tidal Elevations

Location specific tide measurements for St. Francis Bay is not available. However, the site is situated mid-way between Knysna Port and Port Elizabeth, for which predicted tide data were available from UHSLC (University of Hawaii Sea Level Centre). Therefore, tidal data from these two locations were collected and used for this study. The tide data and locations are shown in Table 2 and Figure 4.

Table 2: Summary of Tide data locations

Place	Latitude (S)	Longitude (W)	Heights in meters above Chart Datum (CD)						
			LAT	MLWS	MLWN	ML	MHWN	MHWS	HAT
Port Elizabeth	-33.96	25.63	0	0.21	0.79	1.04	1.29	1.86	2.12
Knysna	-34.08	23.05	0	0.22	0.82	1.06	1.32	1.91	2.21

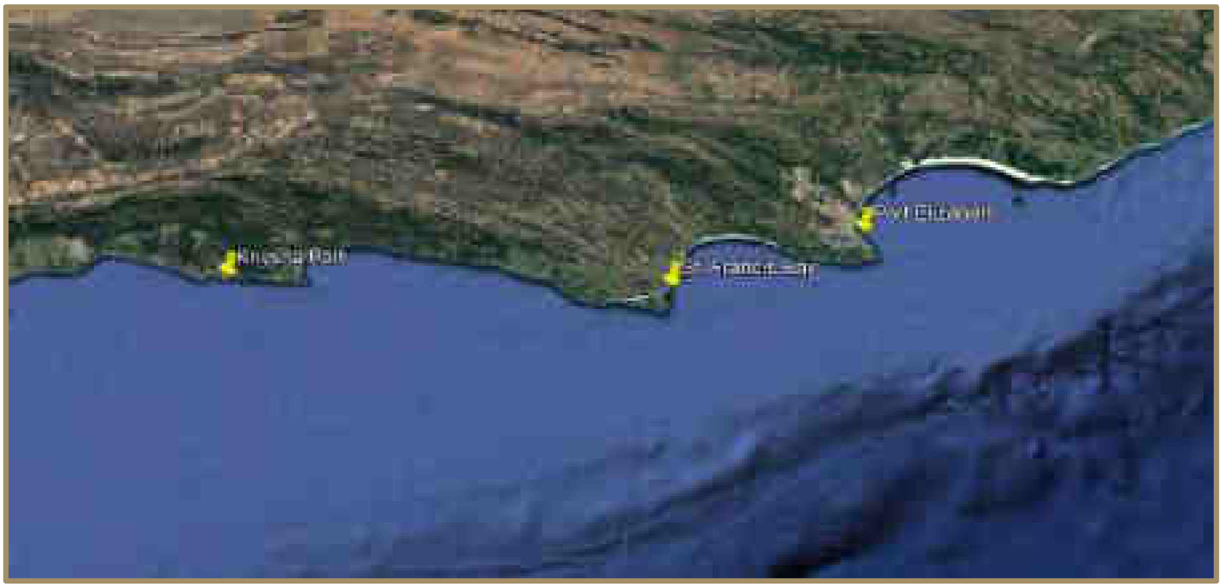

Figure 4: Tide Data Locations

Tide data for both the locations were compared and it is found that tides at Knysna and Port Elizabeth showed similar trends with difference in elevations varying approximately from 0 to 0.5m. The comparison of tide data at these two locations is shown in Figure 5.

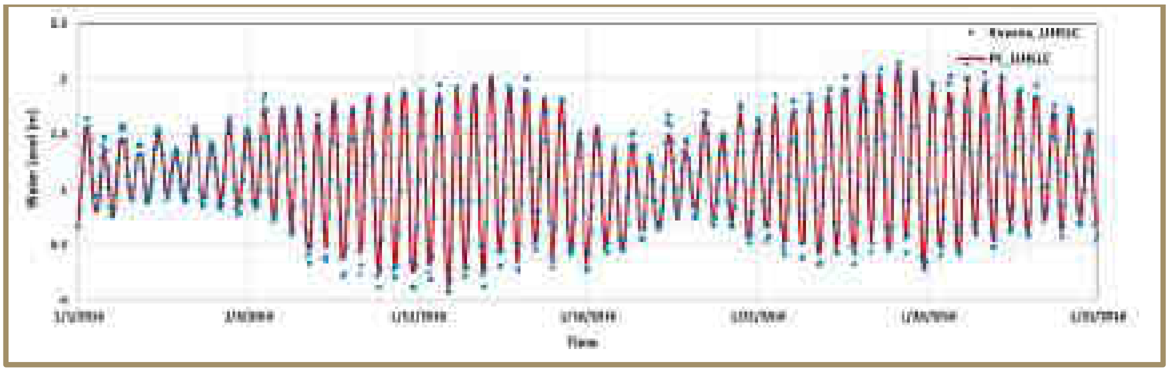

Figure 5: Comparison of UHSLC tide at Knysna and Port Elizabeth

2.3 River Data

Long term river data were available for three locations:

- K9H003 – Daily average river discharge.
- K9H005 – Daily average water level.
- K9H006 – Daily average water level.

Data locations are shown in Figure 6.

Figure 6: River Data Locations

2.3.1 Discharge

Daily average discharge data was available for the location K9H003 from 1983 to 2020 with a gap in data from November 1996 to February 1998. The data showed very low daily average discharges – less than 1 m^3/s most of the time, with occasional high discharge maxima of up to 313 m^3/s. The daily average discharge from downstream of Impofu Dam at K9H003for the period between 2001 and 2020 is shown in Figure 7.

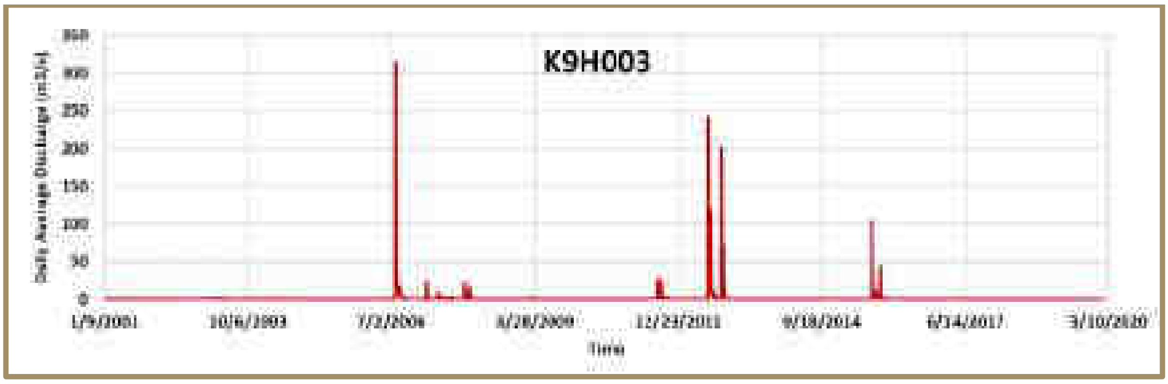

Figure 7: Daily average discharge downstream of Impofu Dam at K9H003

2.3.2 Water Level

Daily average water level data is available at K9H005 and K9H006 for a period starting from 1990 to 2019 and 1994 to 2020 respectively, with intermittent data gaps. The water levels at K9H005 and K9H006 ranges from 0.29m to 1.41m and 0.09m to 2.48m respectively. Water level variations at these two locations are shown in Figure 8 and Figure 9.

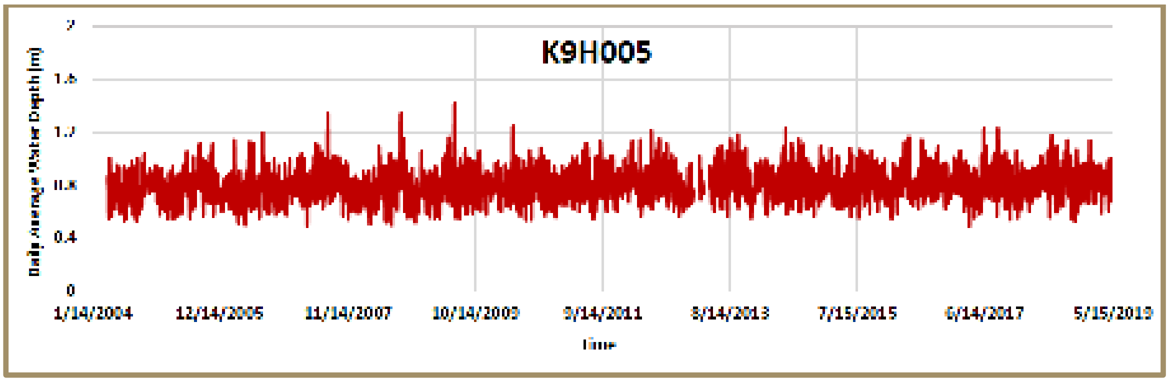

Figure 8: Daily Average Water Depth at K9H005 (inside marina)

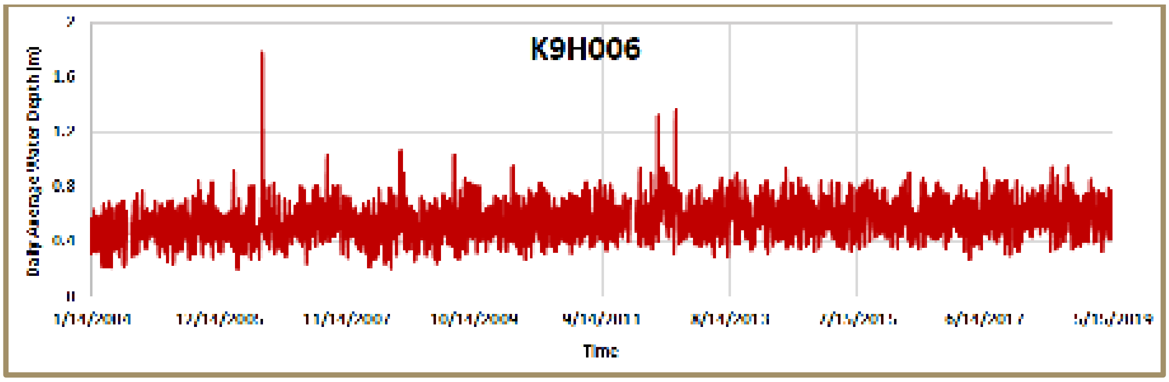

Figure 9: Daily Average Water Depth at K9H006 (inside river)

3 Hydrodynamic Modelling

This section presents the estuarine hydrodynamic modelling carried out to determine the water levels and current speeds for pre- and post- dredging of riverbed/sand bars at Kromme River estuary. The modelling has been undertaken using TELEMAC modelling system. The model solves the conservation of mass and momentum equations to establish the tidal water levels and currents (velocities) within ocean, coastal and estuarine environmentswee.

3.1 Software Description

TELEMAC-2D is a two dimensional (2D) hydrodynamic simulation program which calculates the water depth and depth averaged velocity components that result from tidal and meteorological forcing at each node of the computational mesh. It solves the depth-averaged free surface flow equations/ the Saint-Venant's equation. The main application of TELEMAC-2D is in free-surface maritime or river hydraulics taking into account the following phenomena:

- Propagation of long waves, including non-linear effects,
- Friction on the bed,
- Coriolis force,
- Wind influences,
- Wave influences
- Turbulence,
- Tidal flats
- Floodplains
- Supercritical and subcritical flows,

The module is capable of simulating the following:

- Tide and wind-driven flows (i.e. storm surges).
- Stratified and density driven flows.
- River flow simulations.
- Fresh-water river discharges in bays.
- Transport of dissolved material and pollutants.
- Wave-driven currents.
- Non-hydrostatic flows.

3.2 Modelling Approach

The model domain was developed to cover the mouth of the Kromme River to the Impofu dam and the St. Francis Bay coastal area up to approximately 30m water depth. A triangular mesh was generated to represent the bathymetry of the model domain. A variable mesh size is adopted such that the resolution inside the estuary is accurate enough to simulate the accurate hydrodynamics. The mesh size varies from approximately 150 m in the offshore to approximately 15m along the coastline and 10m inside the estuary and river. The model mesh is shown in Figure 10 and Figure 11.

The bathymetry for the model was interpolated using the depth information from the recent survey and previously available bathymetry data at the site. Bathymetry was assumed for the parts of the river stretches and marina where no survey data was available with due consideration of the secondary source of data for those areas. The bottom depths were corrected to MSL (Mean Sea Level) with the relation MSL = CD+1.04m. The bathymetry of the model is shown in Figure 12. This figure also shows candidate areas for dredging marked within the black lines (described in detail in Section 3.6).

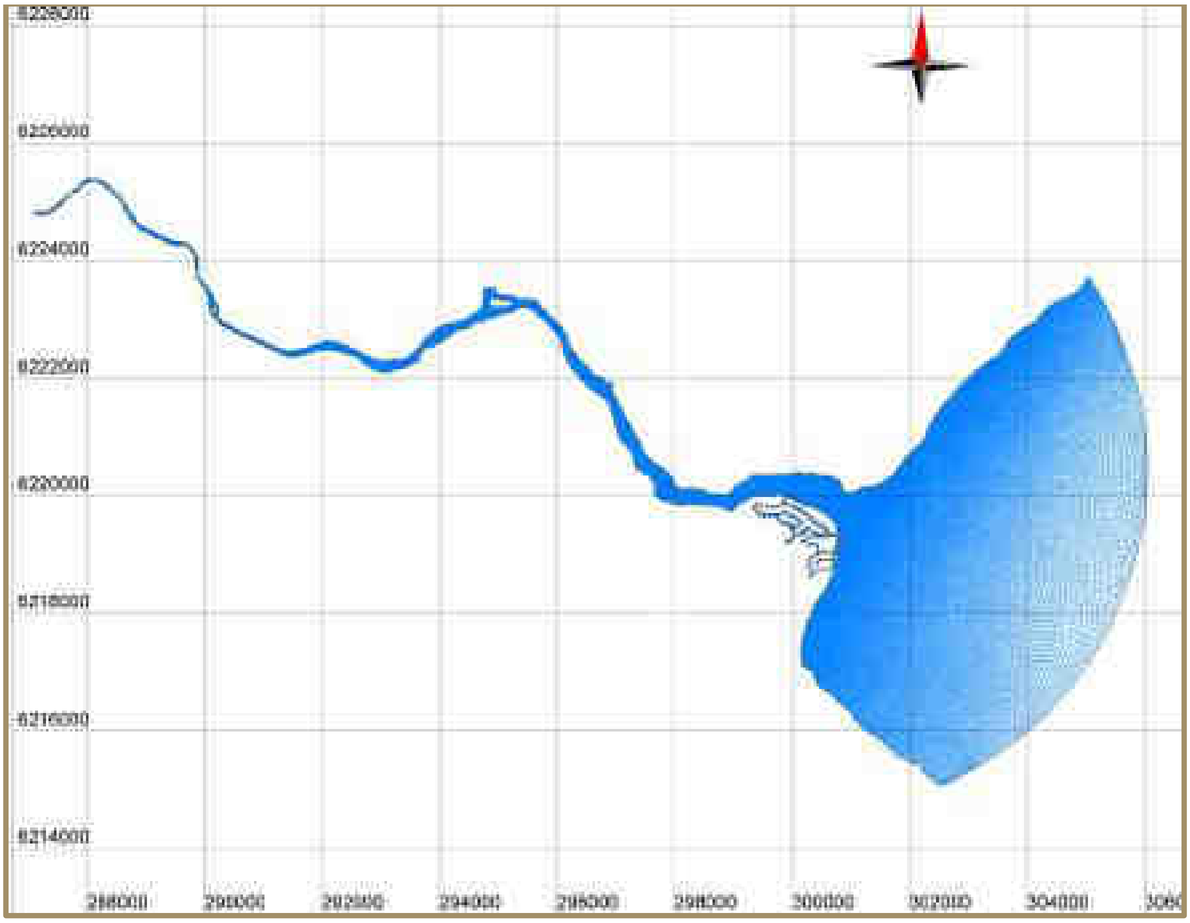

Figure 10: Mesh for the hydrodynamic model

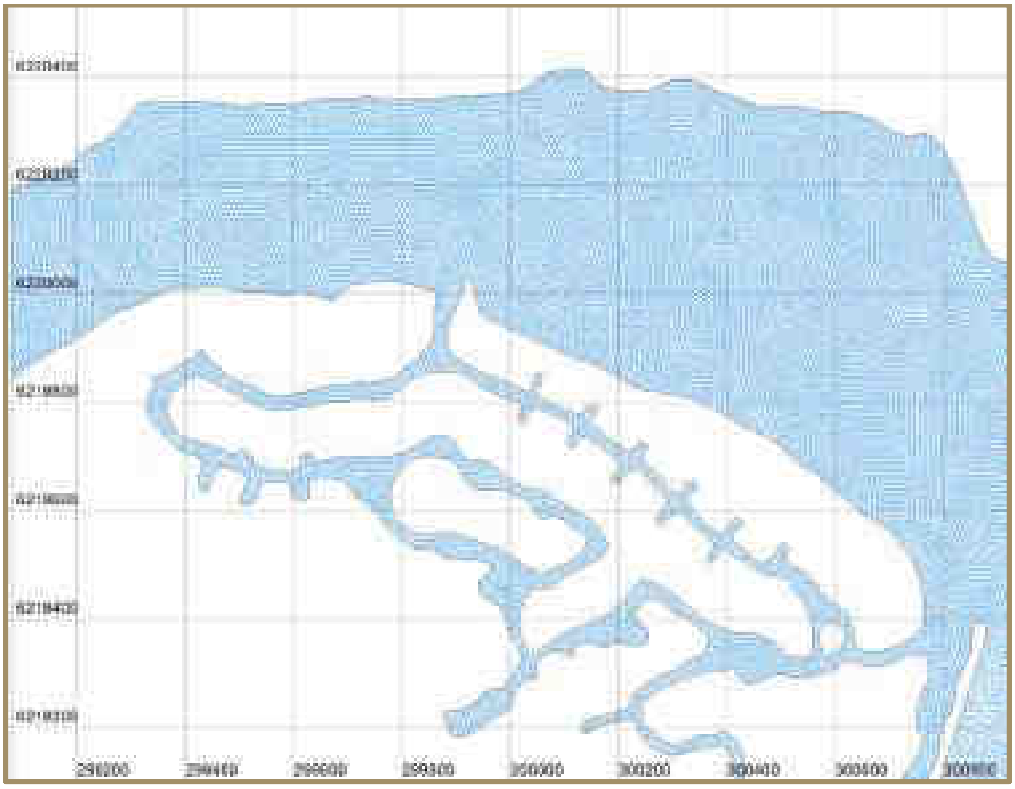

Figure 11: Close-up view of mesh in the estuary

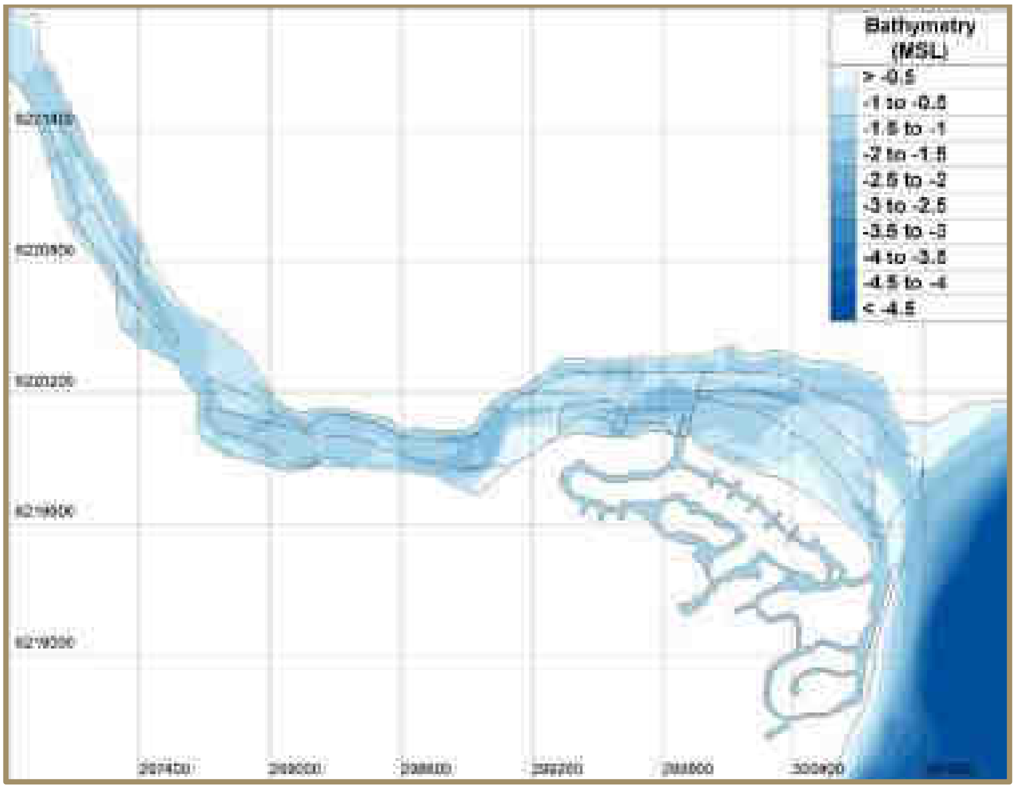

Figure 12: Bathymetry for the Existing Condition (pre-dredging scenario)

3.3 Boundary Conditions

The hydrodynamic model was forced with tidal variations at the offshore boundary and river discharges from Impofu dam.

3.3.1 Tide

In the absence of site-specific tidal information, the tide at Knysna was used as boundary conditions. The tidal boundary conditions in the form of time-varying surface elevation were applied at the offshore boundary. The details of tide are presented in Section 2.2.

Tidal level measurements were also made at the R330 bridge crossing the Kromme River for the period 12 hours during a spring tide on 22 July 2020. This data was used to verify the water levels inside the estuary.

3.3.2 River Discharge

The river discharge downstream of Impofu dam is observed to be very low in the order of 0.05m^3/s for most of the period of available historic data. However, short durations of high discharges are also observed of about 100m^3/s. Therefore, two discharge conditions were considered for the present study.

i. Lean/ Negligible river discharge condition.

The river discharge was specified as 0.05m^3/s for a duration of 30 days.

ii. High river discharge condition.

Based on the available data, high discharge from the dam was observed for short durations. A constant discharge of 150m^3/s was assumed for a duration of 30 days for the present study.

3.4 Model Calibration

Water level / current measurements were not available for complete tidal cycle period of 15 days. Therefore, calibration of the model was carried out with the water level measurement at the site for 12-hour duration and secondary daily average water level data collected for the site (Section 2.3.2). The model simulated current speeds were compared with data from relevant previous study reports (Reference No. 1). The report indicates that the upper reaches of Kromme River experiences current velocities lower than 0.3m/s while current velocities of 1m/s are common near the estuary mouth. Hydrodynamic model results were observed to be in agreement with these values.

Tidal levels outside the estuary were compared with the data for Port Elizabeth and showed good comparison, and in addition, water levels inside the estuary were compared with the measurements at the bridge and (after transposing in the vertical plane to account for datum differences) this indicates good representation of the tidal propagation (See Figures 13 to 17). The graphs clearly show the agreement of model results with the available information and hence the model is considered calibrated and capable of accurately reproducing the hydrodynamic conditions of the estuary.

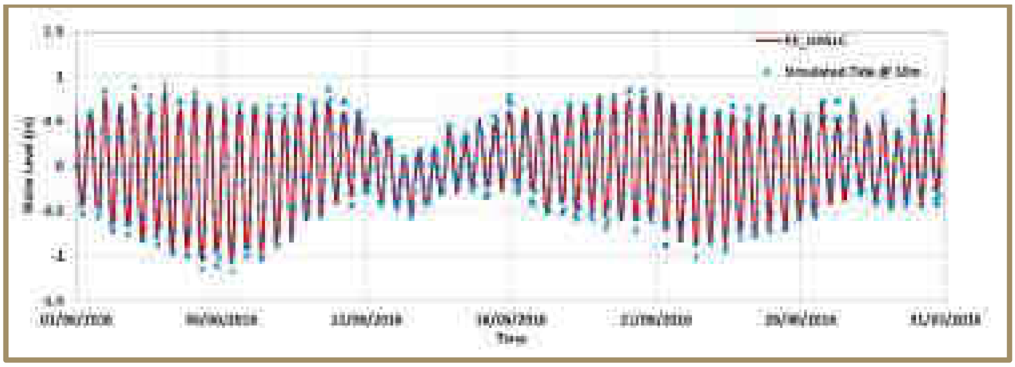

Figure 13: Tide comparison at open sea – at 10m water depth

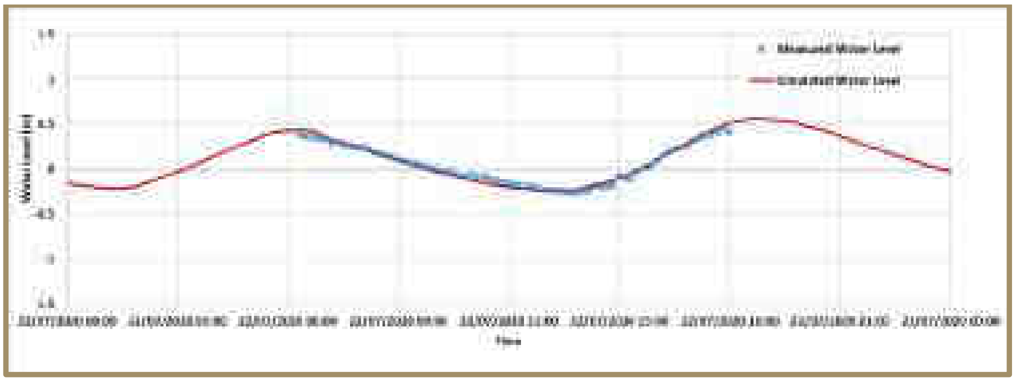

Figure 14: Water Level Comparison inside the Estuary (Near the Bridge)

Figure 15: Water Depth comparison inside marina (K9H005)

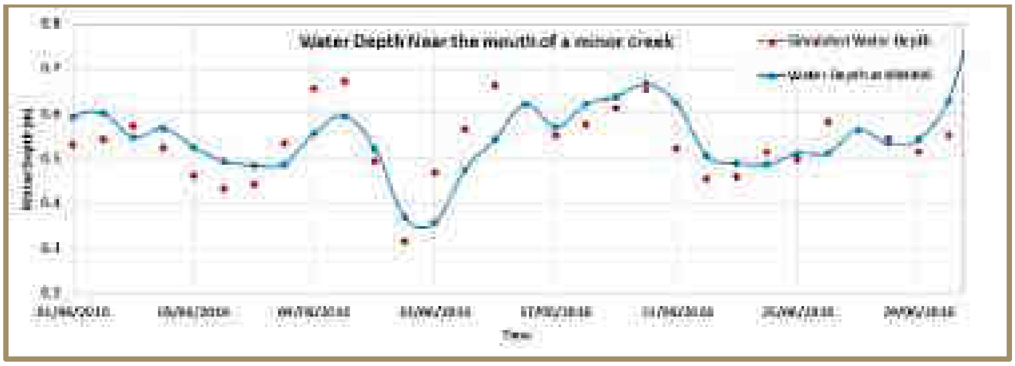

Figure 16: Water Depth comparison inside river (K9H006)

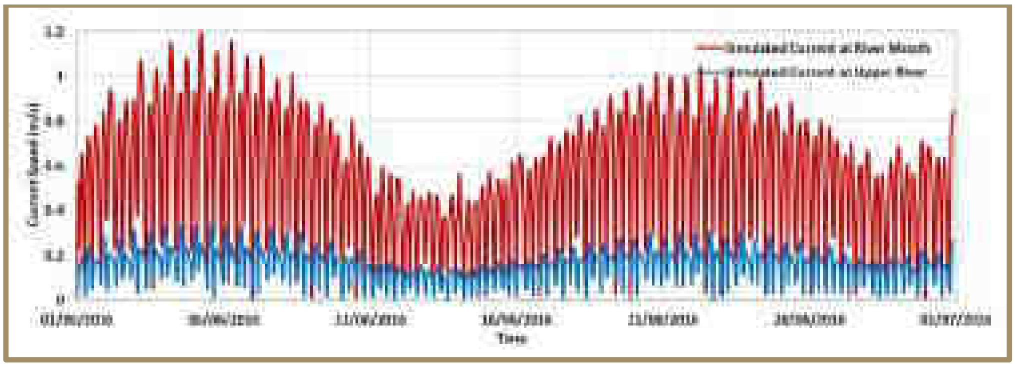

Figure 17: Current Speed Variation at the river mouth and upper part of the river

3.5 Hydrodynamic Conditions – Pre-Dredging Scenario (Existing Conditions)

Model simulations were carried out for the pre-dredging scenario (existing conditions) for two discharge conditions (low and high river discharges), each for a period of two full spring-neap tidal cycles.

The current speeds and water level variations inside the estuary were analyzed for both lean and high discharge scenarios. However, considering the site experiences lean/ negligible river discharge most of the time, results for the lean discharge conditions are discussed in detail. Results for high river discharge conditions are presented in Appendix A, Appendix B and Appendix C.

Two-dimensional (2D) plots of the estuary during flood and ebb phase of spring tide under lean discharge condition are shown in Figure 18 and Figure 19. 2D plots of currents in other scenarios are shown in Appendix A. 2D plot of the maximum current speed in the estuary during the one full tidal cycle has been presented in the Figure 20. The maximum current speed at different locations inside the estuary varies depends on the tidal circulation and river discharge conditions.

The flow in the estuary is mainly tide dominated during lean river discharge condition. Whereas during high river discharge condition, the flow is dominated by river discharge. The maximum current speeds at the river mouth is in the order of 1.8m/s and 2.4m/s during lean and high discharge conditions respectively. The current speed inside the main estuary and river is usually less than 0.3m/s.

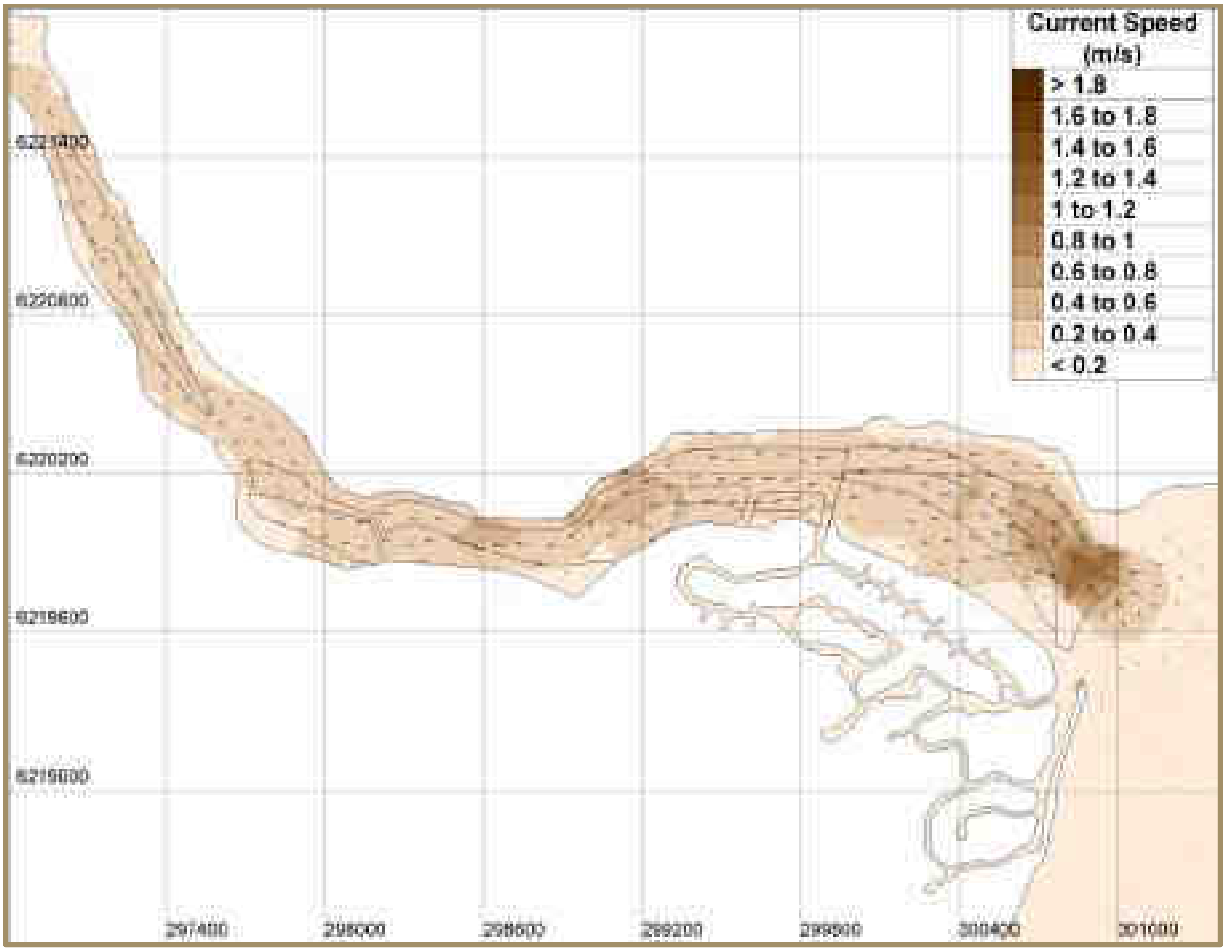

Figure 18: Spatial Variations of Currents during Flood Phase of Spring Tide under Lean Discharge Conditions – Pre-dredging scenario

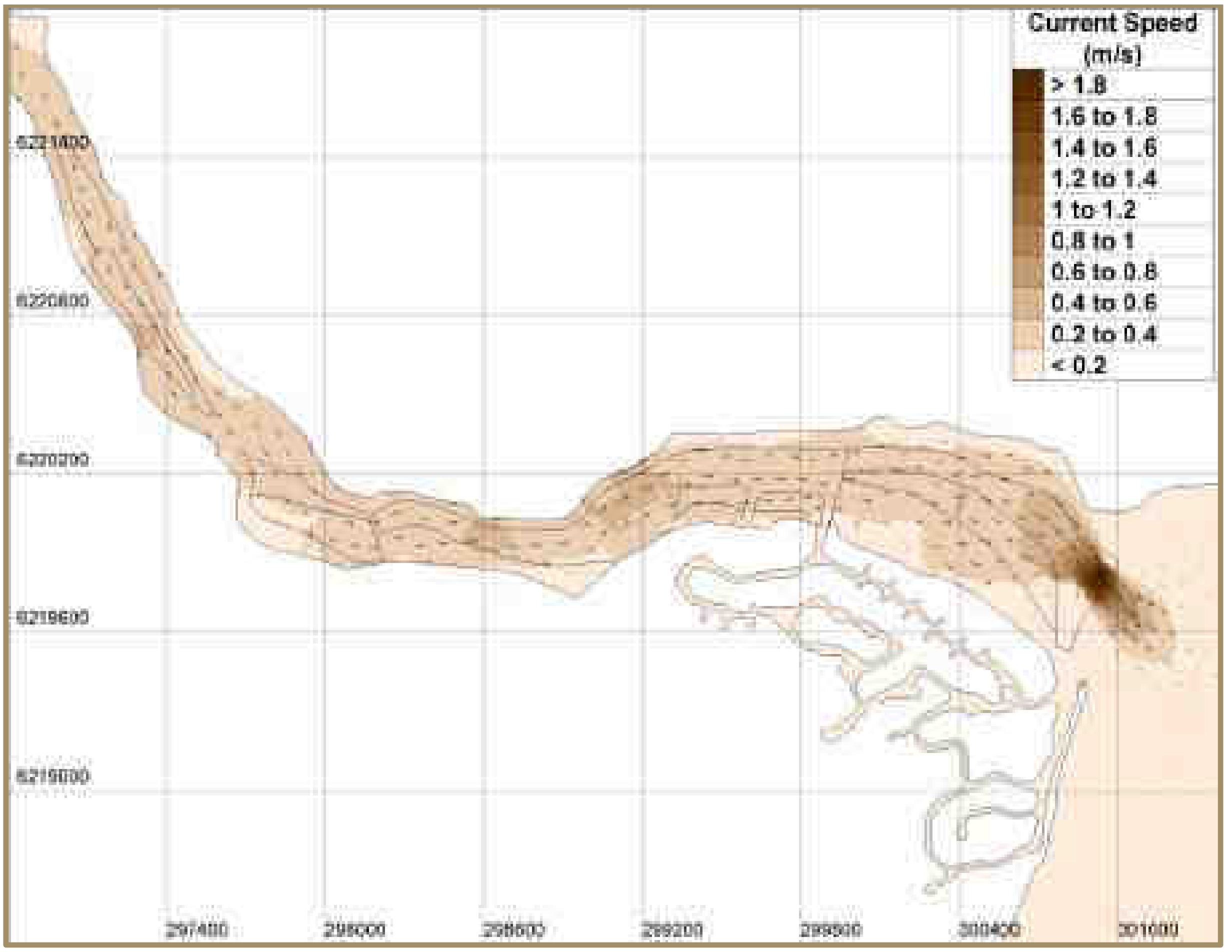

Figure 19: Spatial Variations of Currents during Ebb Phase of Spring Tide under Lean Discharge Conditions – Pre-dredging scenario

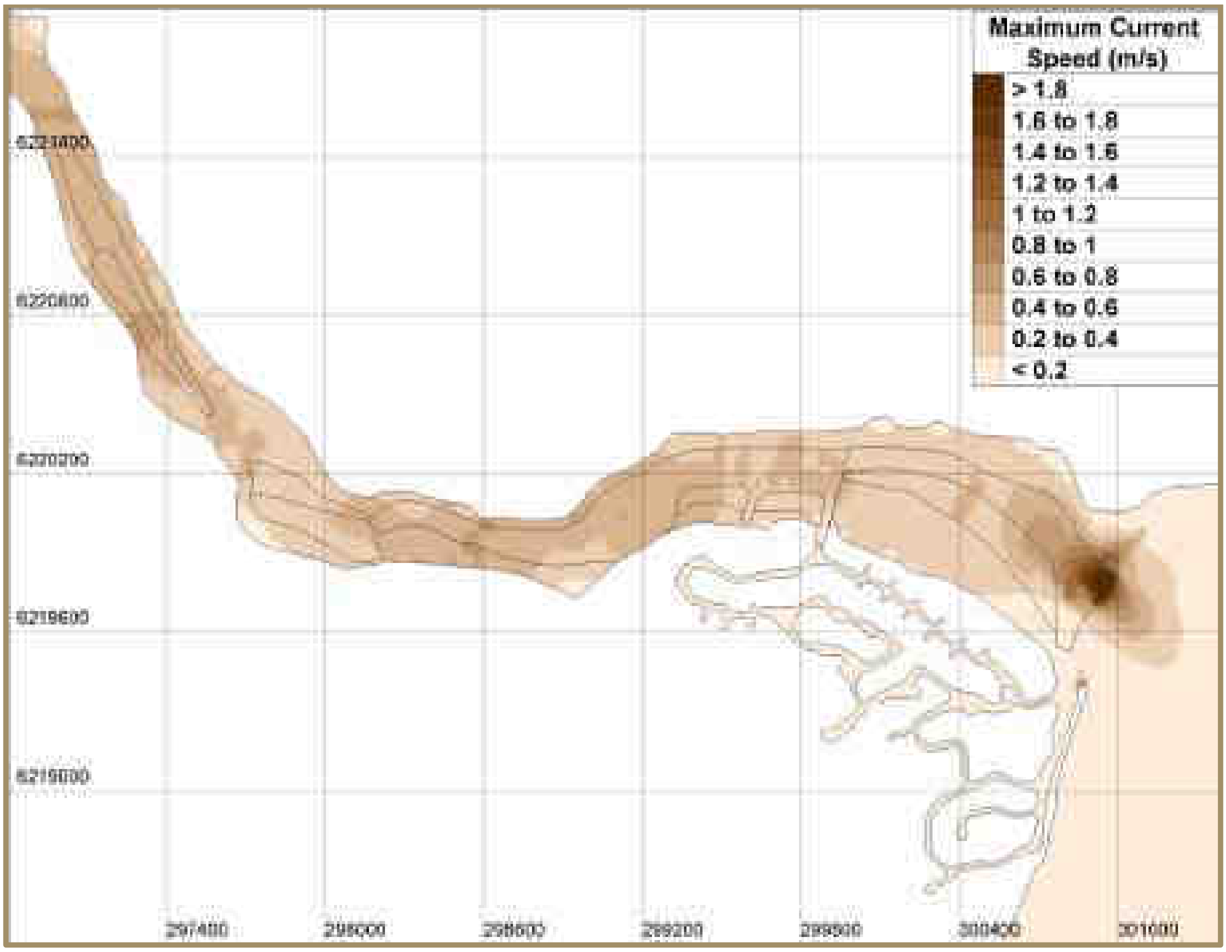

Figure 20: Spatial Variations of Maximum Current Speed under Lean Discharge Conditions – Pre-dredging scenario

3.6 Proposed Dredging of Riverbed

Based on the previous studies for the protection of St. Francis Bay beach, it was planned to dredge the sand from Kromme River estuary and use it for beach nourishment as part of long-term shore protection plan. The areas of riverbed identified as source of sand for beach nourishment are shown in Figure 21.

Primary areas of proposed dredging of riverbed are named from P1 to P4 and secondary areas for dredging (inter-tidal area) are named from S1 to S5. It is proposed to deepen 1 m and 2 m respectively for the primary and secondary areas to the required sand quantity of one million cubic metres for the beach nourishment. The planned dredging depths is shown in Figure 22. The estuary bathymetry for the post - dredging scenario is shown in Figure 23.

Figure 21: Identified Dredging Areas

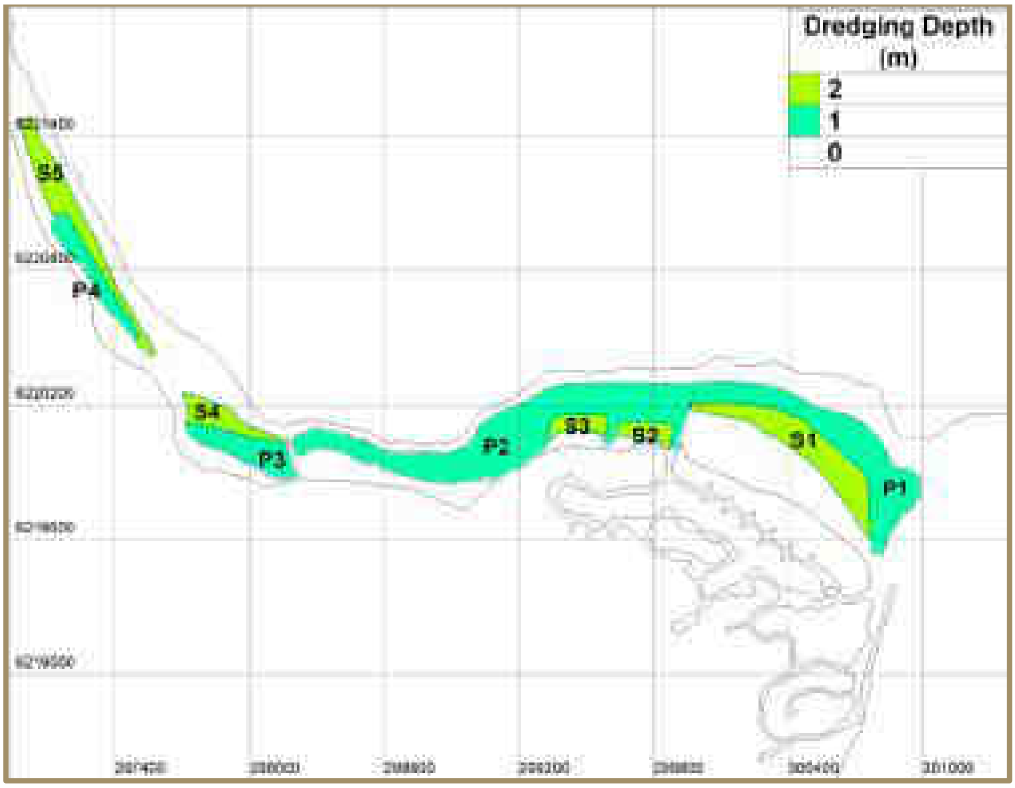

Figure 22: Proposed Dredging Depths for Primary and Secondary Areas

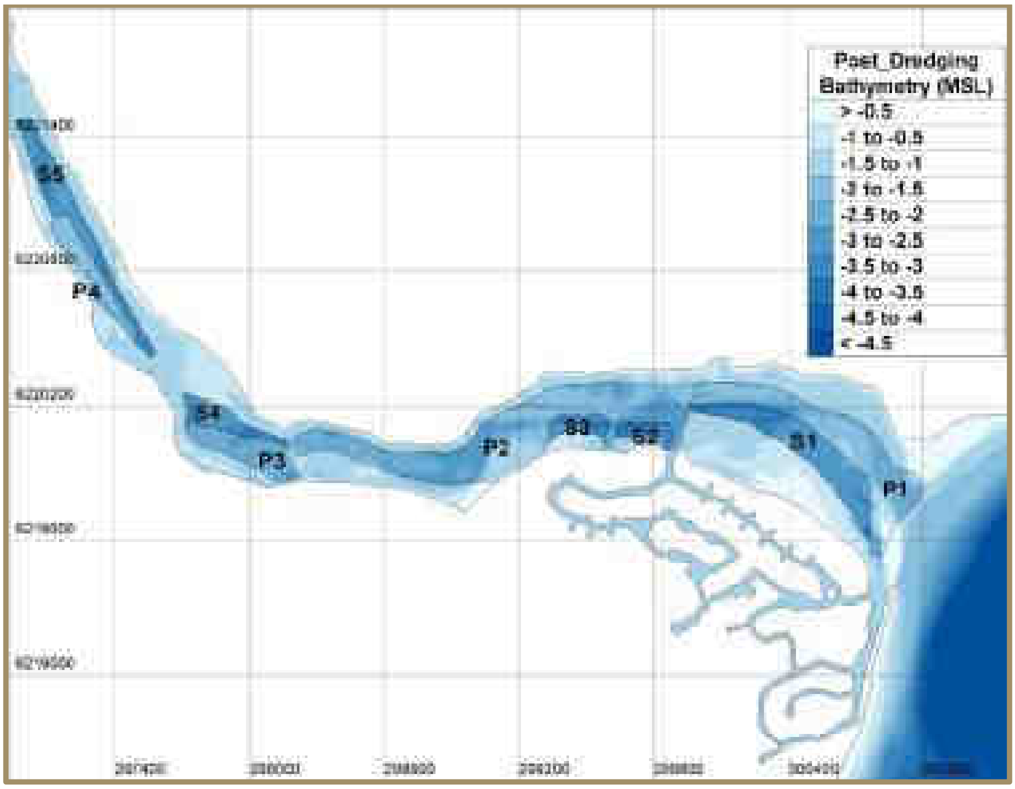

Figure 23: Post Dredging Bathymetry

3.7 Hydrodynamic Conditions - Post Dredging

Model simulations were carried out for the post-dredging scenario for lean and high river discharge conditions for one complete tidal cycle. Two dimensional (2D) plots of current pattern during flood and ebb phase of spring tide for the lean river discharge condition is shown in Figure 24 and Figure 25. Plots for the remaining simulated conditions are presented in Appendix B.

A 2D plot of the maximum current speed in the estuary during the one full tidal cycle has been presented in Figure 26. The maximum current speed at different locations inside the estuary varies depending on the tidal circulation and river discharge conditions.

Current pattern inside the estuary showed similar pattern of that in pre-dredging condition. Detailed comparison of pre- and post-dredging hydrodynamic conditions were made and are presented in Section 3.8.

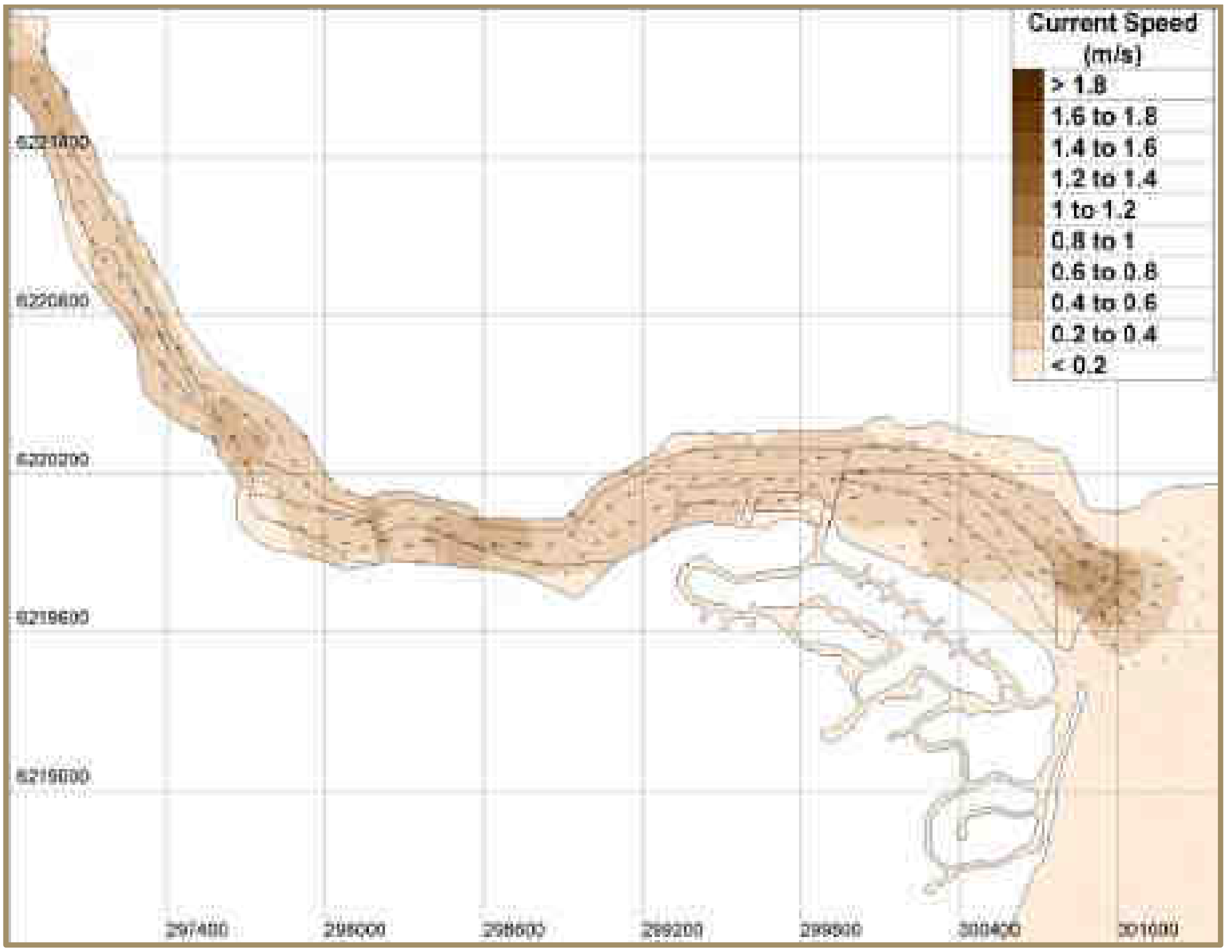

Figure 24: Flood Currents during Spring Tide under Low Discharge Conditions - Post-Dredging Scenario

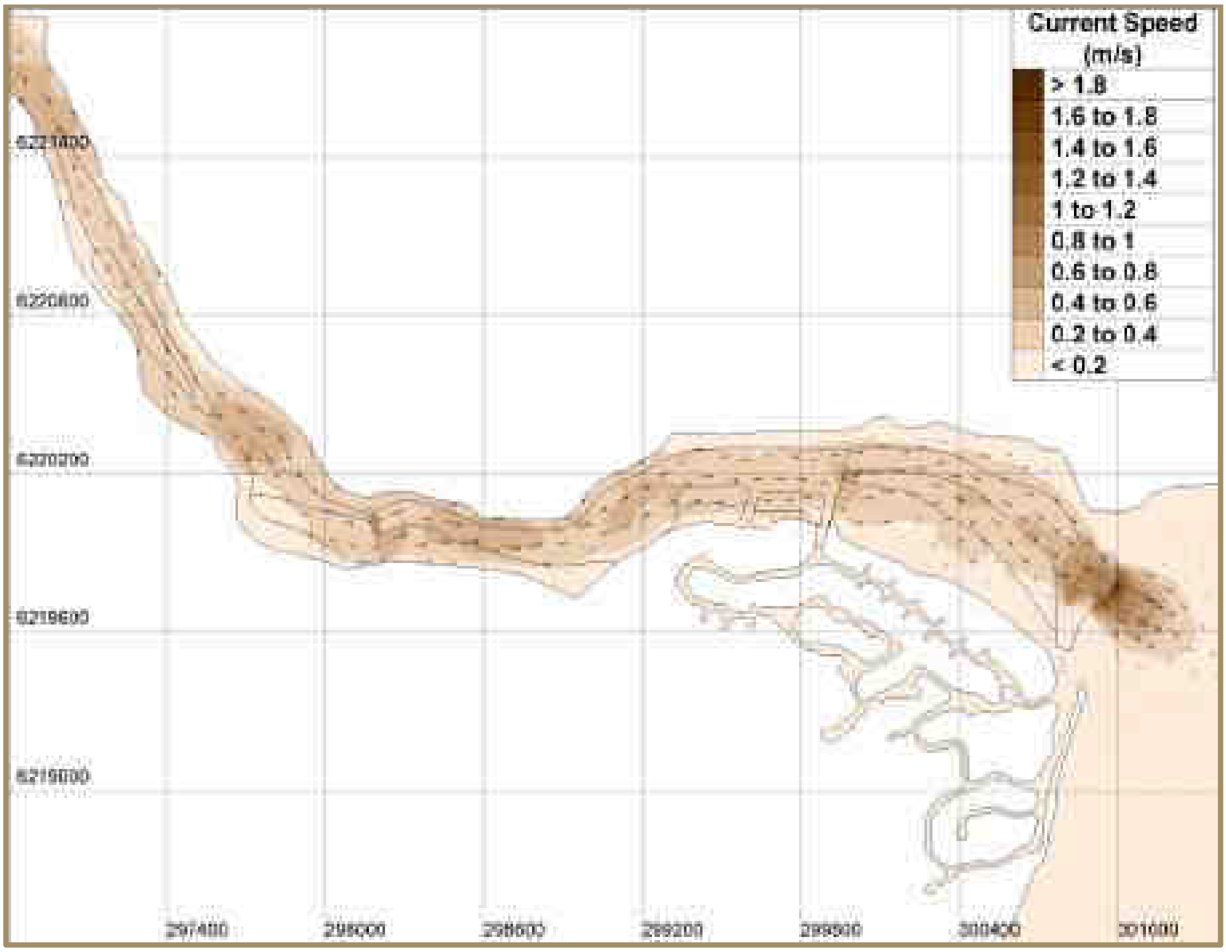

Figure 25: Ebb Currents during Spring Tide under Lean Discharge Conditions - Post-Dredging Scenario

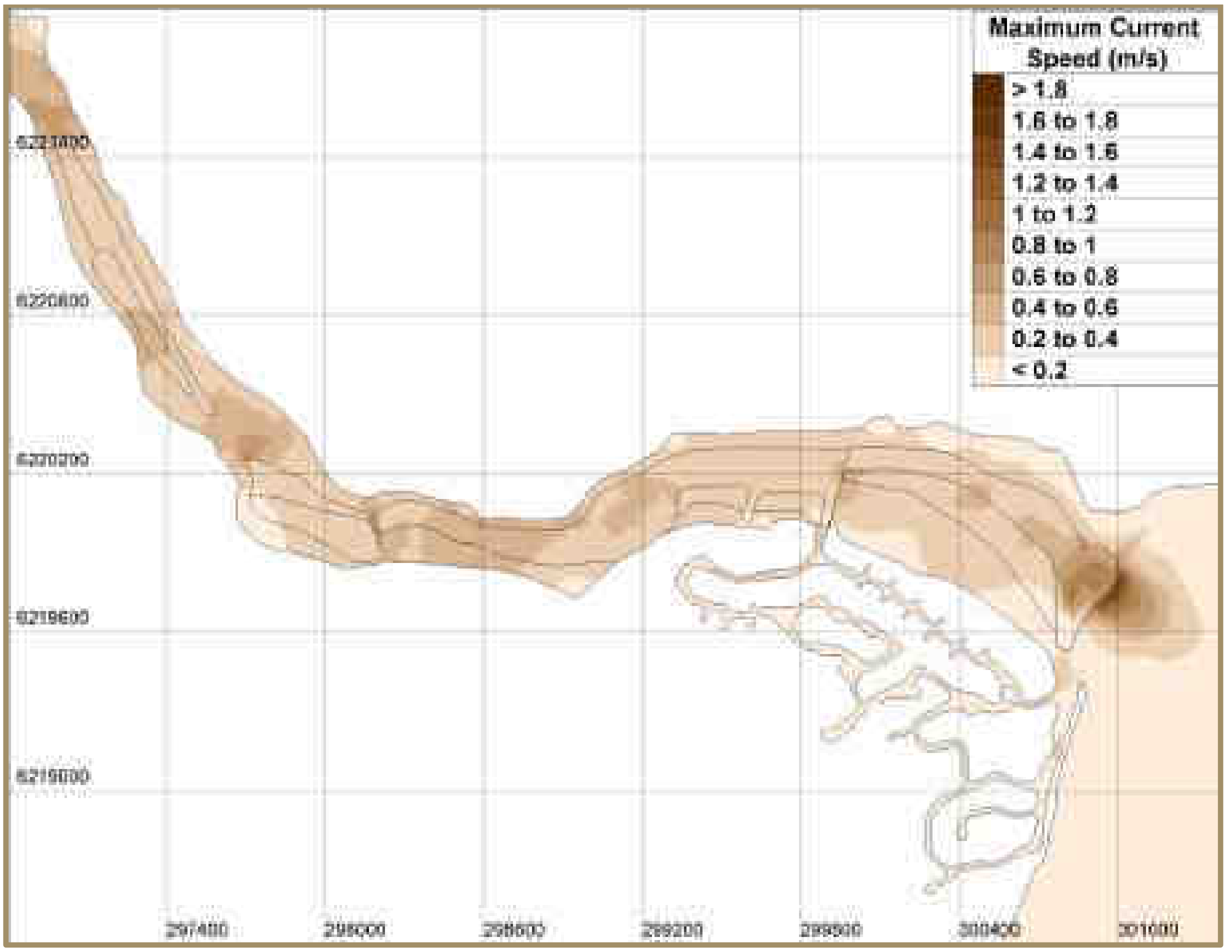

Figure 26: Maximum Current Speed under Lean Discharge Conditions - Post-Dredging Scenario

3.8 Variation in Estuarine Hydrodynamics

The difference in maximum current speeds between pre- and post-dredging conditions were estimated for one complete tidal cycle under lean and high river discharge conditions and are presented in Figure 27 and Figure 28. Shades of Blue (negative values) in the figures shows that the current velocities decreased in the Post-dredging condition and shades of Red (positive values) indicates that current velocity increased in the Post-dredging condition.

The variation in current speed inside the estuary is observed to be negligible under the lean discharge conditions. However, the maximum variation of current speeds in the order of up to 1.3m/s and 1.6m/s over one complete tidal cycle under lean and high river discharge conditions respectively are observed at the mouth of the estuary. This high variation in current speed at estuary mouth could be due to the sudden change in depth after dredging. However, it may be noted that morphological evolution due to post- dredging hydrodynamics is not included in the present study. In actual condition there is possibility that the estuary mouth will undergo morphological changes leading to smoother bathymetry and thereby reducing variation in current speeds.

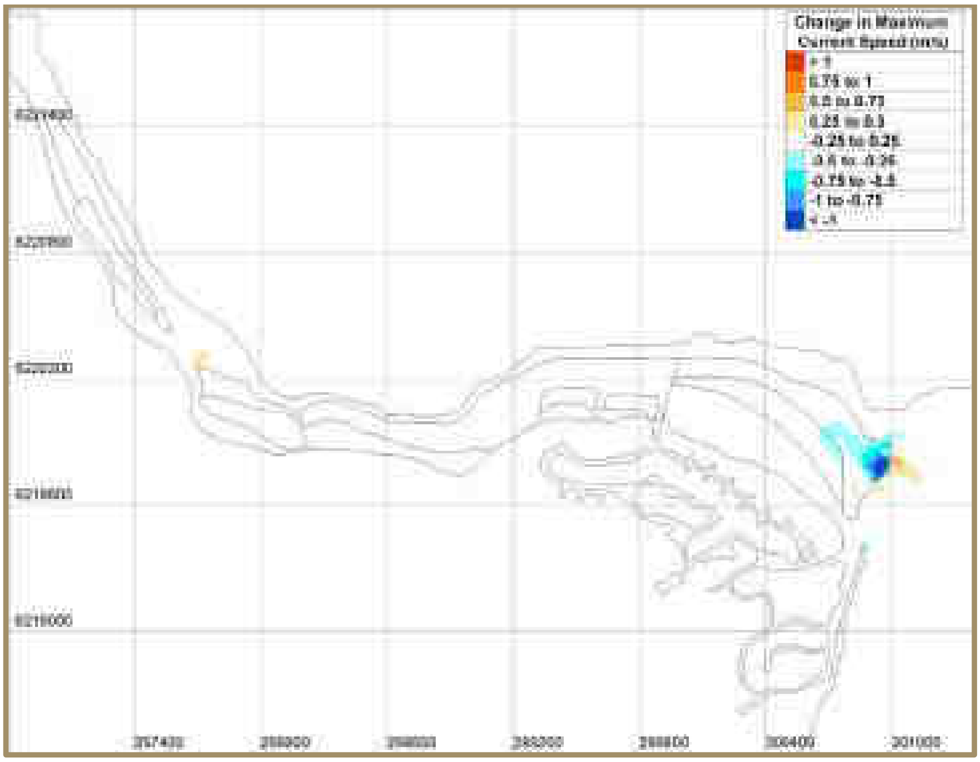

Figure 27: Change in Maximum Currents under Lean Discharge conditions between pre- and post- dredging scenarios-

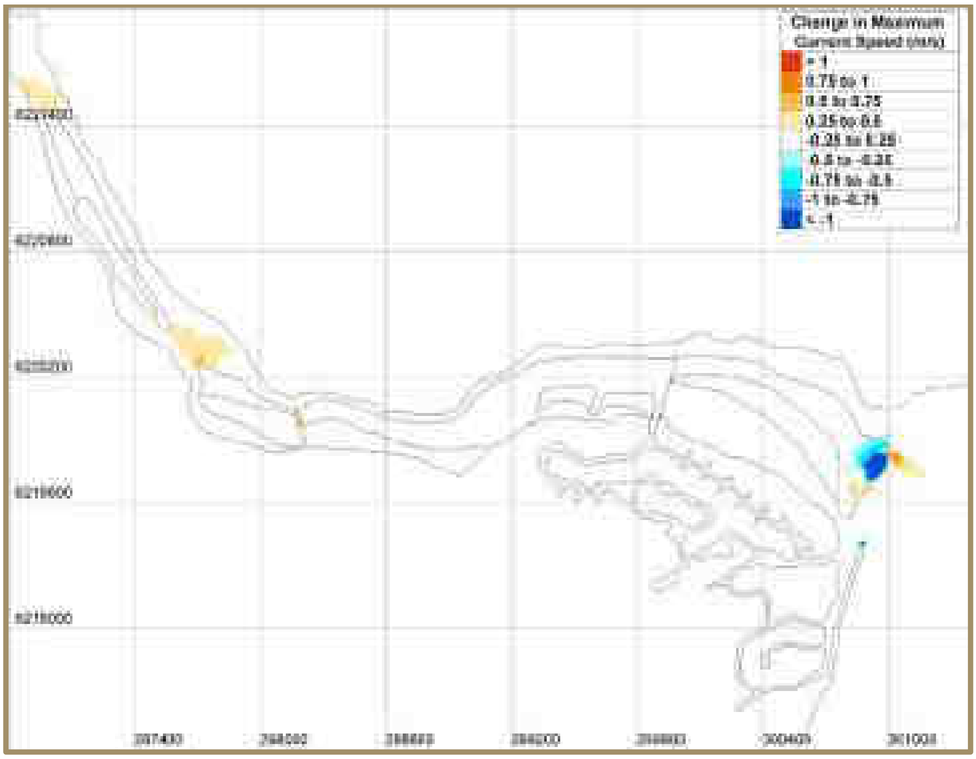

Figure 28: Change in Maximum Currents under High Discharge conditions between pre- and post- dredging scenarios

Temporal variation of flow parameters were extracted at five different points (Figure 29) for pre- and post-dredging scenarios under lean river discharge conditions. Similar comparisons for high river discharge conditions are presented in Appendix D.

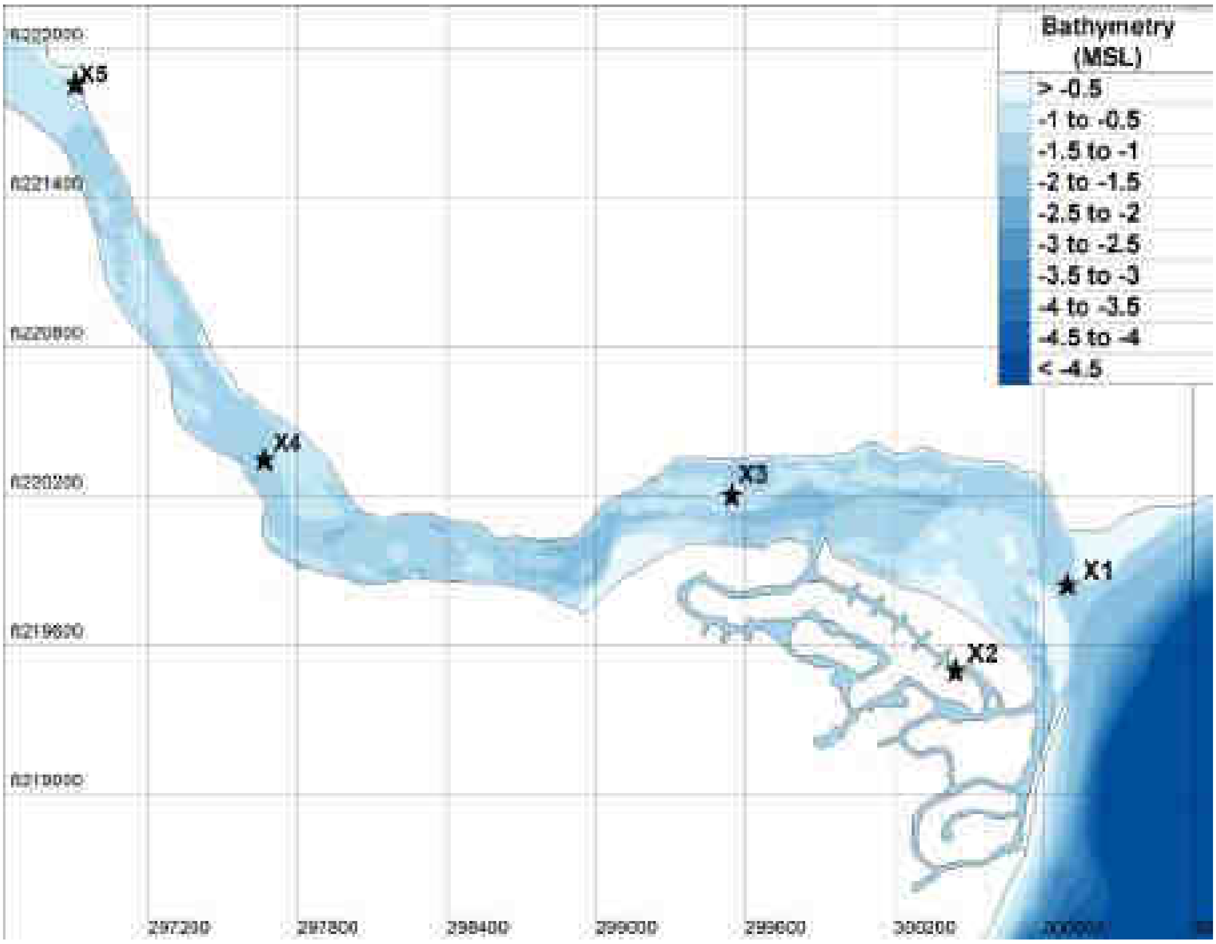

Figure 29: Data Extraction Points for Comparison of Hydrodynamics

Pre- and Post-dredging current speeds were compared at the five locations and the comparison plots are shown in Figure 30. Variation between pre- and post-dredging current speed is predominant (more than 1m/s) at the estuary mouth and negligible at other locations. Water level at the five locations were also compared for pre- and post-dredging conditions and are shown in Figure 31.

Water level and currents are tide driven along the estuary, but the tidal effect decreases as it moves upstream of the river. The current speed comparison for pre- and post- dredging scenarios at the estuary mouth (X1) shows a decrease in current speed by about 0.6m/s post dredging whereas, at X3 and X5 locations shows negligible variation in current speed of less than 0.1m/s. Negligible variation in current speed was observed at location X2 as it is away from the dredging areas. The location X4 lies in between dredging areas S4 and S5. At this location increase in current speed is observed due to the sudden change in water depth as the current moves from deeper depth to shallower depth (in post dredging scenario). The variations in current speed at these areas are due to increase in water depth in the post-dredging scenario and same can be observed inFigure 27 and Figure 28. At the estuary mouth the current speed reduces during the flood phase as the tide moves from shallower depths to deeper depths in the post-dredging scenario. Whereas during the ebb phase the tide moves from deeper water to shallower water (in post dredging scenario) and hence it is observed an increase in current speed. These variations in current speed are expected to be a temporary phenomenon until the bathymetry of the estuary mouth get smoothed out by natural hydrodynamics and morphological evolution over time.

High water levels in the estuary shows negligible variation in pre- and post-dredging scenarios. Due to the shallower water depths in the existing condition variations in low water levels between pre- and post-dredging scenarios were observed inside the estuary. This is understood as being caused by increased tidal propagation into the estuary as a result of increased water depth after dredging. With increased water depth more water is found to be flushing into the sea during ebb phase of the tide. In the post-dredging scenario water depth in the estuary is increased by a minimum of 1m. The variation in the low water levels is less than the increased water depth and will not have any impact on the minimum water depth availability in the estuary channel. However, in the non-dredging areas the decrease in water level may cause reduction in available water depth during low tide, leading to exposure of shallow sandbanks inside the estuary in post dredging scenario. 2D plots showing exposed shallow sandbanks areas in pre-and post-dredging condition is shown in Figure 32.

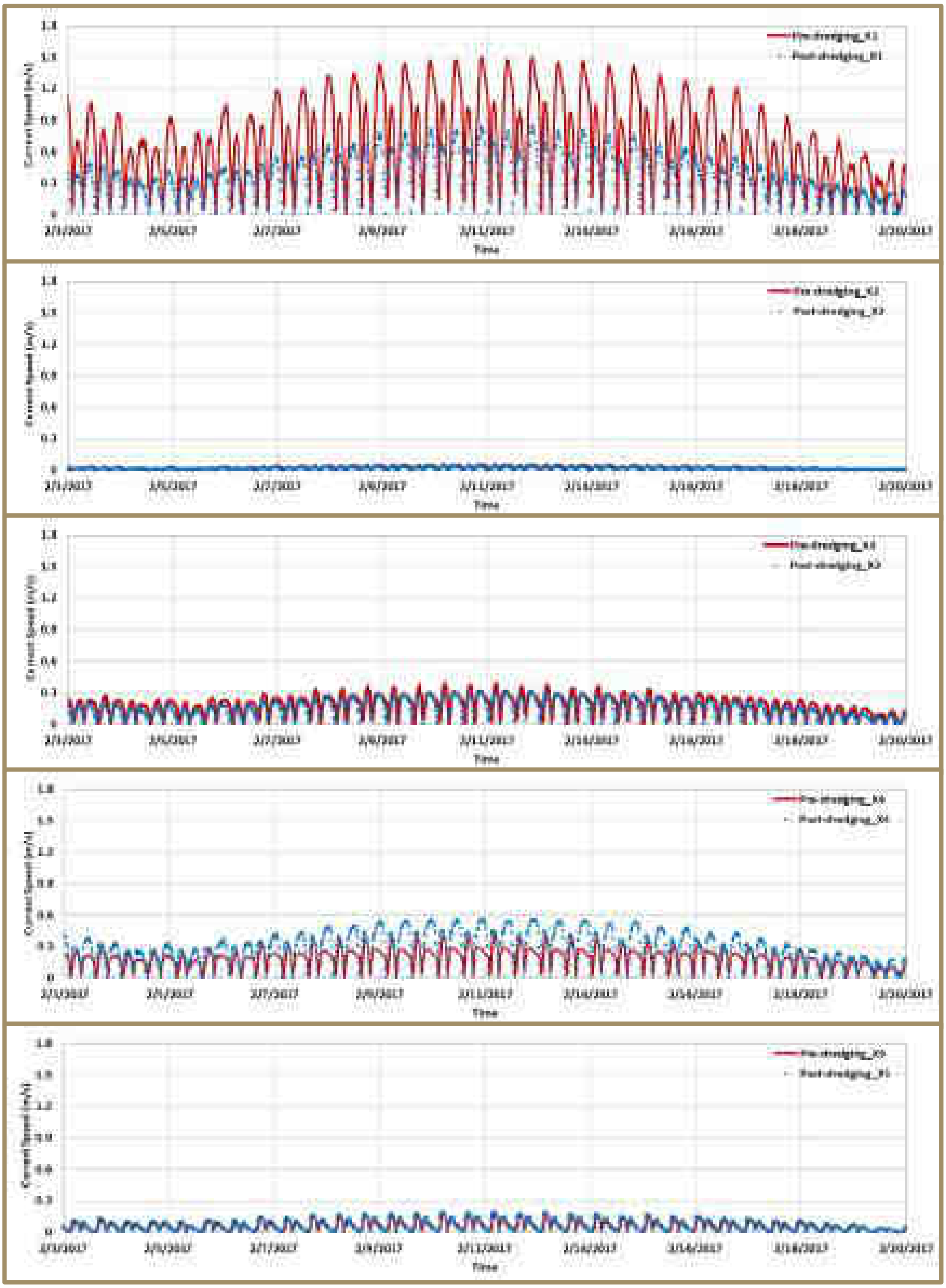

Figure 30: Comparison of Current Speeds for Pre- and Post-dredging Conditions (Lean River Discharge Condition) at locations X1 to X5.

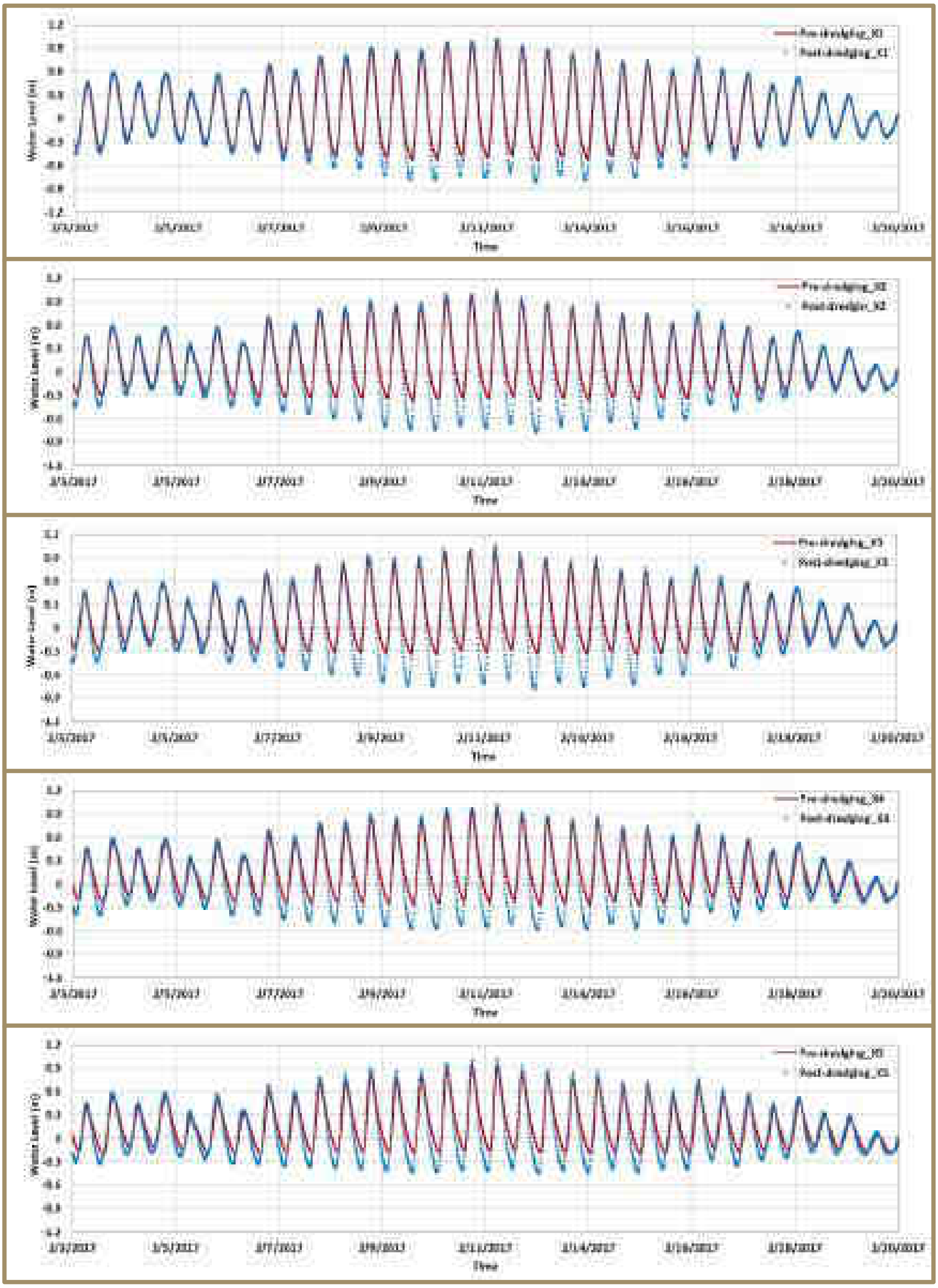

Figure 31: Comparison of Water Levels for Pre- and Post-dredging Conditions (Lean River Discharge Condition) at locations X1 to X5.

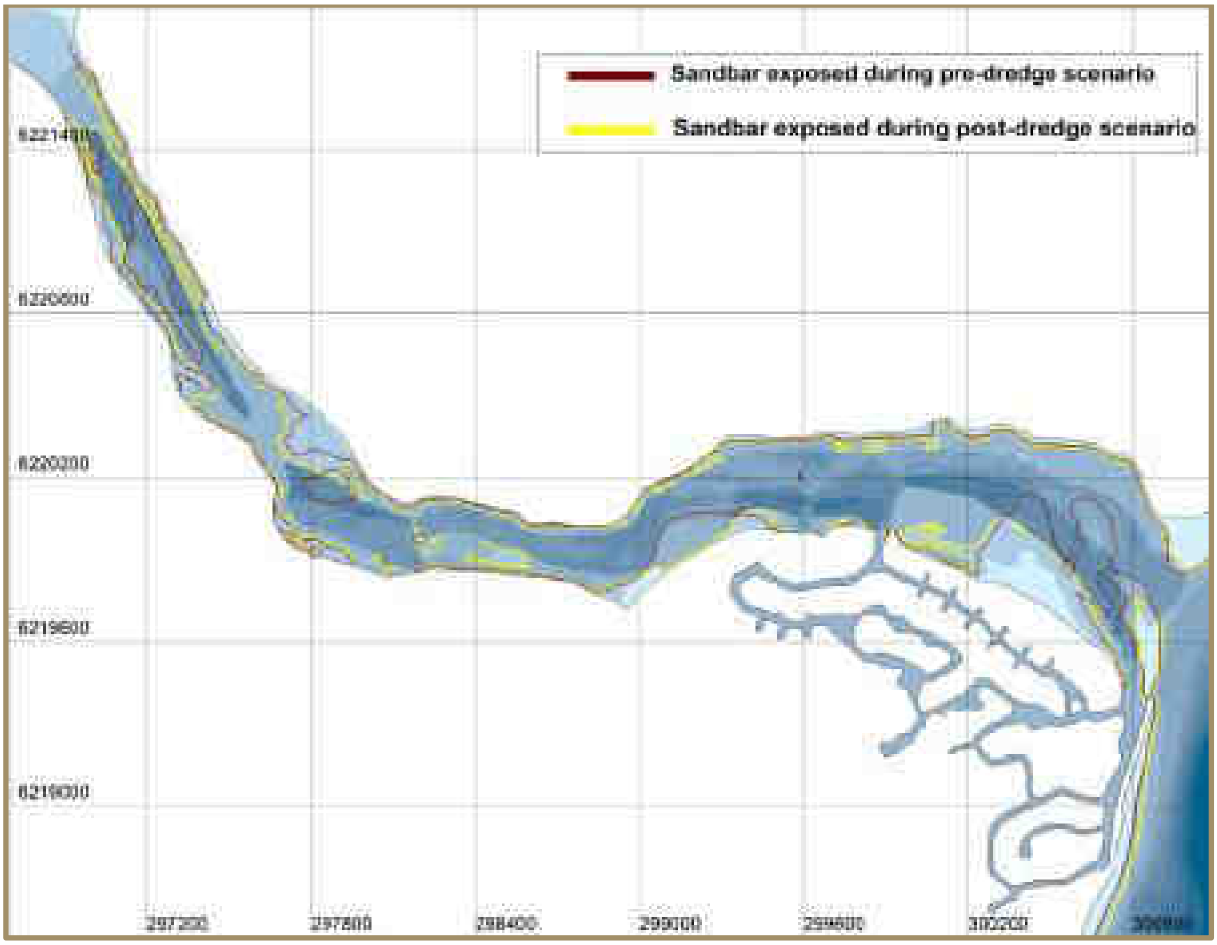

Figure 32: Exposed Area of Sandbanks during Pre- and Post-dredging Scenarios (Lean River Discharge Condition)

4 Summary and Conclusion

A hydrodynamic study was carried out to investigate the existing flow conditions (pre-dredging) inside the Kromme River estuary and possible variations in flow post-dredging the estuary for beach nourishment at St. Francis Bay.

The dredging of the river, and in particular the area around the river mouth has the effect of allowing the water to drain out more effectively, which lowers the low water level (with respect to MSL). It is assumed that this low water level is a variable phenomenon in any case given the dynamic nature of the river mouth which will govern this low tide level. The variation in the low water levels is less than the increased water depth and will not have any impact on the minimum water depth availability in the dredged area whereas a reduction in water depth is observed in the non-dredged areas during post-dredging scenario. This may lead to exposure of shallow non-dredged areas inside the estuary during low tides.

The variation in current speed inside the estuary and along the riverbanks due to dredging is generally very small. The estuary mouth shows the greatest change in current speed with a reduction of up to 1.3m/s and 1.6m/s for lean/ negligible river discharge condition and high river discharge conditions, respectively. These variations in current speed are expected to be a temporary phenomenon until the bathymetry of the estuary mouth get smoothed out by natural hydrodynamics and morphological evolution over the time. Based on the strong flow (maximum current speed of 1.8m/s at the estuary mouth observed from the model studies) the estuary mouth is not expected to close.

Plots of the maximum tidal current throughout the simulation period confirm that the currents outside the main channel (i.e. near to the banks) and in particular on the northern bank close to the river mouth are low (up to 0.2m/s) and that the dredging does not lead to any significant change in the currents in this area.

5 References

1. *'Draft Environmental Impact Report: Proposed Coastal Protection Scheme, St. Francis Bay, Kouga Local Municipality, Eastern Cape Province (December 2019)'* by Coastal & Environmental Services.

2. '*Estuarine Assessment: Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province (August 2019)*' by Coastal & Environmental Services.

3. *'St. Francis Bay Beach Long-Term Coastal Protection Phase 2 – Spit Protection: Preliminary Design Report (February 2019)'* by Advisian.

4. *'St. Francis Bay Beach Long-Term Coastal Protection Phase 2 – Preliminary Design Report (February 2018)'* by Advisian

5. *TELEMAC2D User Manual Version v8p1 (March 2020)*

Appendix A
Hydrodynamic Conditions – Pre-Dredging Scenario (Existing Conditions)

Lean/ Negligible River Discharge Condition

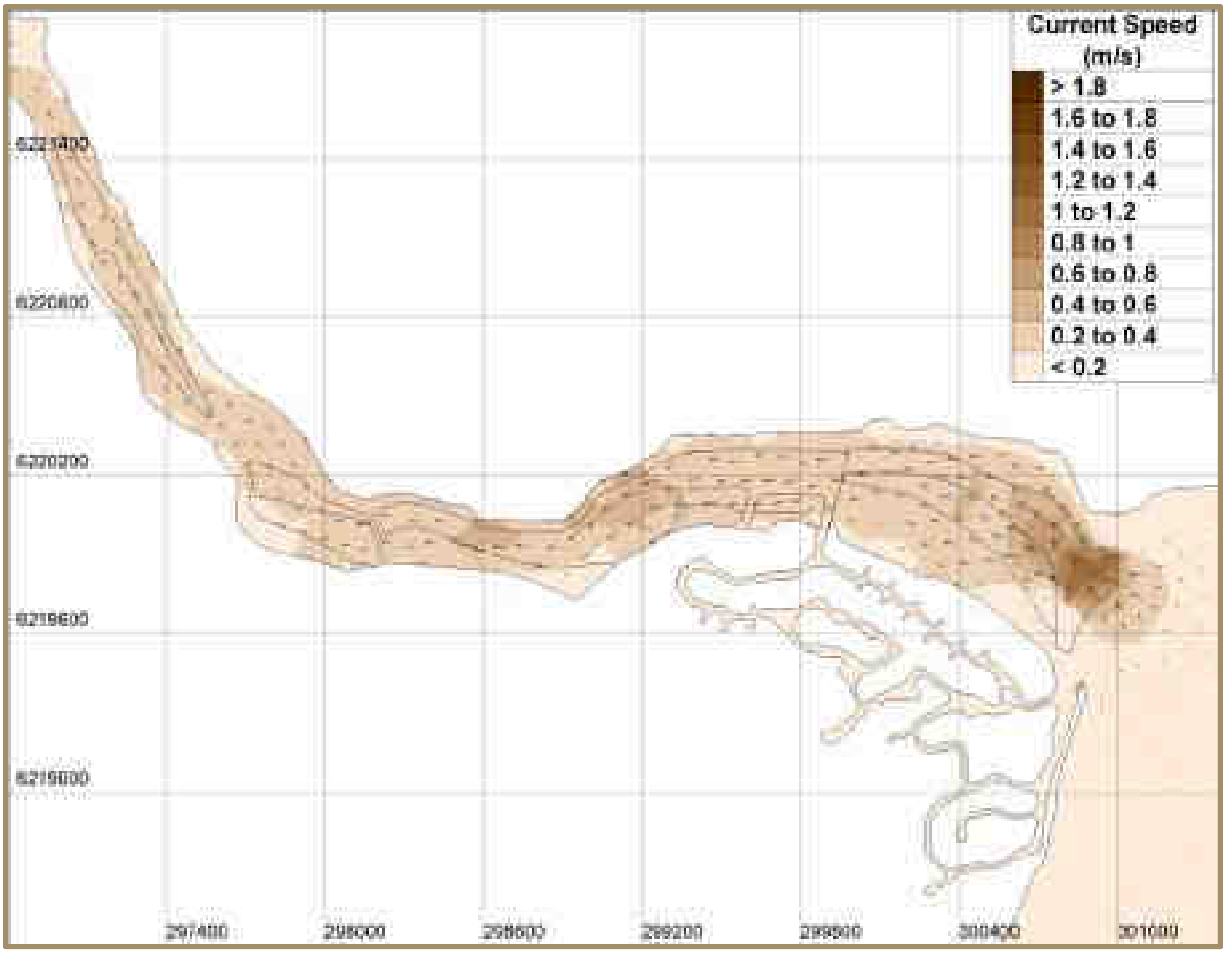

Figure 33: Flood Currents during Spring Tide under Lean Discharge Conditions – Pre-Dredging Scenario (Existing Conditions)

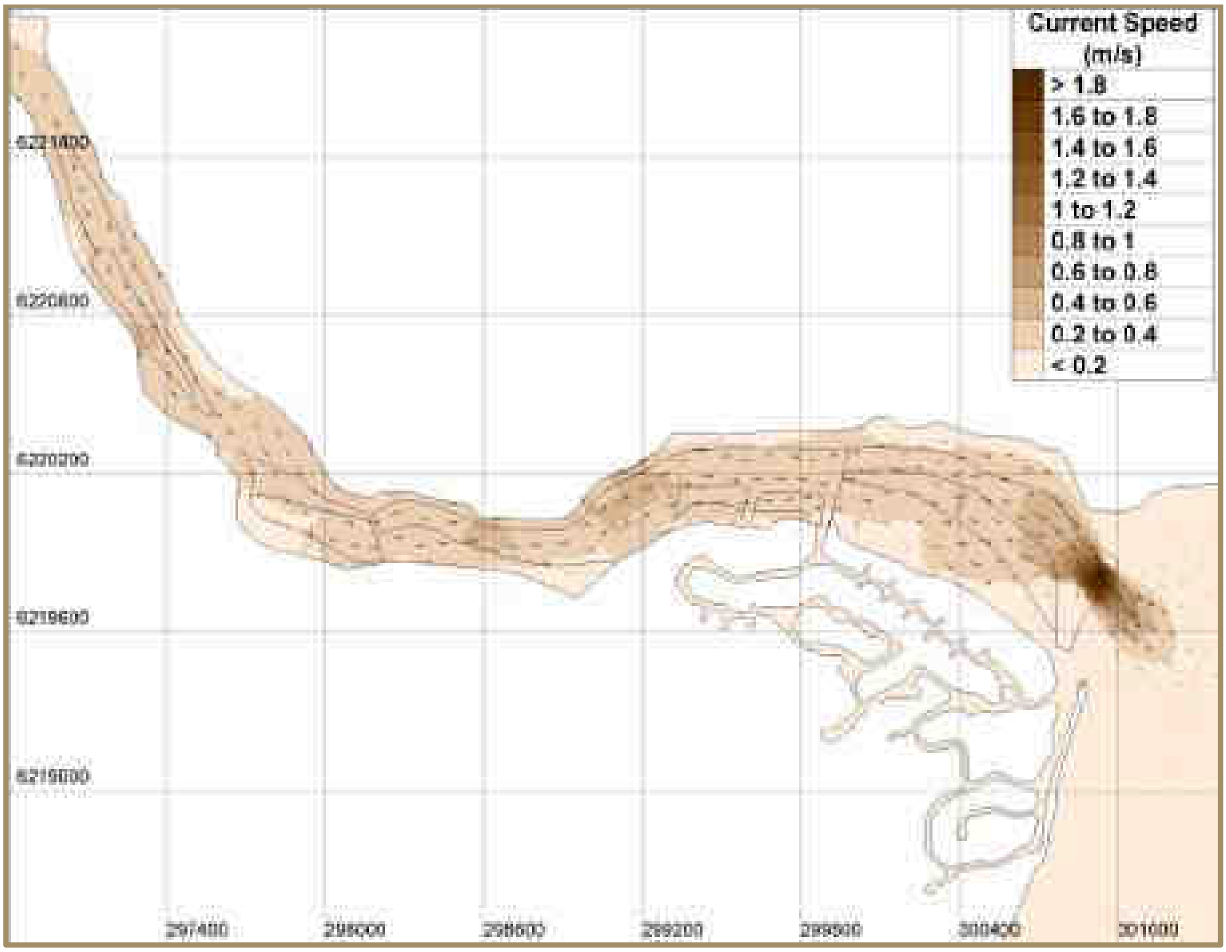

Figure 34: Ebb Currents during Spring Tide under Lean Discharge Conditions – Pre-Dredging Scenario (Existing Conditions)

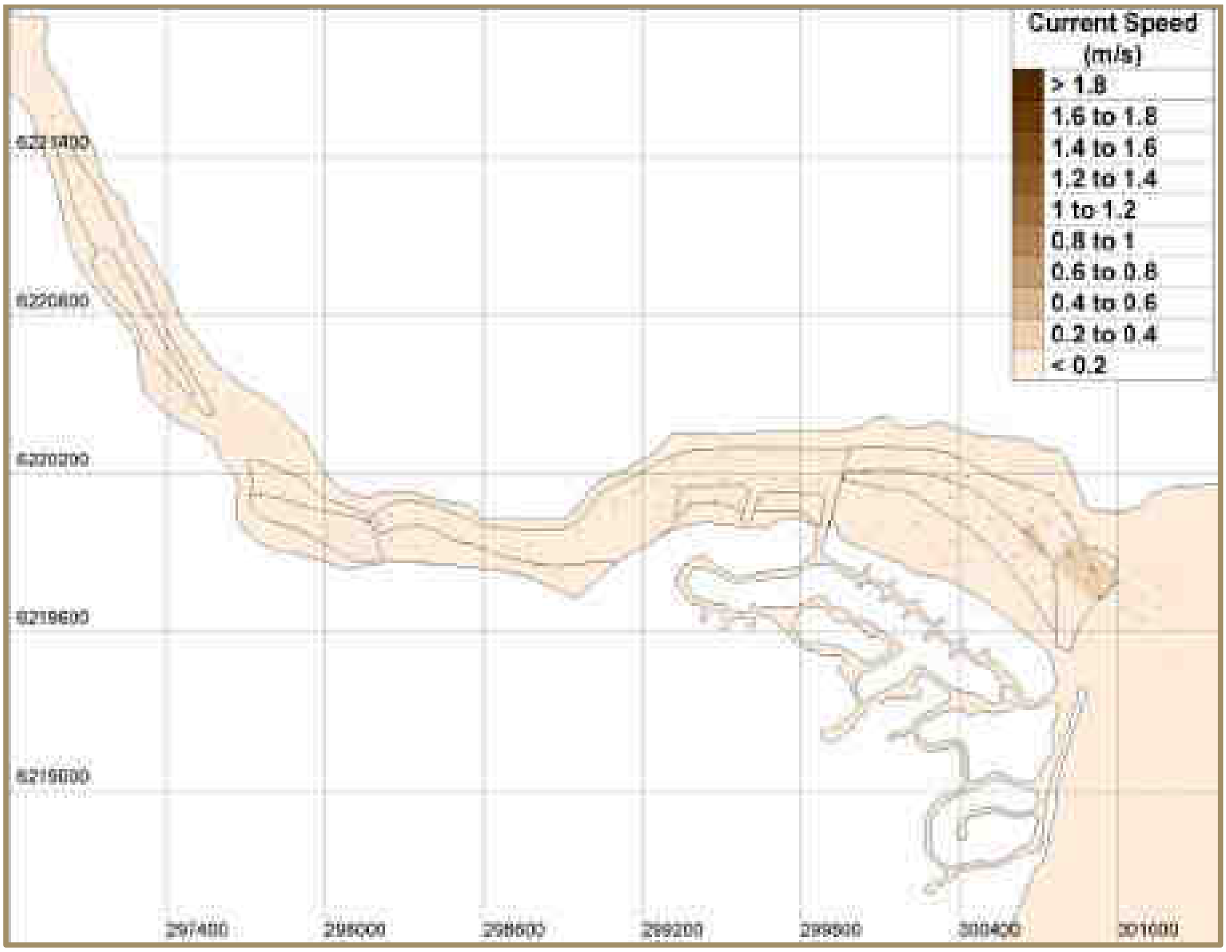

Figure 35: Flood Currents during Neap Tide under Lean Discharge Conditions – Pre-Dredging Scenario (Existing Conditions)

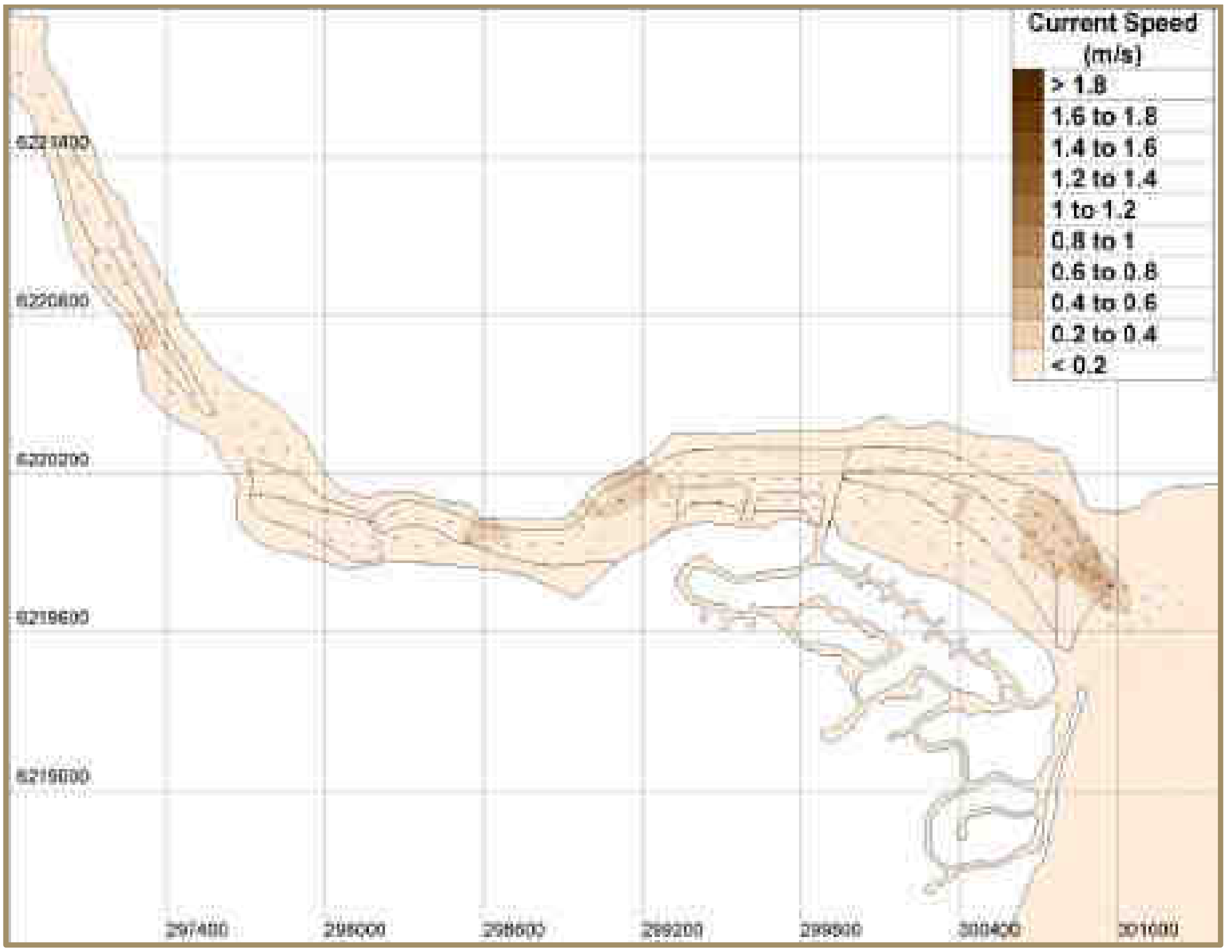

Figure 36: Ebb Currents during Neap Tide under Lean Discharge Conditions – Pre-Dredging Scenario (Existing Conditions)

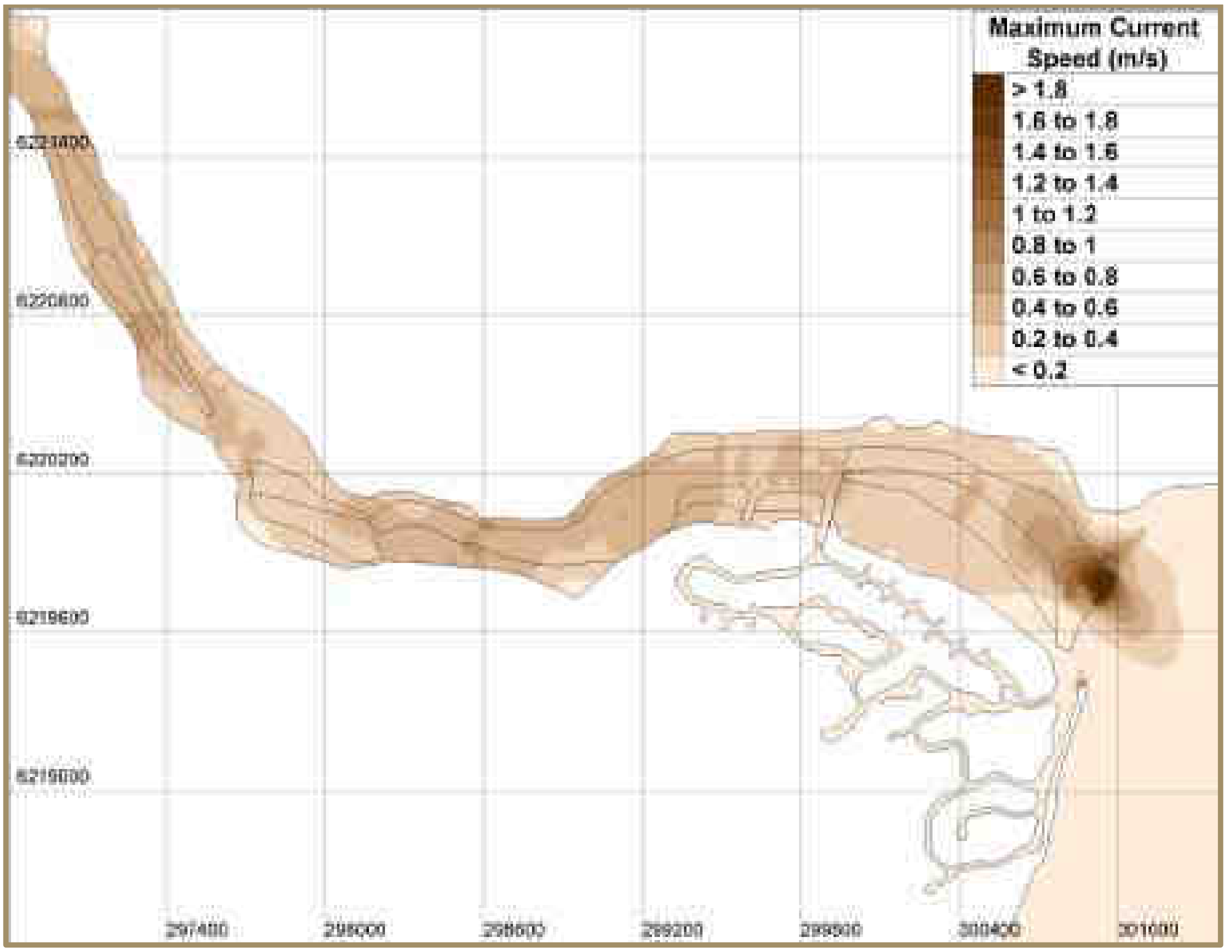

Figure 37: Maximum Current Speed under Lean Discharge Conditions – Pre-Dredging Scenario (Existing Conditions)

<u>High River Discharge Condition</u>

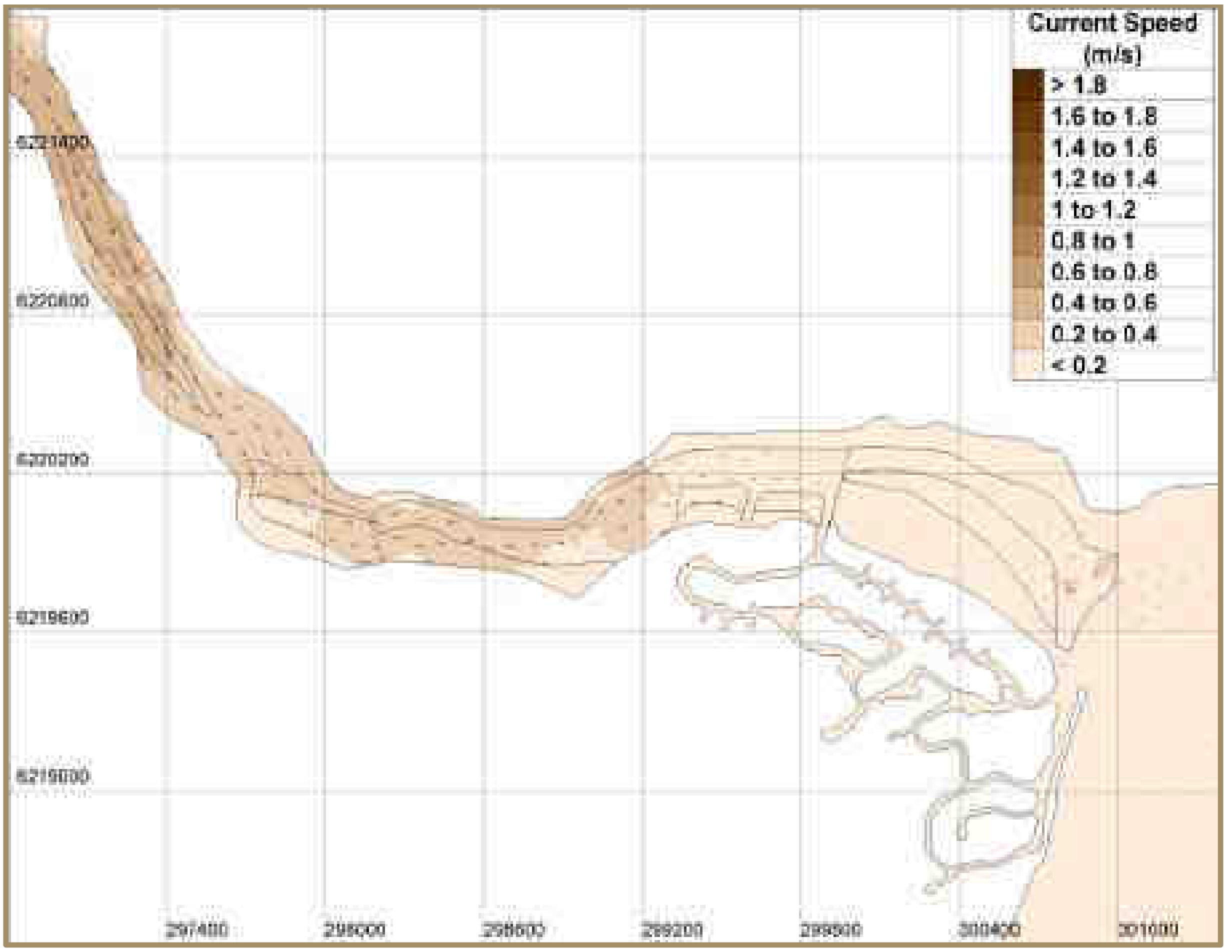

Figure 38: Flood Currents during Spring Tide under High Discharge Conditions – Pre-Dredging Scenario (Existing Conditions)

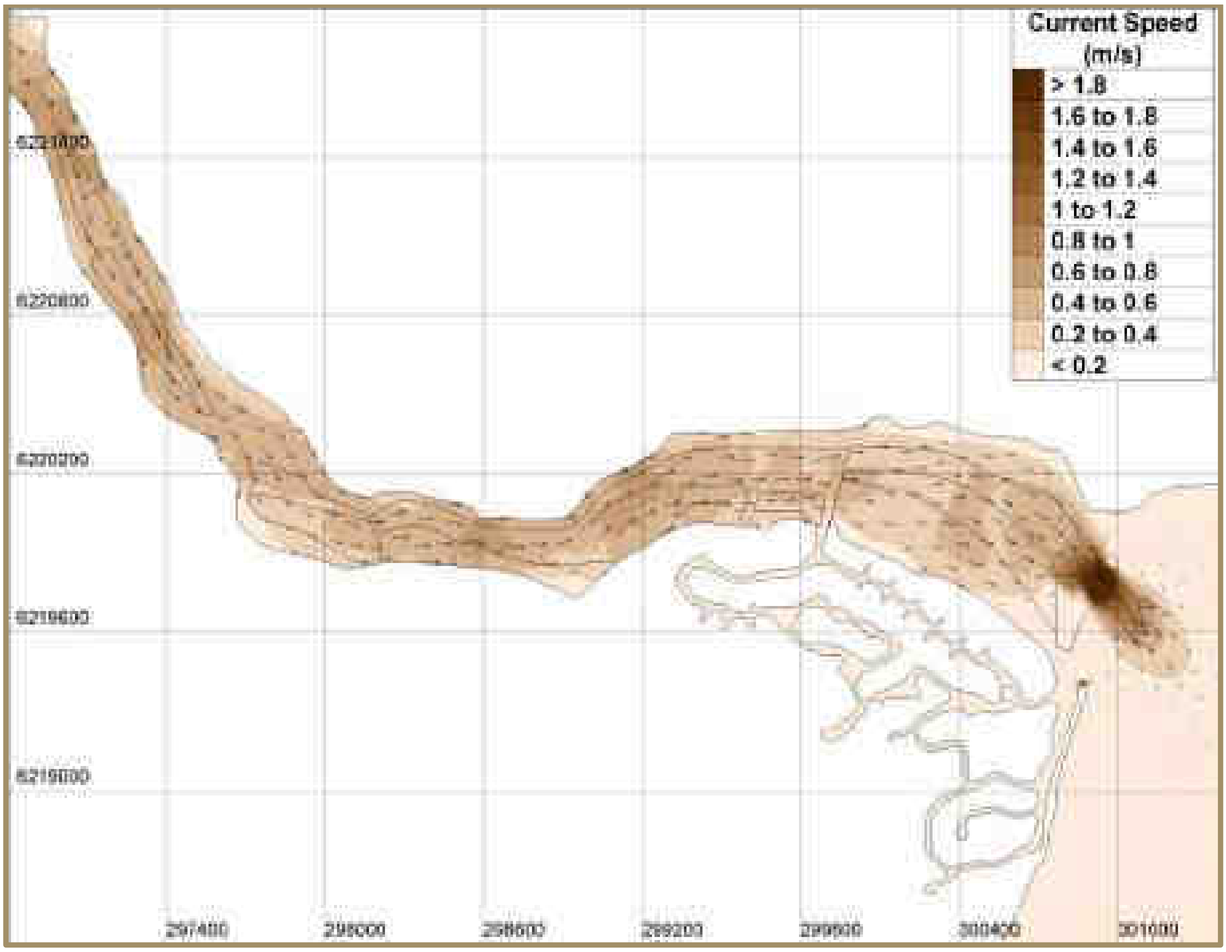

Figure 39: Ebb Currents during Spring Tide under High Discharge Conditions – Pre-Dredging Scenario (Existing Conditions)

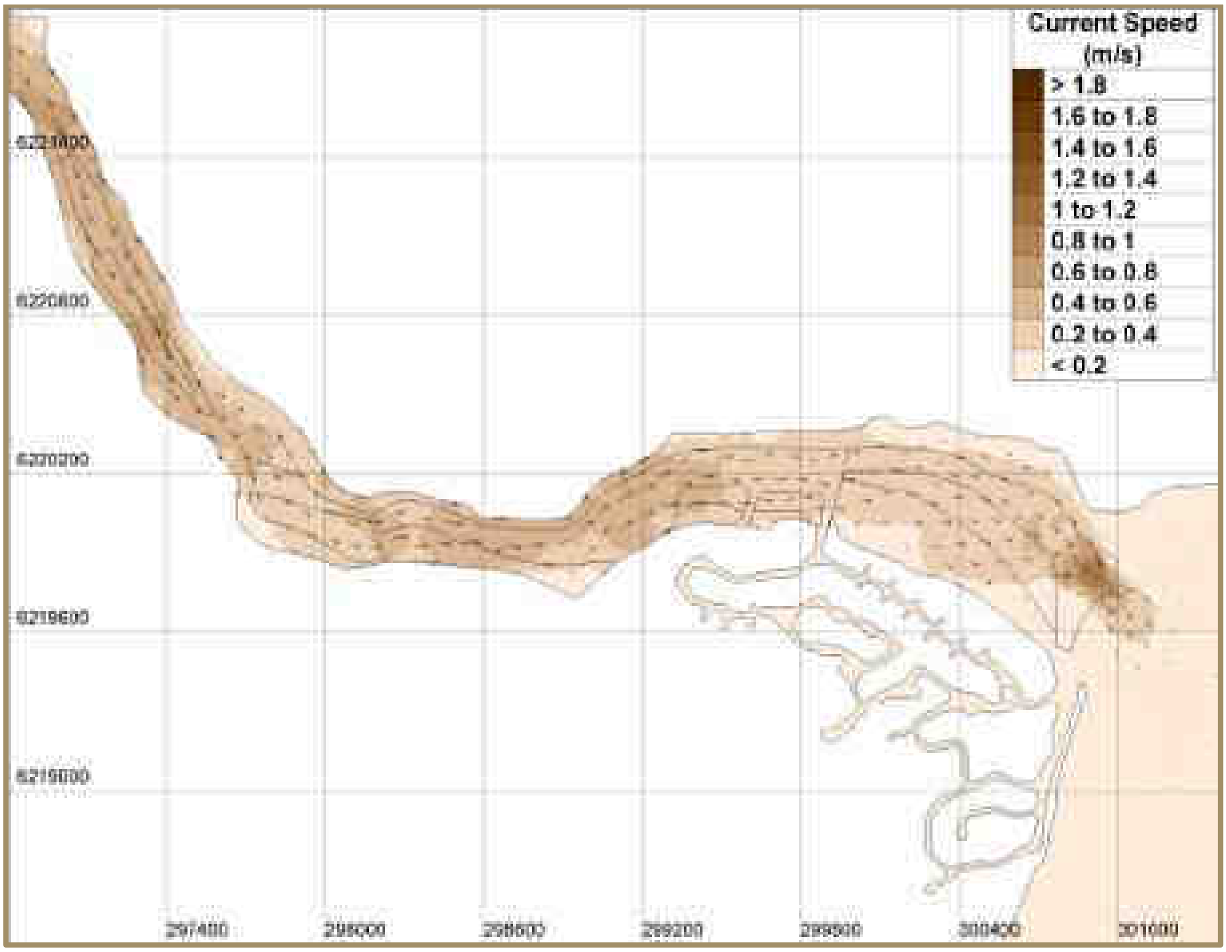

Figure 40: Flood Currents during Neap Tide under High Discharge Conditions – Pre-Dredging Scenario (Existing Conditions)

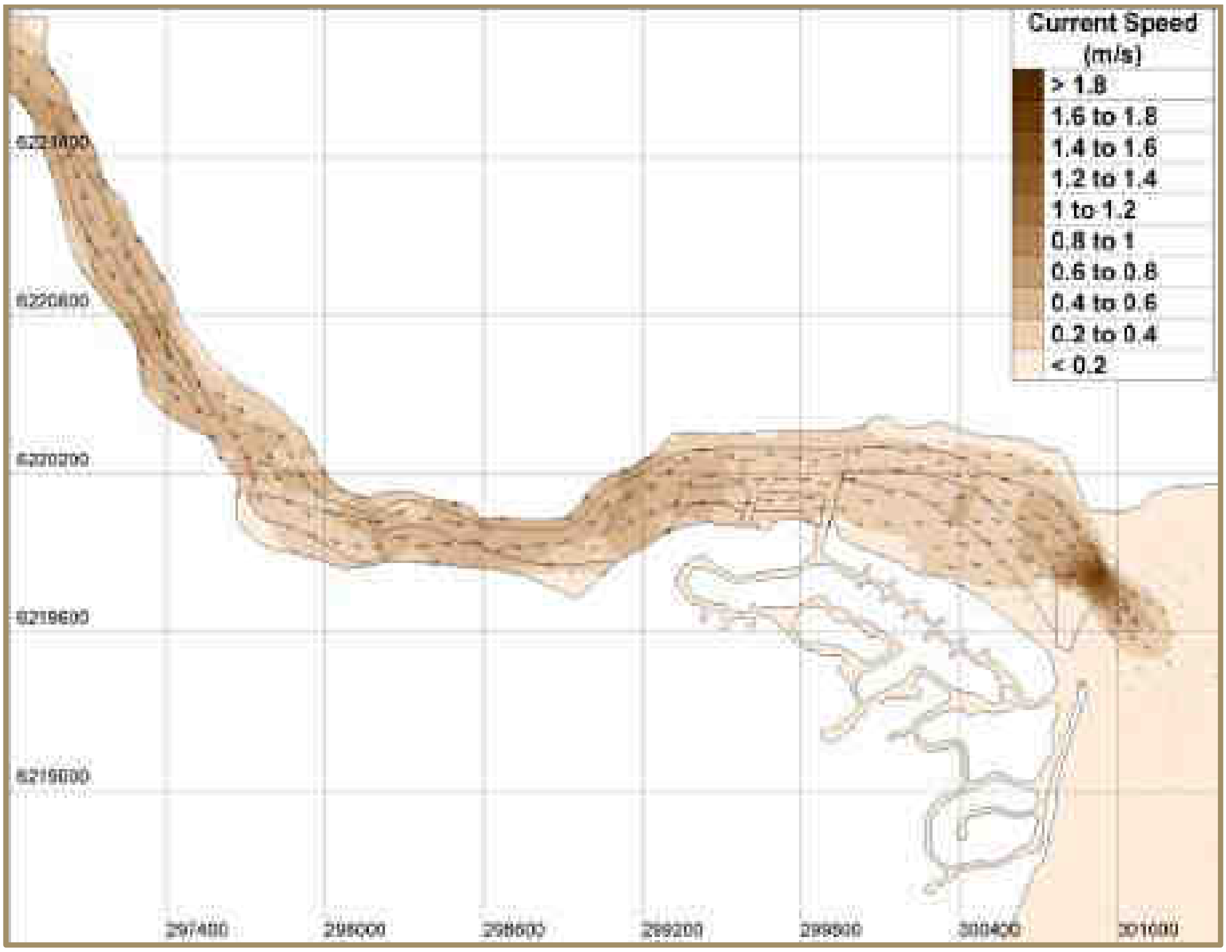

Figure 41: Ebb Currents during Neap Tide under High Discharge Conditions – Pre-Dredging Scenario (Existing Conditions)

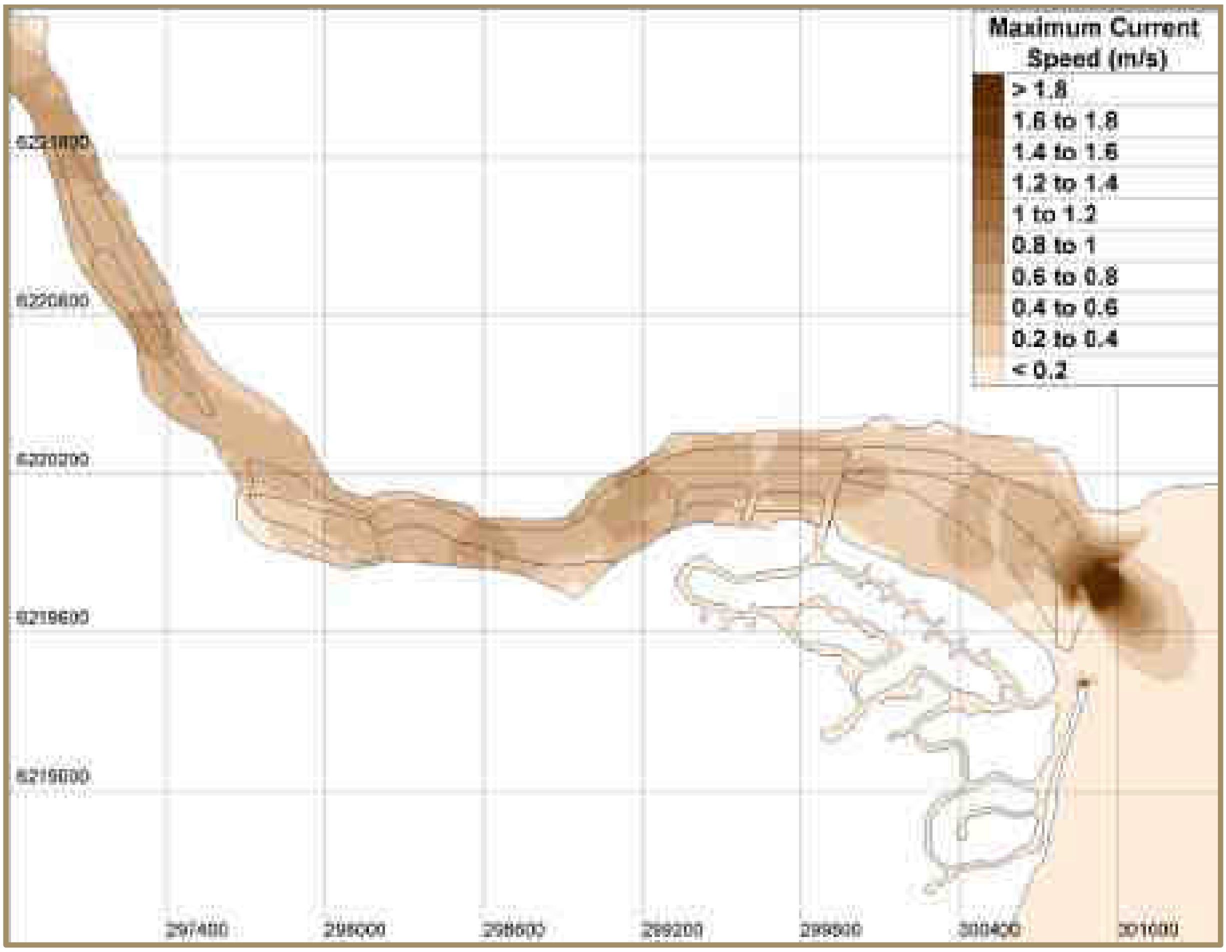

Figure 42: Maximum Current Speed under High Discharge Conditions – Pre-Dredging Scenario (Existing Conditions)

Appendix B
Hydrodynamic Conditions - Post-Dredging Scenario

Lean/ Negligible River Discharge Condition

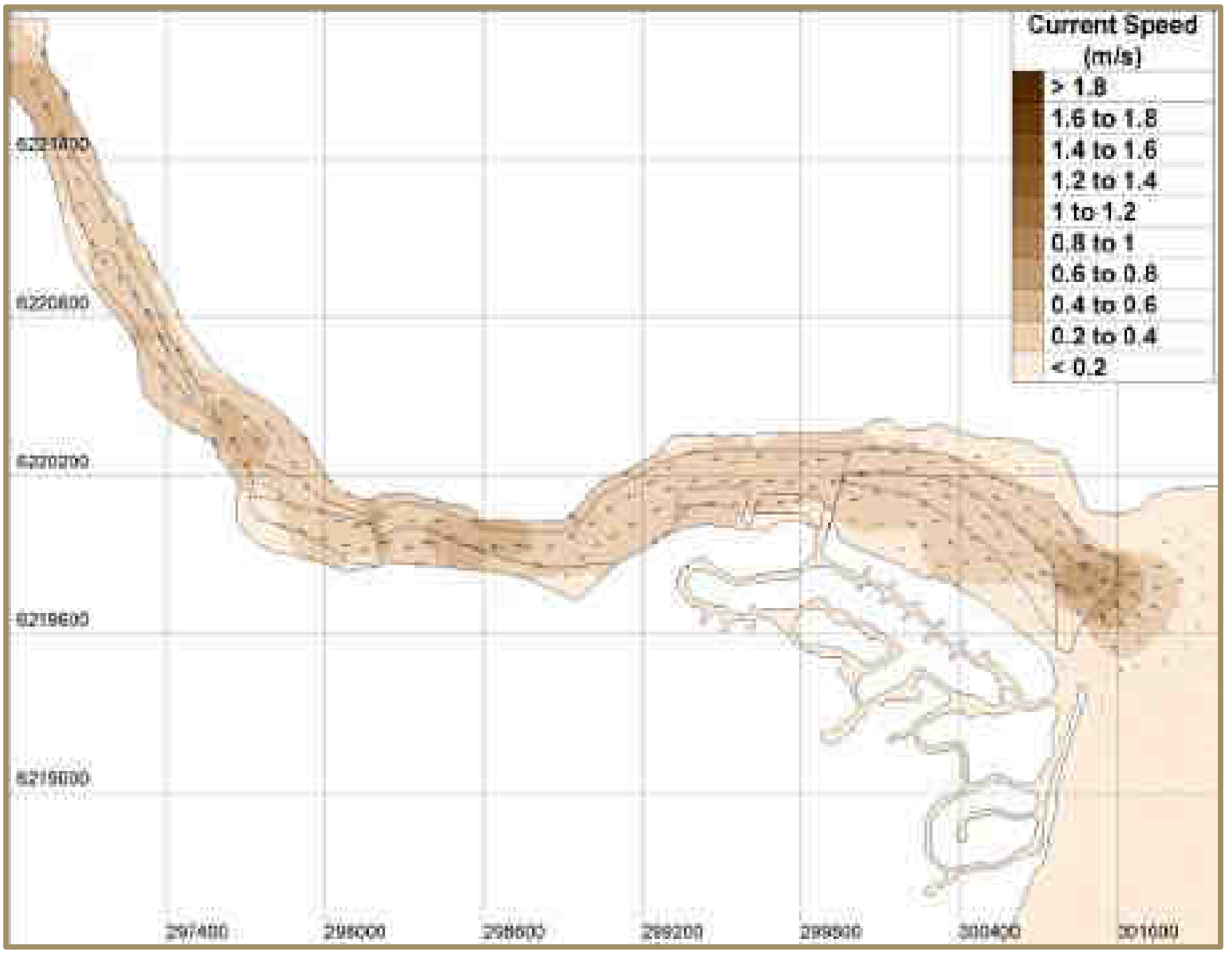

Figure 43: Flood Currents during Spring Tide under Lean Discharge Conditions – Post-Dredging Scenario

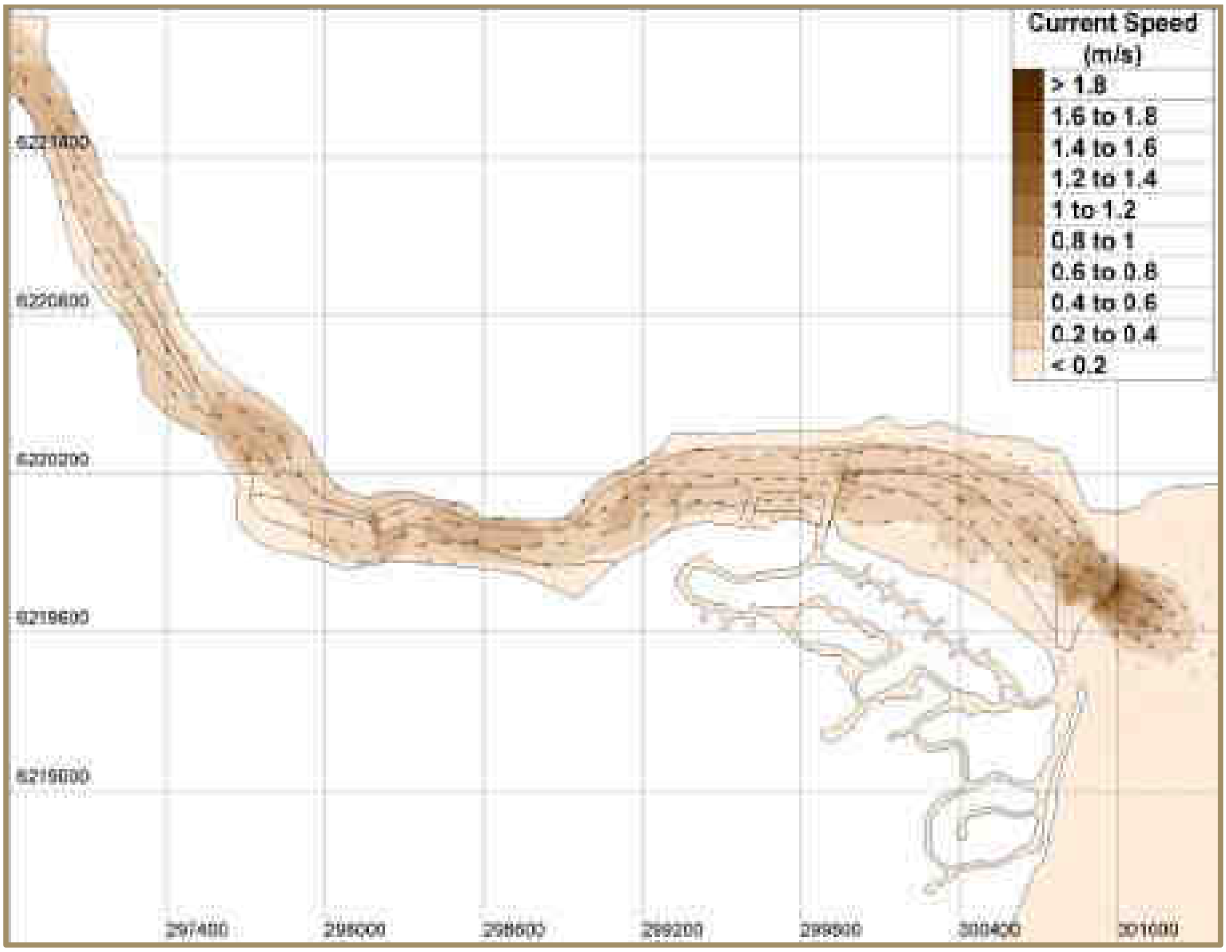

Figure 44: Ebb Currents during Spring Tide under Lean Discharge Conditions – Post-Dredging Scenario

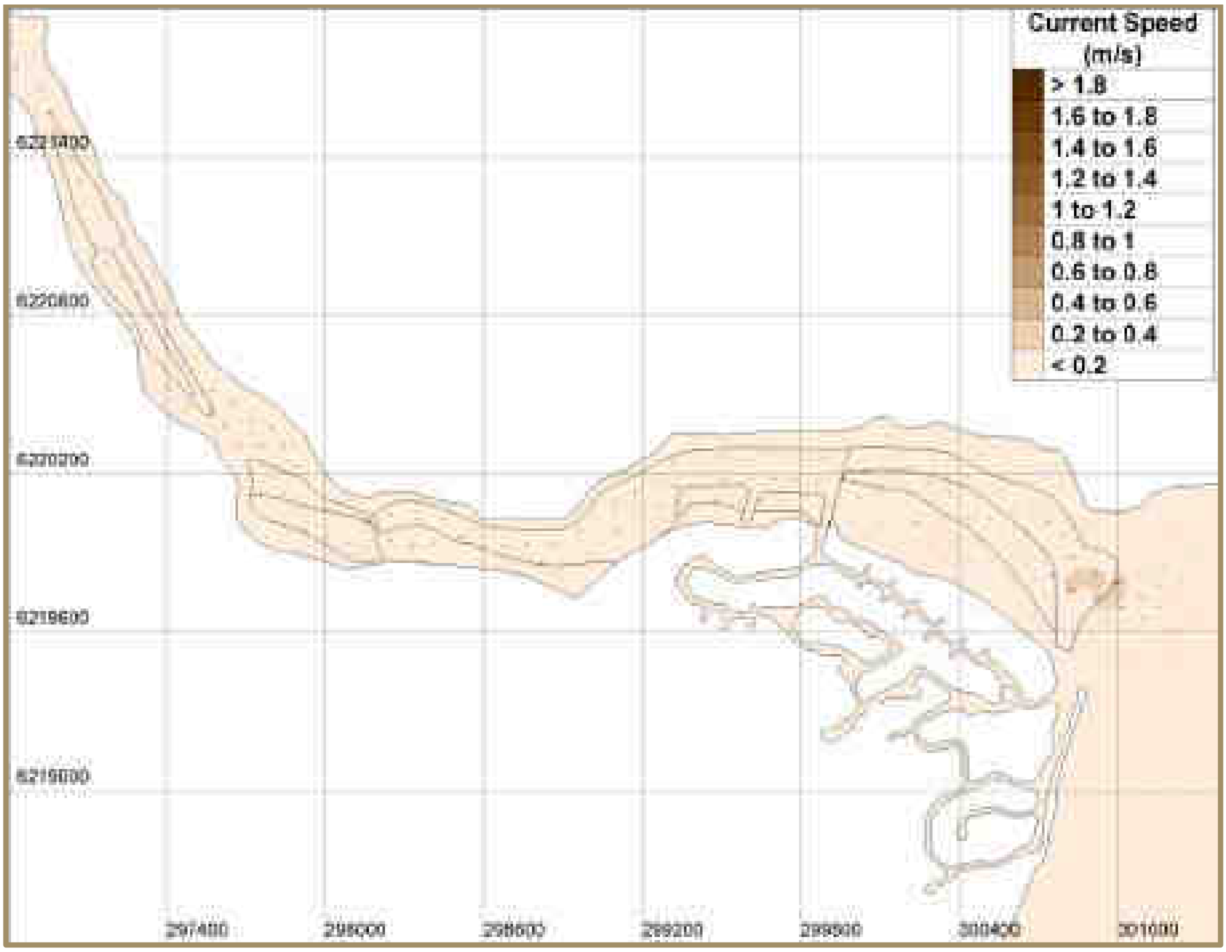

Figure 45: Flood Currents during Neap Tide under Lean Discharge Conditions – Post-Dredging Scenario

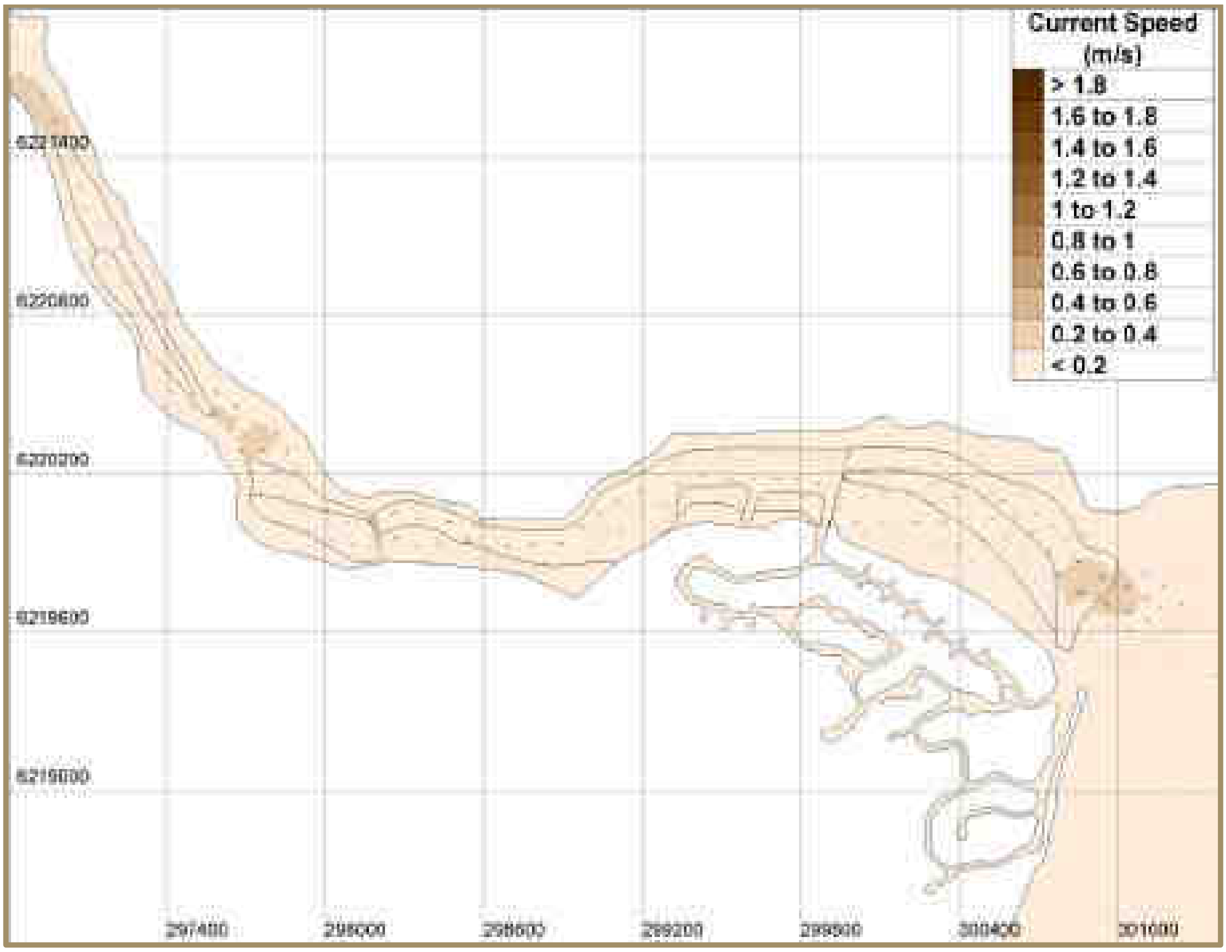

Figure 46: Ebb Currents during Neap Tide under Lean Discharge Conditions – Post-Dredging Scenario

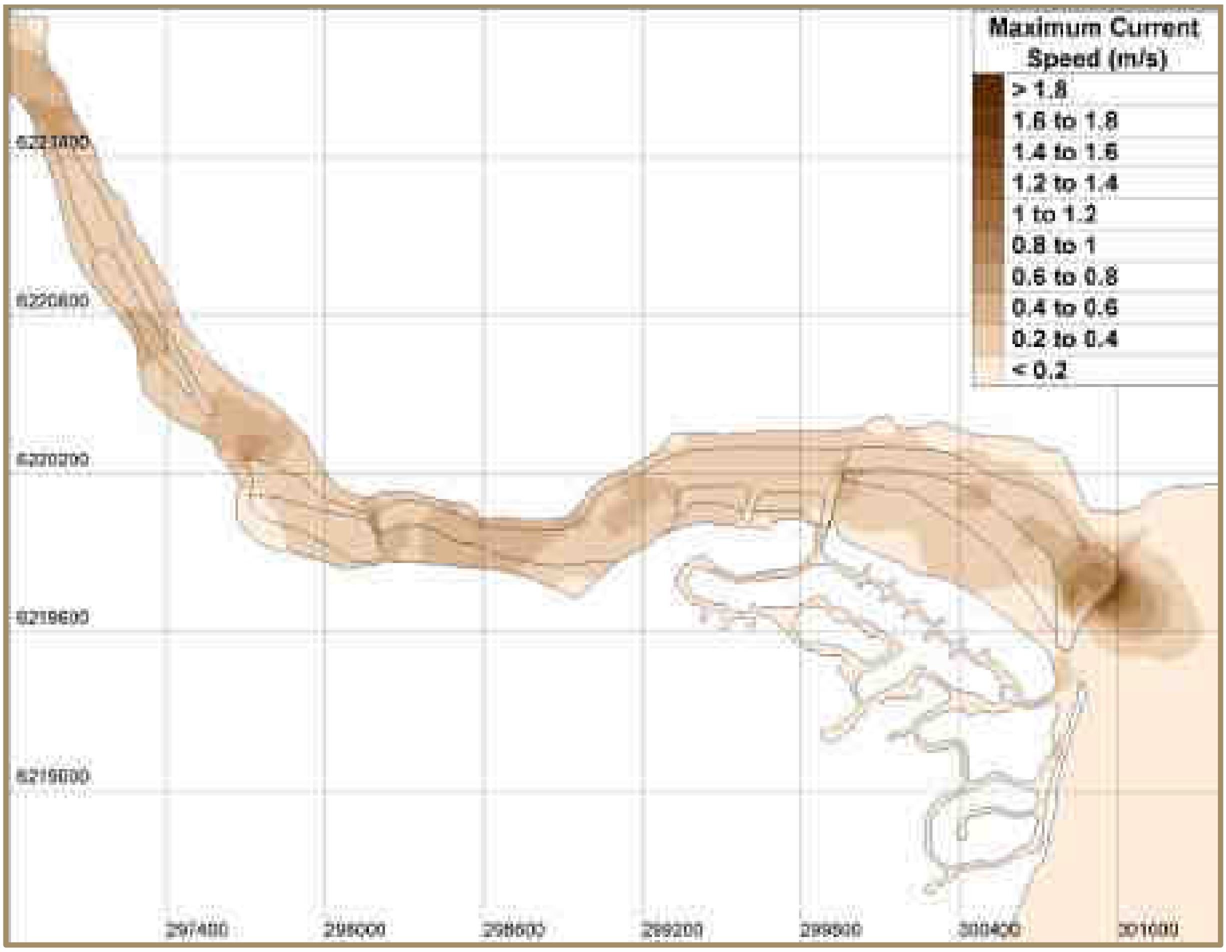

Figure 47: Maximum Current Speed under Lean Discharge Conditions – Post-Dredging Scenario

High River Discharge Condition

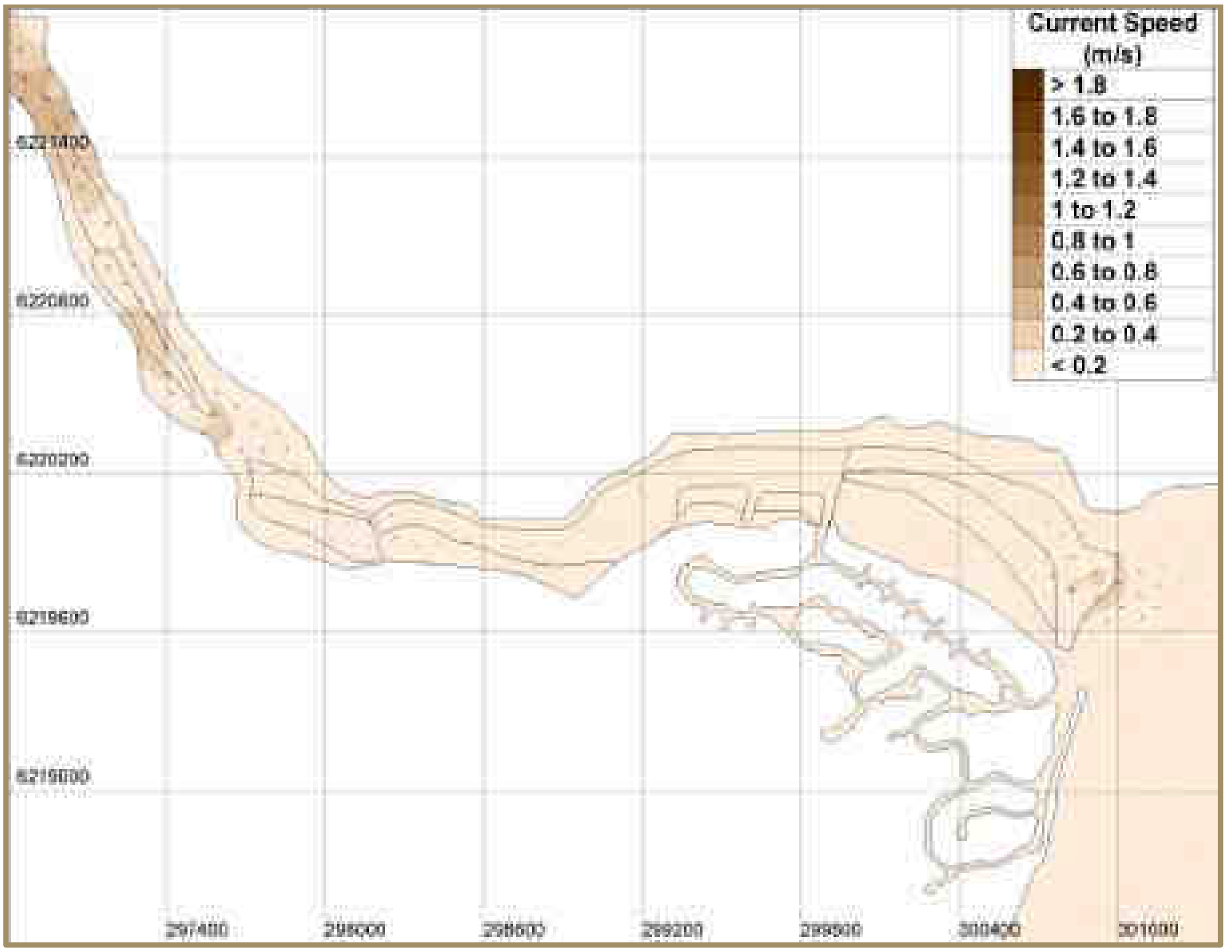

Figure 48: Flood Currents during Spring Tide under High Discharge Conditions – Post-Dredging Scenario

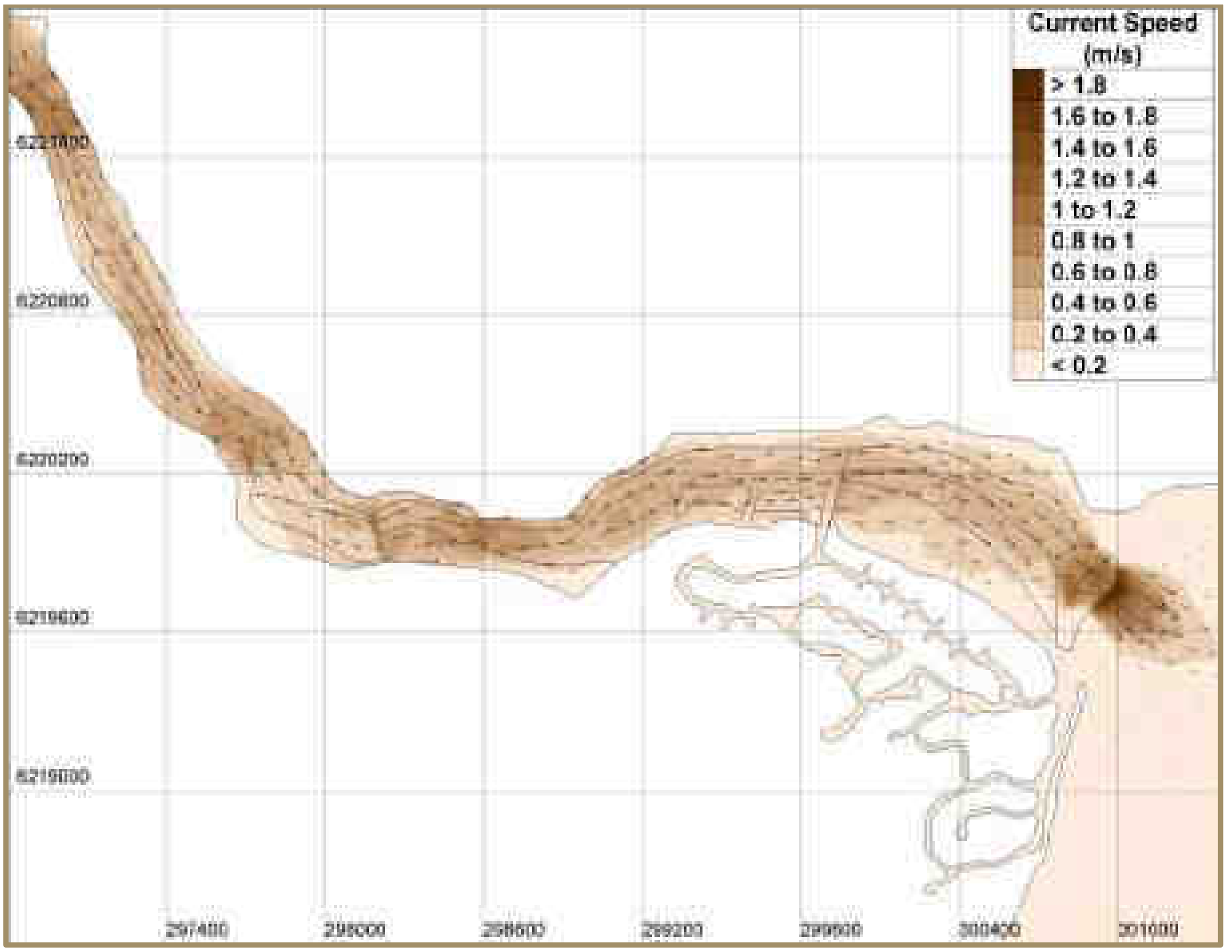

Figure 49: Ebb Currents during Spring Tide under High Discharge Conditions – Post-Dredging Scenario

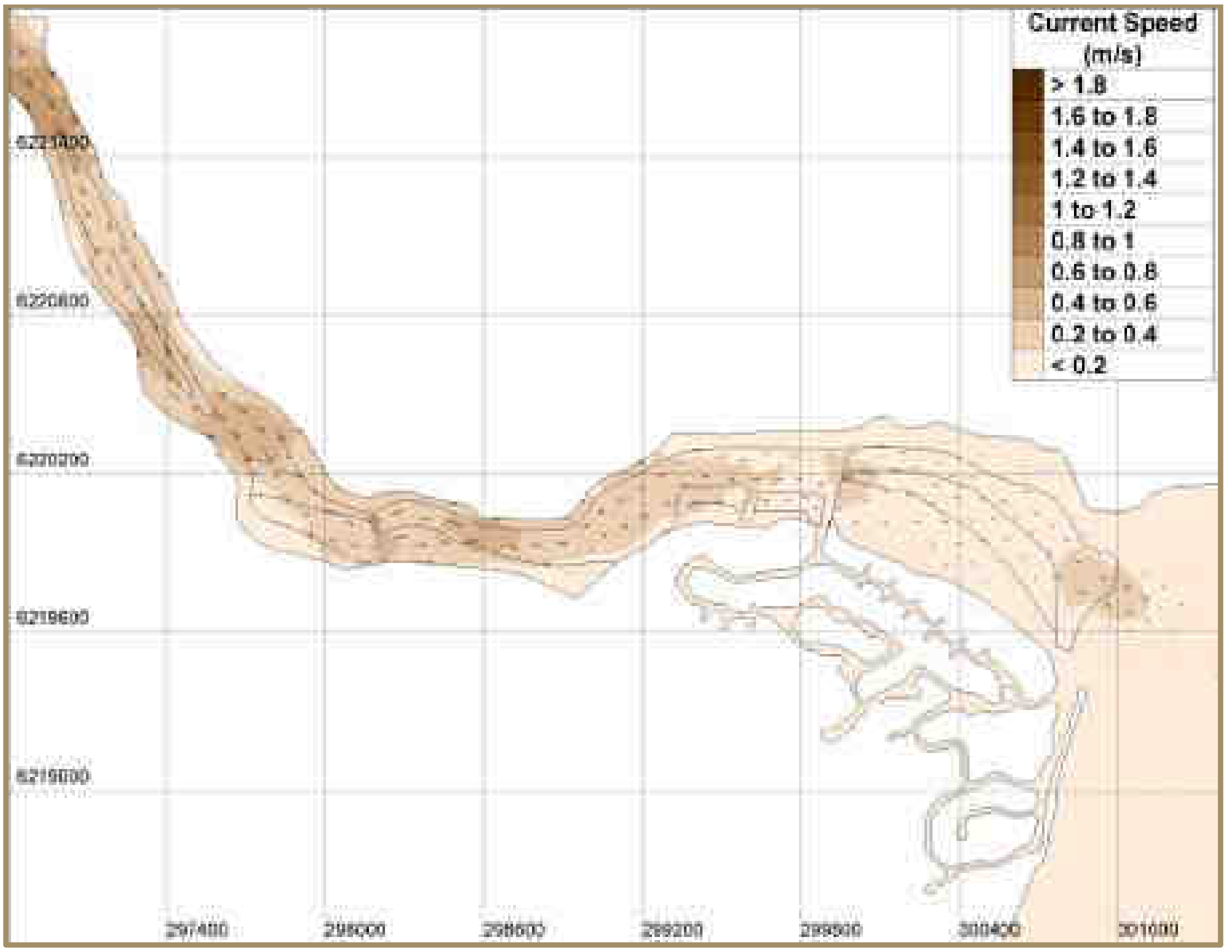

Figure 50: Flood Currents during Neap Tide under High Discharge Conditions – Post-Dredging Scenario

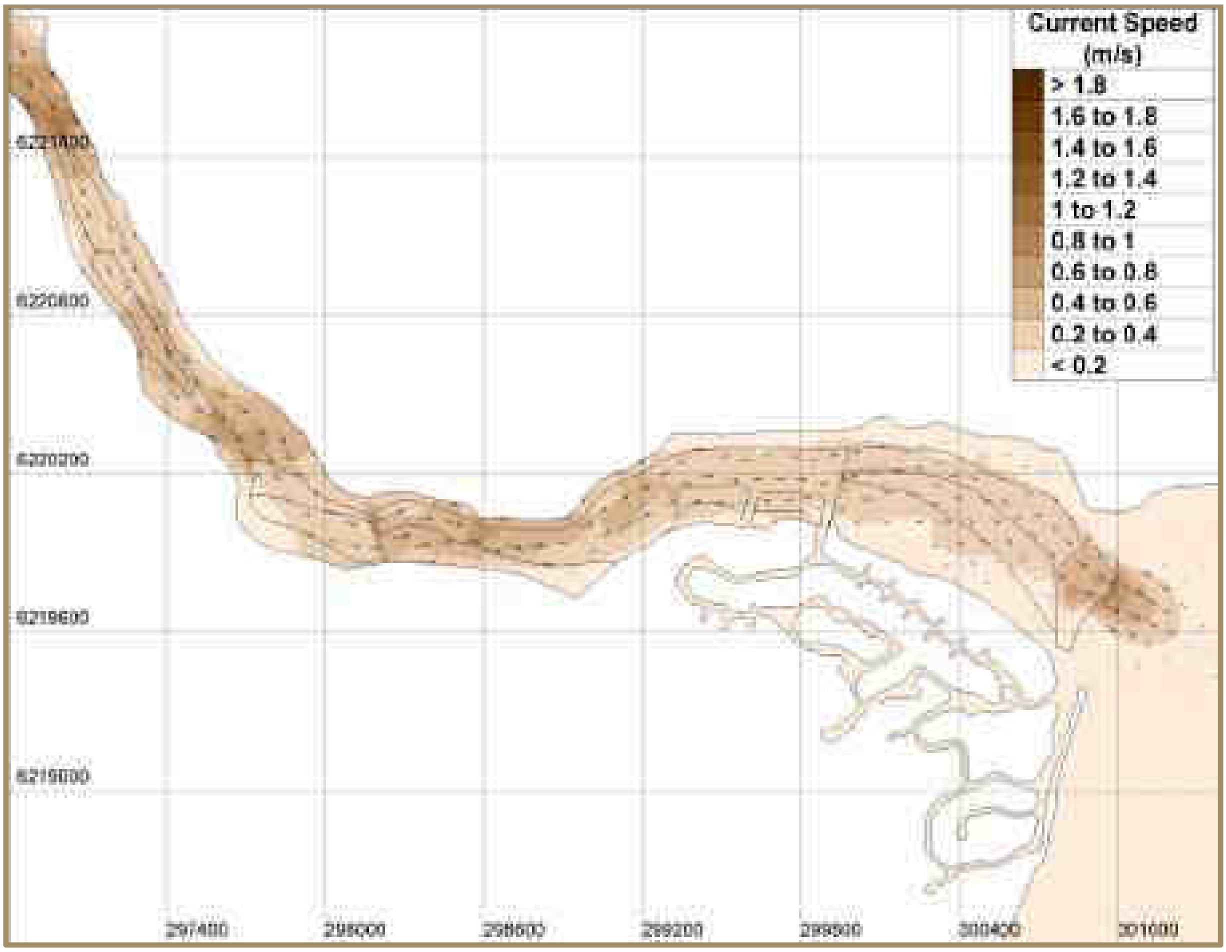

Figure 51: Ebb Currents during Neap Tide under High Discharge Conditions – Post-Dredging Scenario

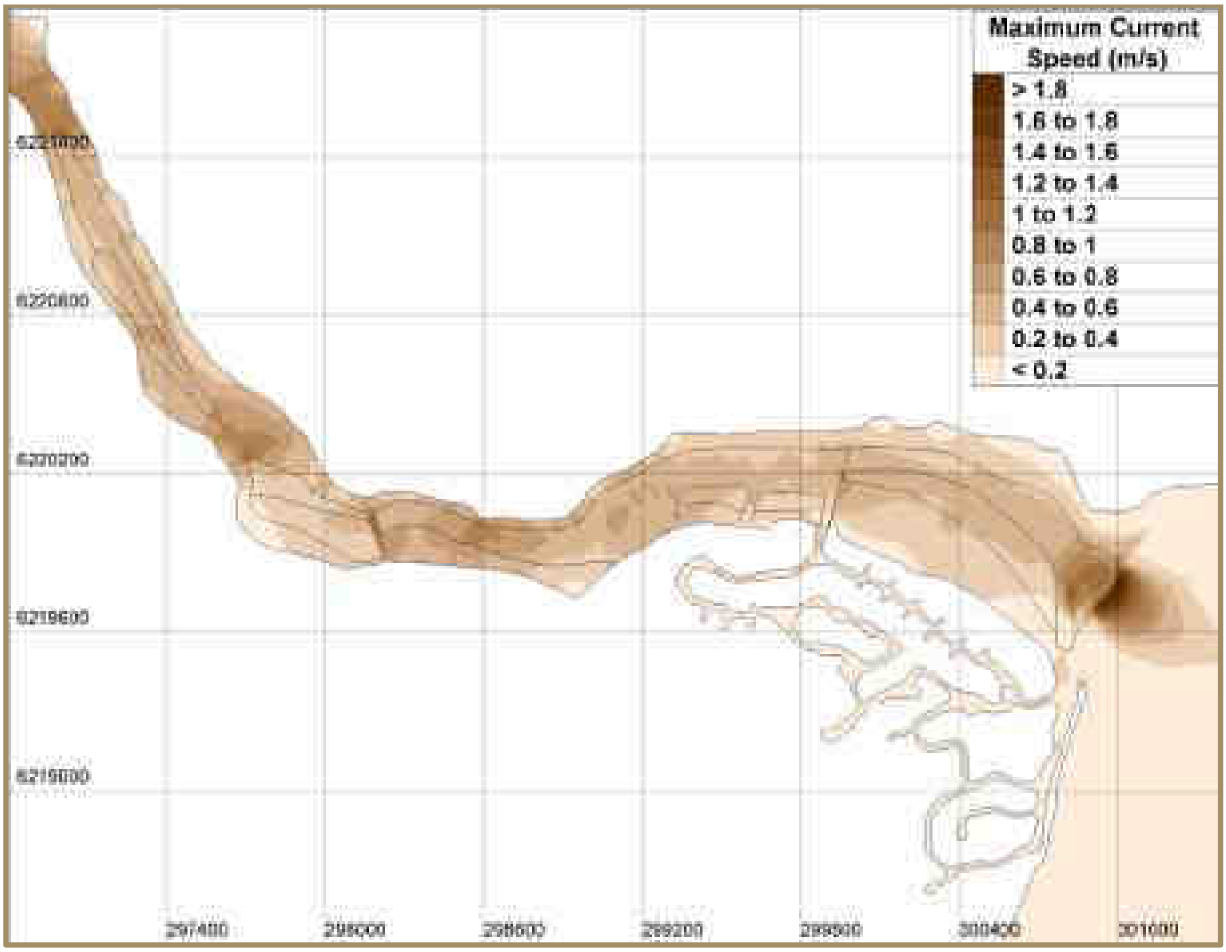

Figure 52: Maximum Current Speed under High Discharge Conditions – Post-Dredging Scenario

Appendix C
Variation in Hydrodynamics (2D Plots)

Lean / Negligible River Discharge Condition

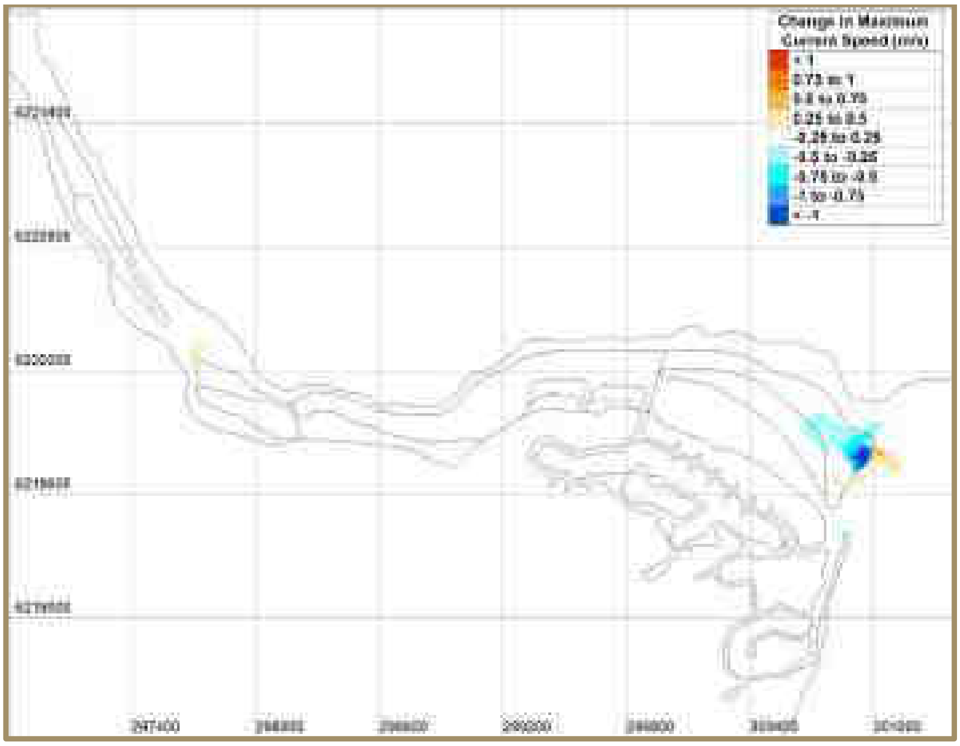

Figure 53: Change in Maximum Current under Lean Discharge conditions between pre- and post- dredging scenarios

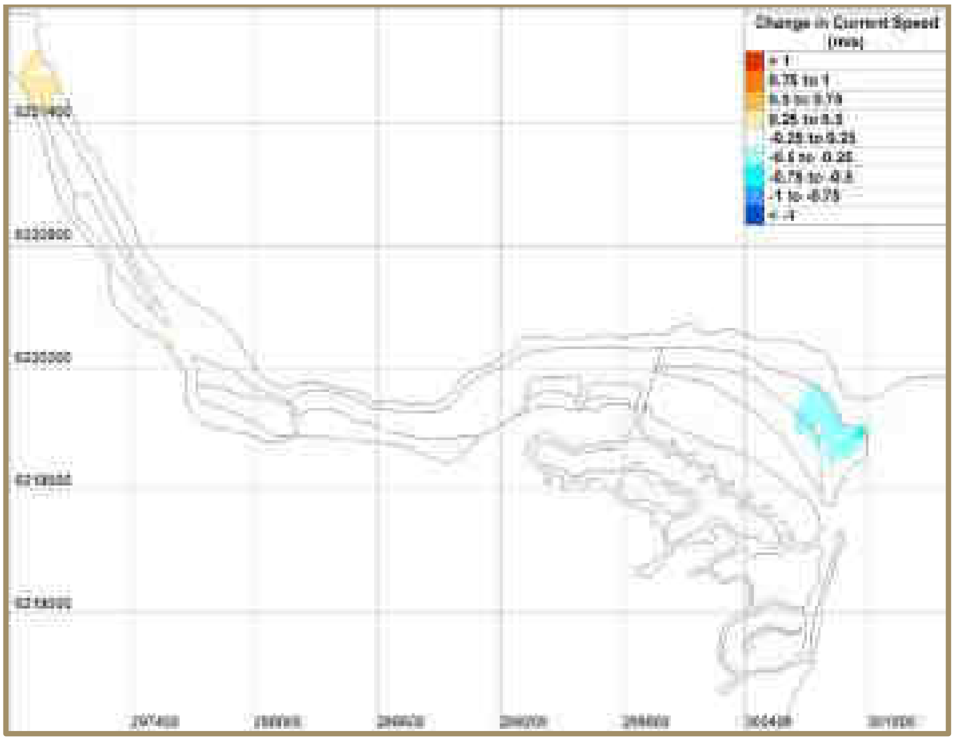

Figure 54: Change in Flood Current during Spring Tide under Lean Discharge conditions between pre- and post- dredging scenarios

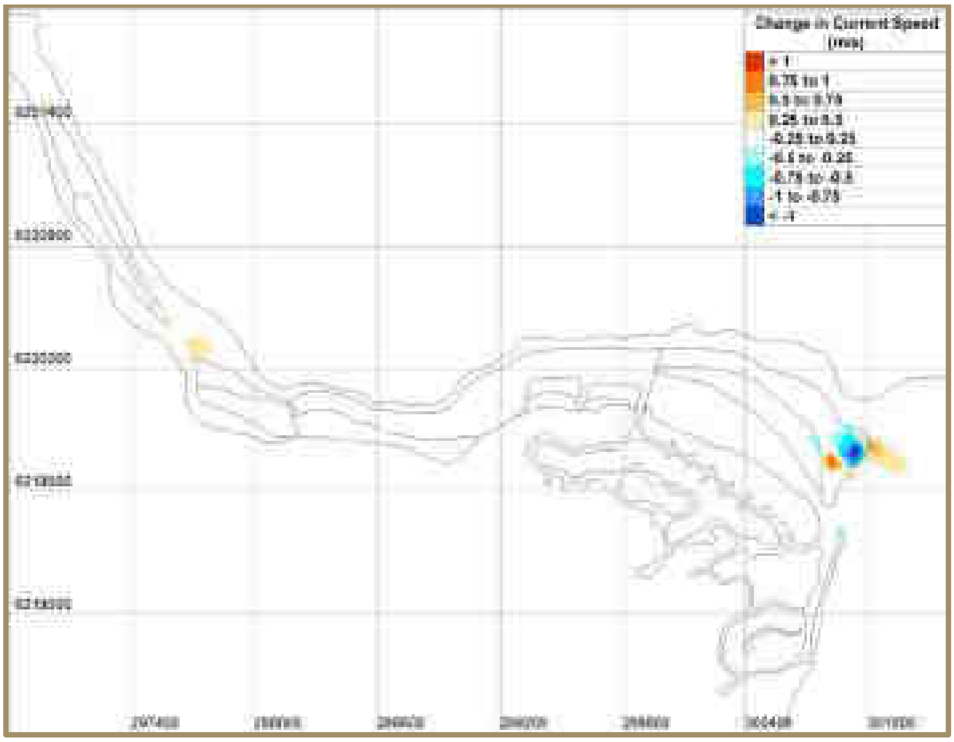

Figure 55: Change in Ebb Current during Spring Tide under Lean Discharge conditions between pre- and post-dredging scenarios

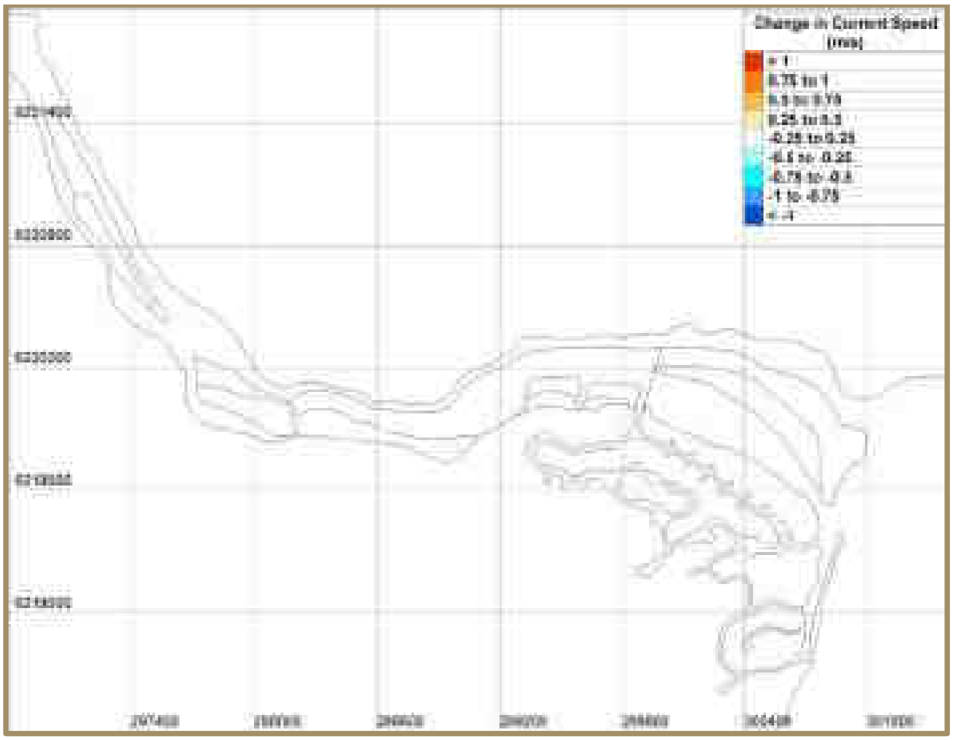

Figure 56: Change in Flood Current during Neap Tide under Lean Discharge conditions between pre- and post-dredging scenarios

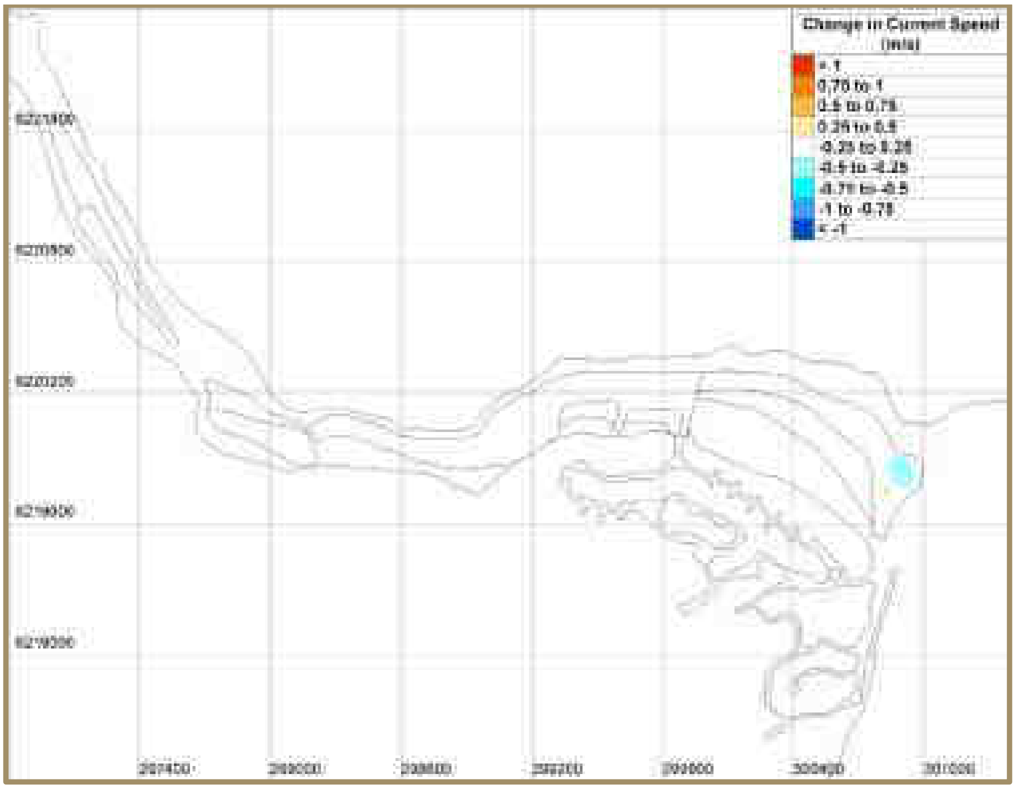

Figure 57: Change in Ebb Current during Neap Tide under Lean Discharge conditions between pre- and post-dredging scenarios

High River Discharge Condition

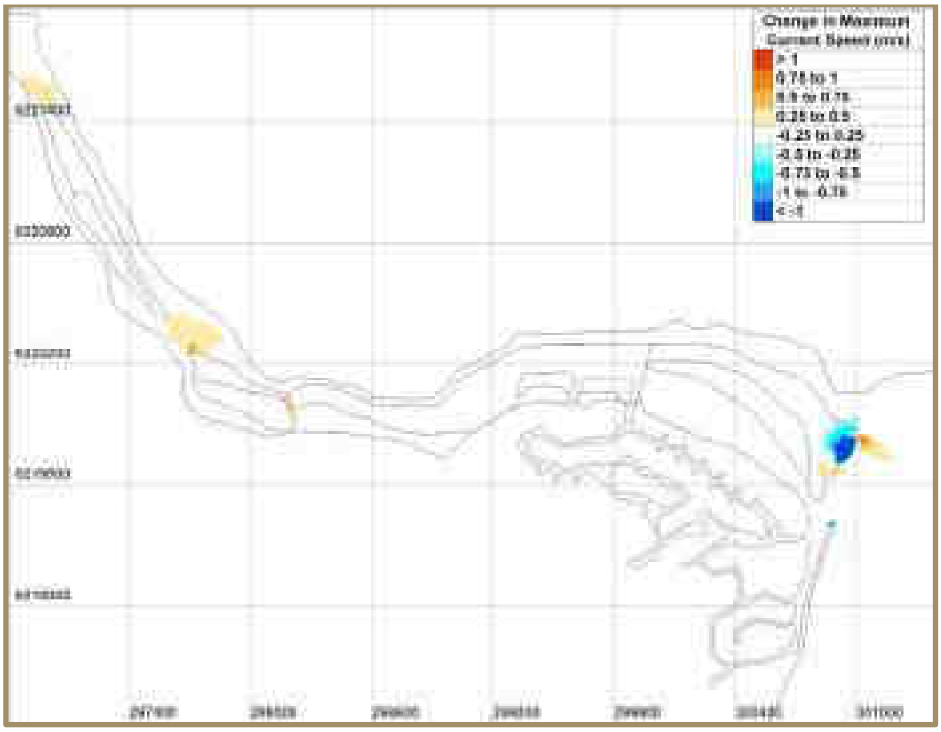

Figure 58: Change in Maximum Current under High Discharge conditions between pre- and post- dredging scenarios

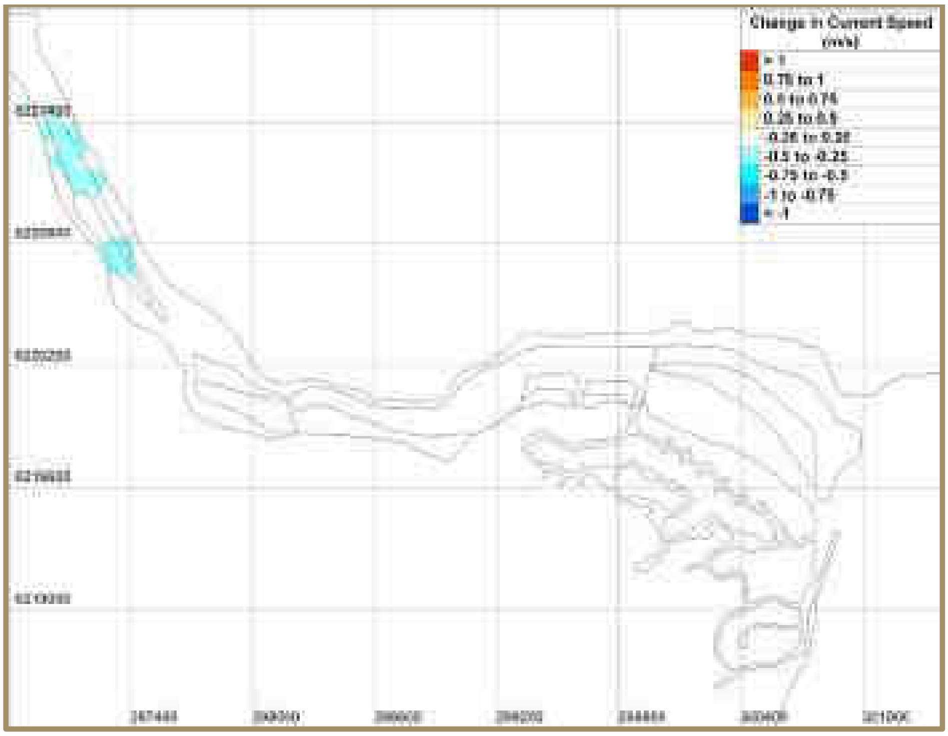

Figure 59: Change in Flood Current during Spring Tide under High Discharge conditions between pre- and post- dredging scenarios

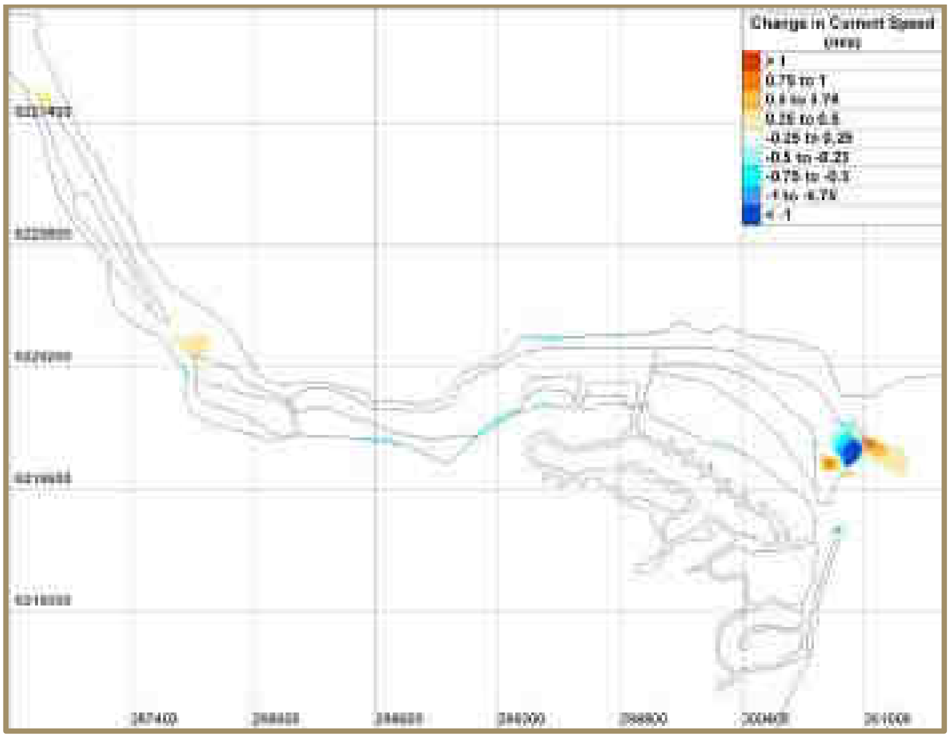

Figure 60: Change in Ebb Current during Spring Tide under High Discharge conditions between pre- and post-dredging scenarios

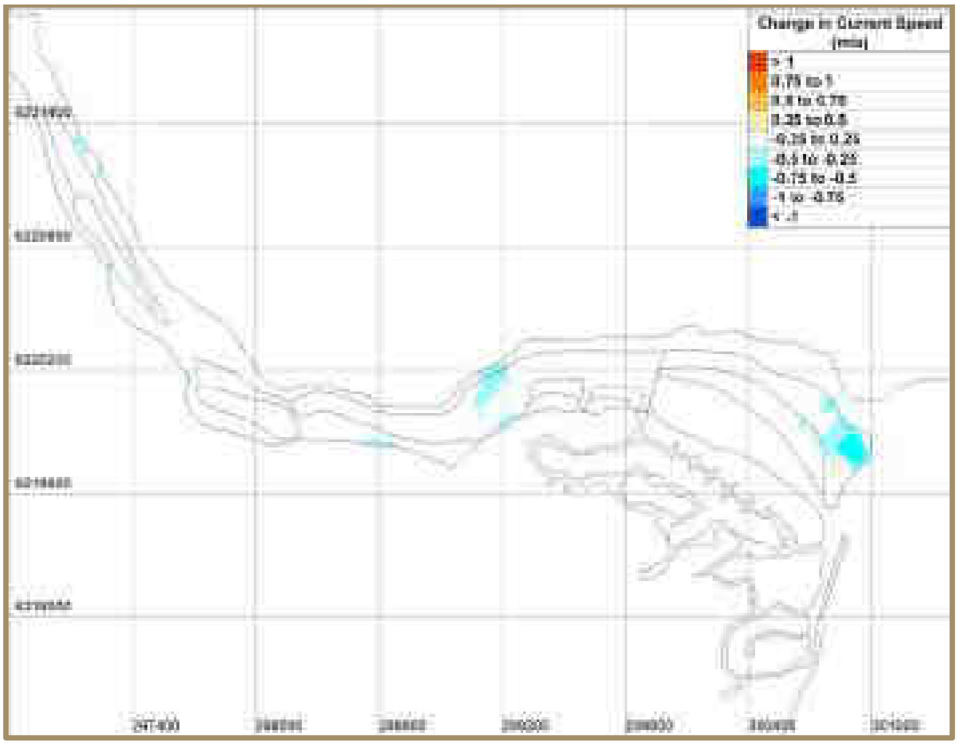

Figure 61: Change in Flood Current during Neap Tide under High Discharge conditions between pre- and post-dredging scenarios

Advisian

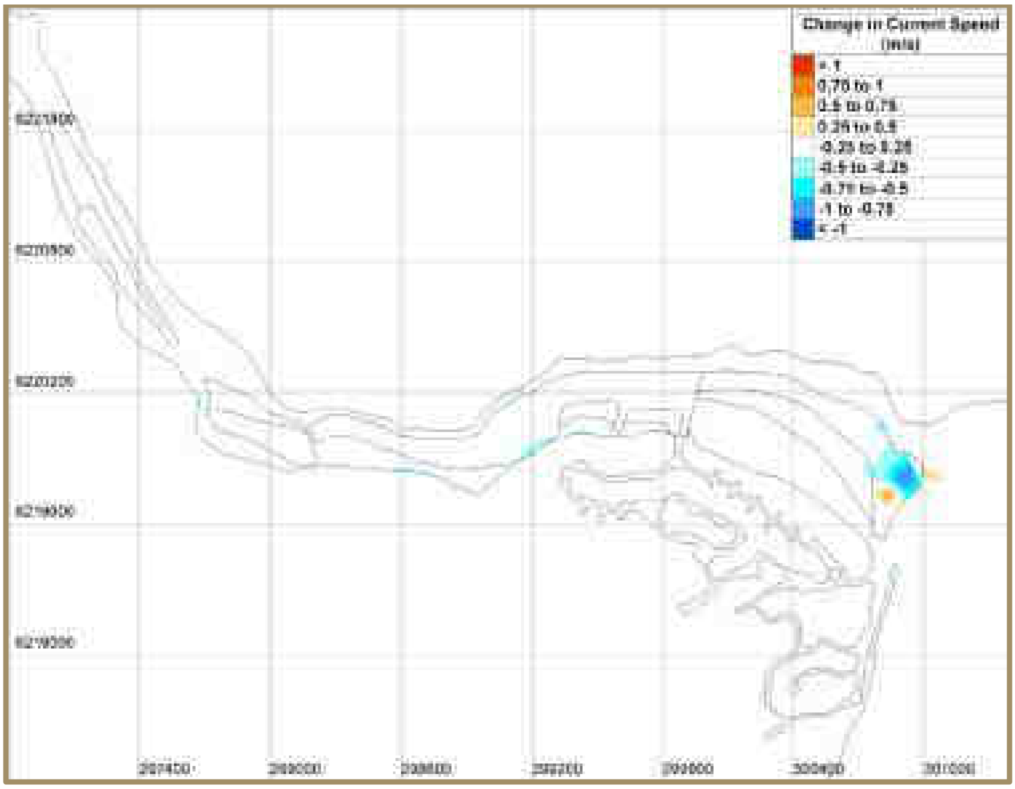

Figure 62: Change in Ebb Current during Neap Tide under High Discharge conditions between pre- and post-dredging scenarios

Appendix D
Temporal Variation in Flow Parameters (High River Discharge Condition)

Temporal variations of flow parameters were extracted at five different points (Figure 63) for pre- and post-dredging scenarios (high river discharge condition).

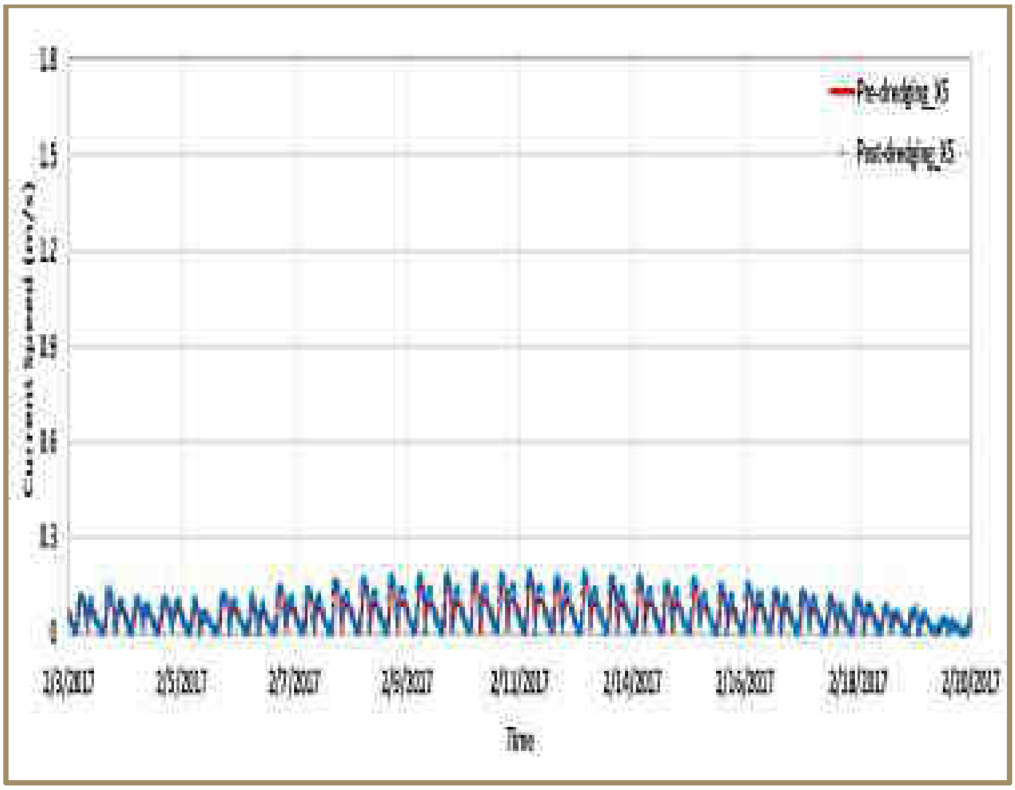

Figure 63: Data Extraction Points for Comparison of Hydrodynamics

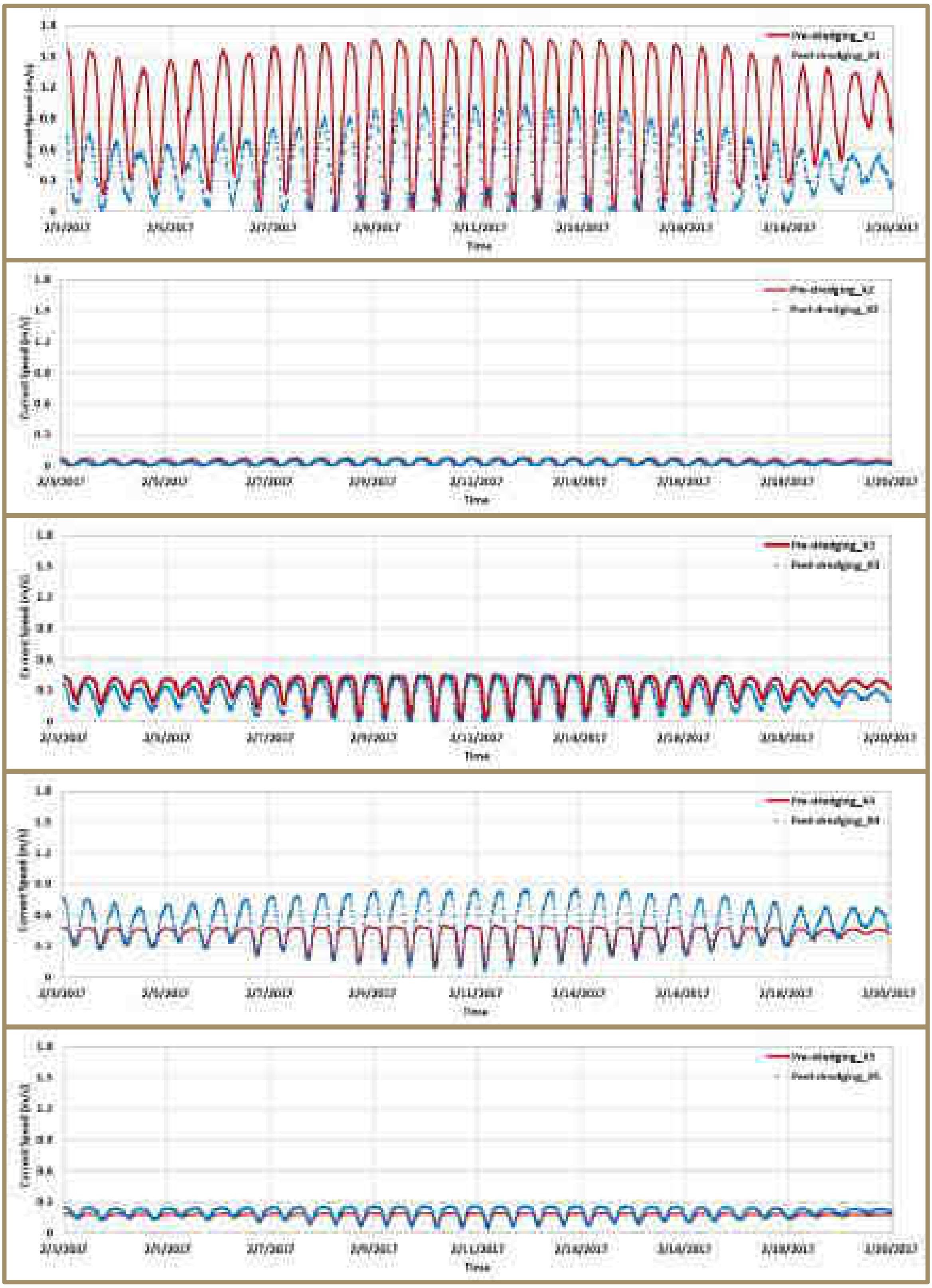

Figure 64: Comparison of Current Speeds in Pre- and Post-dredging Conditions (High River Discharge Condition)

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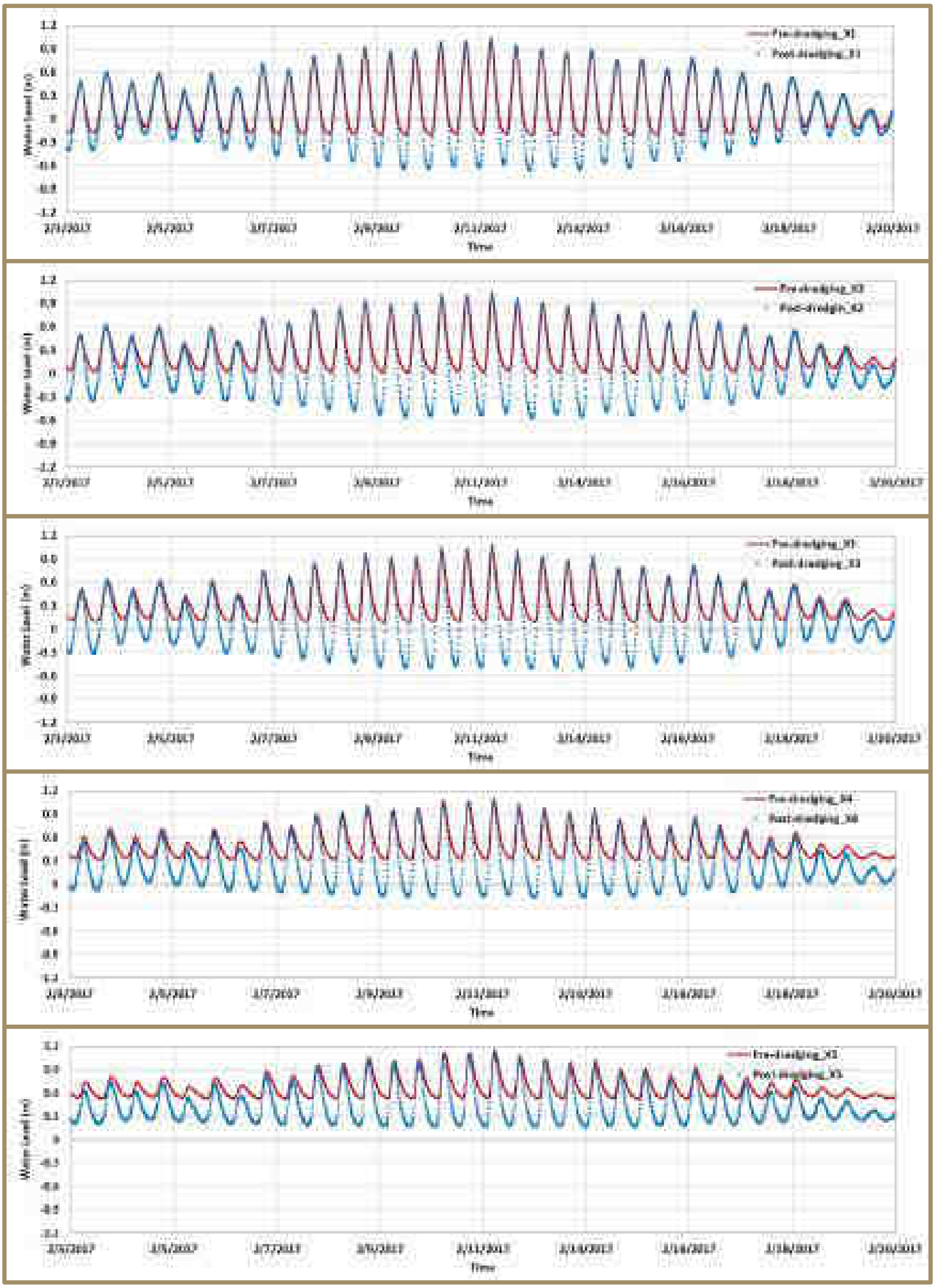

Figure 65: Comparison of Water Levels in Pre- and Post-dredging Conditions (High River Discharge Condition)

St. Francis Bay Beach Long-Term Coastal Protection Phase 2

Supplementary Shoreline Modelling Report

St. Francis Property Owners NPC

06/11/2020

C00729

Advisian

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Company details

Worley RSA (Pty) Ltd.

Melrose Arch
39 Melrose Boulevard Melrose Arch
Johannesburg 2176
South Africa

T: +27 11 218 3000
F: +27 11 218 3100

PROJECT C00729 - 01-PMT-PRE-0003: St. Francis Bay Beach Long-Term Coastal Protection Phase 2 - Supplementary Shoreline Modelling Report

Rev	Description	Author	Review	Advisian approval	Revision date	Client approval	Approval date
A	Issued to Client	AVD / FB	FS	TC	21/10/2020		
B	Re-Issued to Client	AVD / FB	FS	TC	06/11/2020		

-

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Executive summary

This report presents the revision of the numerical wave and shoreline modelling carried out as part of the preliminary design (Task i) to assess the proposed changes to the overall groyne layout of the St. Francis Bay coastal protection scheme requested by SFPO NPC on 18 April 2020.

Available information on bathymetry, topography, wave and wind conditions, tidal levels and sediment characteristics was used to establish the metocean and seabed conditions at the project site.

The numerical models previously used to define the preferred long-term coastal protection layout (Advisian, 2018) were updated using updated bathymetric and topographic data. As a result, more accurate nearshore wave climates were established to assess the shoreline evolution along the project site due to the construction of the two long-term coastal protection schemes considered, i.e. Advisian general layout and SFPO modifications to the proposed general layout.

With reference to the wave modelling results, the following was found:

- The wave climate in St. Francis Bay is considered mild since most of the swell wave energy is substantially reduced in wave height due to the shelter offered by Cape St. Francis, as well as refraction and diffraction effects.
- Local strong easterly winds can generate strong short-period waves throughout St. Francis Bay enhancing the harshness of the coastal environment.

A shoreline evolution assessment was carried out to compare the two long-term coastal protection schemes considered in this study. The following was noted from this assessment:

- The longshore transport along St. Francis Bay has a net northerly direction. This is clearly seen in the shoreline evolution modelled as part of the validation exercise, prior to the construction of the groynes.
- Slight differences on the future shoreline planform were observed between the two long-term coastal protection layouts, even though the SFPO layout has one additional groyne at the coastal revetment located immediately south of the Kromme river mouth.
- It is recommended that newly proposed Groyne 5 of SFPO's layout be constructed in an oblique angle (similar to Groyne 4 from Advisian's proposed layout) as this will assist in protecting the sand spit of breaches if no nourishment is undertaken nor revetments are constructed.
- The inclusion of the additional groyne (newly proposed Groyne 4 in SFPO's layout) will only marginally assist in stabilising the beach in front of the revetment when regular nourishment of the beach is undertaken; however, its construction can be delayed if required.
- The total length of the groynes ranges between 170 m and 200 m for both coastal protection layouts. These lengths were established as follows:
  - The seaward end of the groynes was located as far as practically possible bearing in mind constructability of such structures going towards "deeper" waters versus effective blockage of littoral drift. It should be noted that approximately 50% of sand by-passing around these structures should be expected.
  - To ensure the stability of the rock groynes against toe scouring, the root of the groynes was embedded in the nourished beach slope or existing coastal revetments.

- The long-term planform when considering the maintenance beach nourishment evolves in a similar manner to the long-term shoreline presented in this study but shifted seawards (see Figure 6-12 and Figure 6-13), as long as maintenance nourishment of 6,000 m^3/year for the embayments south of the spit and 10,000 m^3/year for the remaining embayment at the spit takes place on a regular basis.
- Even though the construction of any of the long-term coastal protection schemes assessed in this study will have an impact on the northern coast, this effect is considered relatively limited as the length of the groynes do not extend that far offshore to fully block the entire littoral drift and, thus, the existing and future imported sand will still travel towards this northern beach area due to longshore processes.
- The proposed groyne scheme in combination with beach maintenance will provide a continues supply of sediment of approx. 28,000m^3 per year that will be transported towards the northern coastline when the complete solution is implemented. This is considered to be more beneficial to the northern coastline than allowing the St Frances Beach to erode to the extent where negligible sediment transport can occur which would result in the northern beaches experiencing accelerated erosion.

Acronyms and abbreviations

Acronym/abbreviation	Definition
CCRC	The University of New South Wales Climate Change Research Centre
CD	Chart Datum
CFSR	Climate Forecast System Reanalysis
CL	Coastline
DEM	Digital Elevation Model
GDAS	Global Data Assimilation System
GIS	Geographic Information System
HAT	Highest Astronomical Tide
H_s	Significant Wave Height
H_{m0}	Spectrally Derived Significant Wave Height
LAT	Lowest Astronomical Tide
LLD	Land Levelling Datum
LT	Longshore Transport
MepBay	Model of Equilibrium of Bay Beaches
MHW	Mean High Water
MLW	Mean Low Water
MSL	Mean Sea Level
MWD	Mean Wave Direction
NCEP	National Center for Environmental Prediction
NGI	National Geo-spatial Information
NOAA	National Ocean and Atmospheric Administration
SDB	Satellite Derived Bathymetry
SFPO	St. Francis Property Owners
SI	International System of Units
SLR	Sea Level Rise
T_P	Peak Wave Period
UNIBEST	Uniform Beach Sediment Transport
UTM	Universal Transverse Mercator

WD	Wind Direction
WGS84	World Geodetic System
WS	Wind Speed
WW3	WaveWatch III

1 Introduction

The purpose of the current Project is the design and construction supervision of Phase 2 of the long-term coastal protection, beach renourishment and sand retention structures at St. Francis Bay.

The project scope of work is outlined below:

i. Provide feasible long-term solutions that will restore beach amenity, that is both time and cost effective:
    a. Present alternative long-term conceptual solutions.
    b. Select the preferred solution during a Workshop, to be further developed during the Preliminary Design;
    c. Detail and optimize the design with a focus on minimizing capital and maintenance costs during the detailed design stage;
ii. Interact with the environmental consultant on the project as required;
iii. Prepare construction drawings and tender documentation;
iv. Identify suitable contractors to undertake the work;
v. Assist during tendering and respond to contractors' queries;
vi. Assess submitted tenders and compile a tender report with recommendation;
vii. Carry out 6 months of construction monitoring during the implementation phase.

This report is related to the update of the numerical wave and shoreline modelling carried out as part of the preliminary design (Task i) to accommodate the requested changes on the overall groyne layout and orientation of the proposed protection scheme. This report is intended to be an addendum to the initial numerical modelling report which forms part of the Preliminary Design Report (Advisian, 2018).

1.1 Reference Systems and Projections

1.1.1 Project datum and projection

The coordinate system to be used for all setting out and survey shall be UTM, Zone 34H, spheroid WGS84.

All levels in maritime works shall be relative to Chart Datum (CD) which is the Lowest Astronomical Tide (LAT) in all ports in South Africa. CD is 0.836 m below the Mean Sea Level (MSL) or Land Levelling Datum (LLD).

1.1.2 Direction convention

- Wind and wave: wind and wave directions refer to the directions wind and wave are coming from.

1.1.3 Units

S.I Units are adopted throughout the drawings, calculations and documentation.

Table 1-1: Units

Parameter	Units	
Water depth	metres	(m)
Water level	metres	(m)
Wave direction	degrees	(º, deg.)
Wave height	metres	(m)
Wave period	seconds	(s)
Wind direction	degrees	(º, deg.)
Wind speed	metres per second	(m/s)

1.2 Report Structure

The report is structured as follows:

Section 2 describes the updates made to the physical and environmental site characteristics as well as a summary of the relevant environmental characteristics, which serves as input to the coastal numerical modelling presented in Section 5 and 6. The modelling comprises wave modelling described in Section 5 and long-term shoreline evolution modelling presented in Section 6. The updates are related to the topographic and bathymetric data. For more information about the environmental and site characteristics, refer to the previous numerical modelling report.

Section 3 presents the preliminary design of the preferred option based on the conceptual layout options outlined in (Advisian, 2018), as well as the requested changes to the preferred option considering the suggestions from the Client.

Section 4 lists the numerical models used in this study and provides a brief overview of the models' capabilities.

The report is concluded with recommendations given in Section 7 and followed by the list of references cited throughout the report in Section 8.

2 Site Characterisation

A summary of the relevant environmental information to undertake this additional modelling study is provided in the following sub-sections. For further information, refer to the preliminary design report (Advisian, 2018).

2.1 Bathymetry

The following bathymetric data was utilized in the present study:

- ETOPO2 Topographic and Bathymetric model generated from several digital databases of seafloor and land elevations on a 2-minute latitude/longitude grid (National Geophysical Data Center, 2006). It includes a combination of satellite altimetry observations, shipboard echo-sounding measurements, data from the Digital Bathymetric Data Base Variable Resolution and data from the GLOBE project.
- Project specific satellite derived bathymetric data, as shown in Figure 2-2, was acquired from EOMAP in February 2020 (EOMAP, 2020). Satellite-Derived Bathymetry (SDB) is the most recently developed method of surveying shallow waters. SDB algorithms developed since the 1990s, strictly follows physics-based, quantitative solutions to convert information collected by satellite sensors into bathymetric data. SDB data fulfil the highest quality requirements and are being used in recent nautical charts, operational hydrodynamic models and coastal zone management plans. SDB data is available in very high (2 m), high (10 m) and moderate (15-30 m) spatial resolutions.
- A detailed bathymetric survey study was also undertaken by Mr Dylan Anderson during 2005 as part of his MSc studies (ASR, 2006). Despite study team requests, the raw survey data depicted in Figure 2-3 was unfortunately not made available. The image was however digitised, and the depth contours were manually traced, so use of this bathymetric data was possible.

Figure 2-1 shows the coverage of the bathymetric survey data sets in the project vicinity. The project specific satellite data provided by EOMAP was supplemented the ASR local survey and the ETOPO2 database in the offshore areas (see Figure 2-1).

All bathymetric data presented in this report is set relative to CD.

The nearshore sea bed slope (200 to 300 m from the coastline) varies approximately between 1 in 40 and 1 in 70.

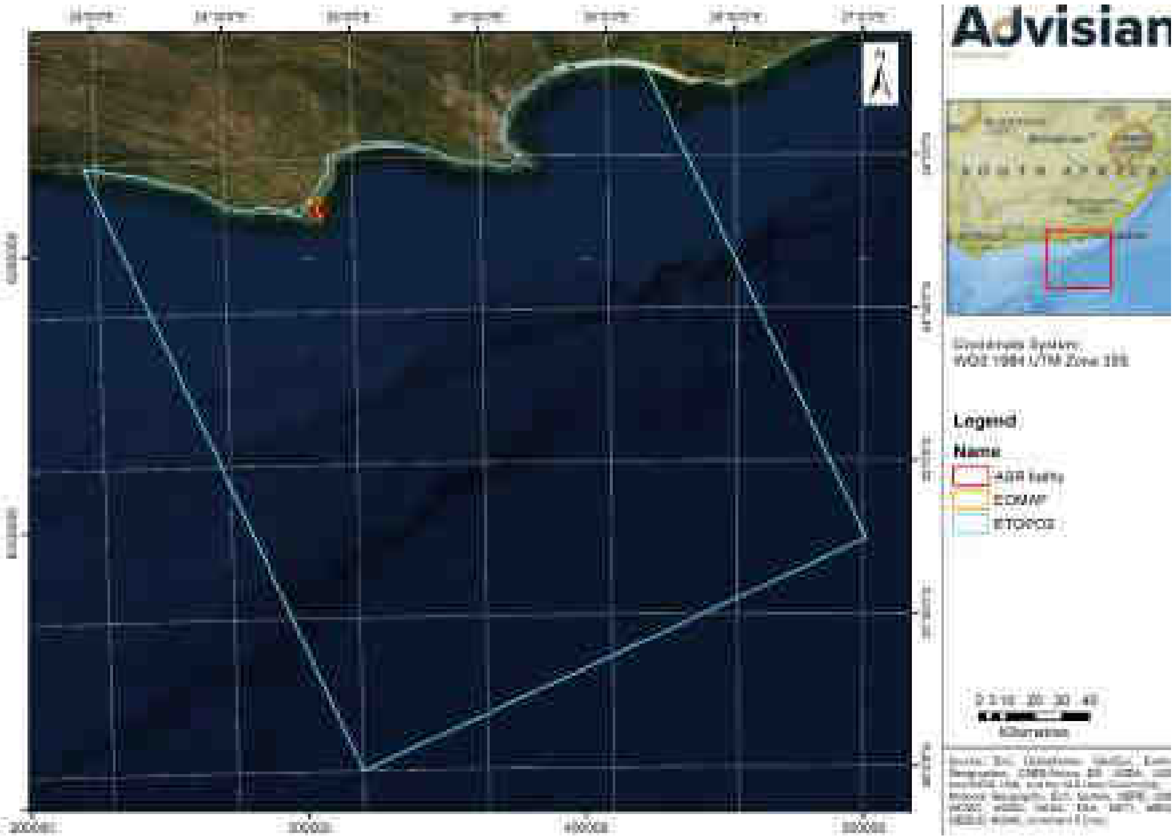


Figure 2-1: Location and extents of bathymetric data sources

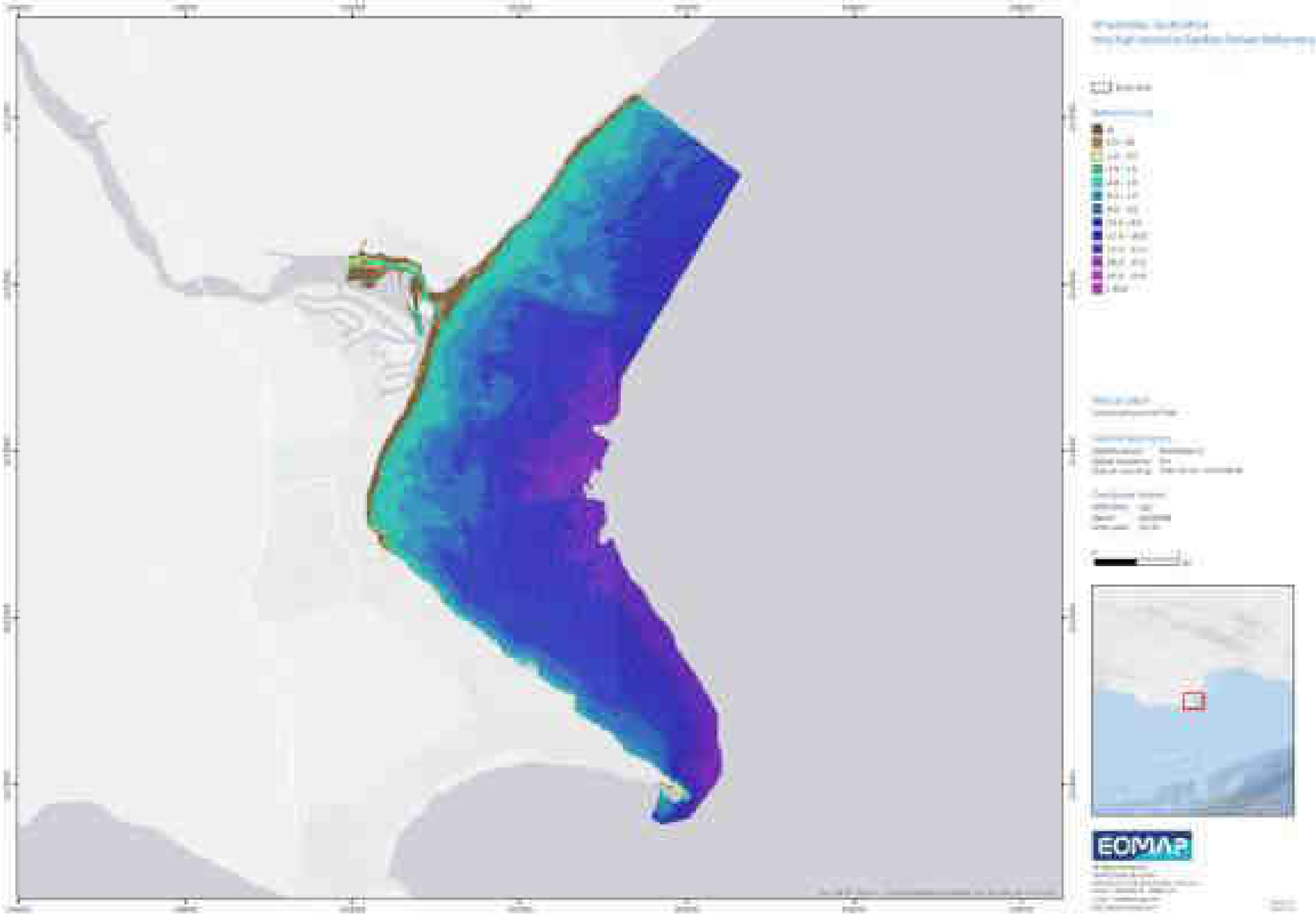


Figure 2-2: Very high-resolution Satellite Derived Bathymetry for St. Francis Bay (EOMAP)

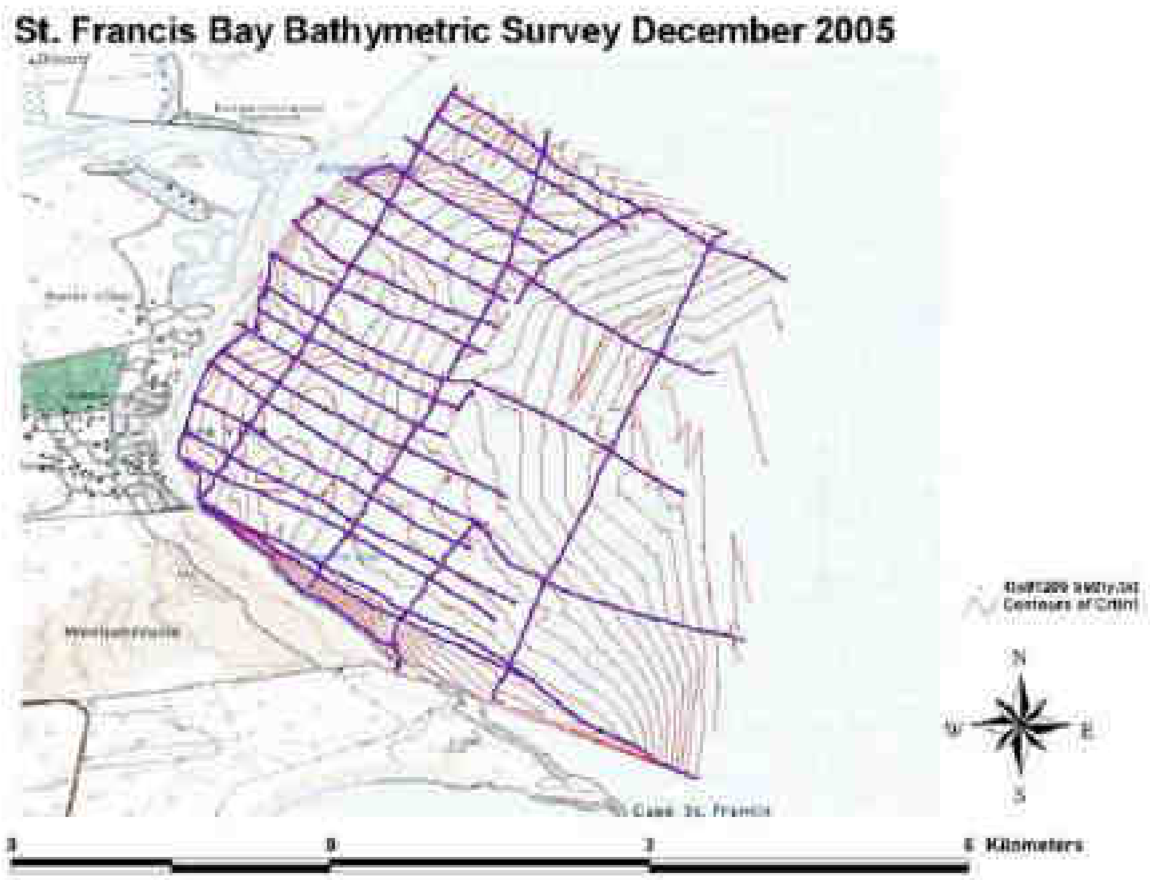


Figure 2-3: Bathymetric Chart showing the survey run-lines (ASR, 2006)

2.2 Topography

The following topographic data was utilized in the present study:

- National Geo-spatial Information (NGI) has developed and maintains a Digital Elevation Model (DEM) covering approximately 66% of South Africa. The DEM derived from photogrammetric applications (i.e. stereo digital imagery) at 25 m resolution is accurate to 3 m at a 95% confidence level.
- Detailed site-specific beach profile surveys undertaken by Maarschalk & Partners including an additional beach survey undertaken in February 2020.

Topography elevation data from the detailed profile surveys was supplemented with 25 m DEM datasets obtained from NGI for the project area.

All topographic data presented in this report is set relative to LLD.

2.3 Beach Sand Grain Size

The same sand information as previously presented in the preliminary design report (Advisian, 2018) was utilised in this study. The average median grain size, D_{50}, of the upper beach was found to be 0.18 mm and the lower beach was 0.22 mm.

2.4 Tidal Levels

The same tidal information as previously provided in the preliminary design report (Advisian, 2018) was utilised in this study, which were related to the tidal planes derived at Port Elizabeth (The SA Navy Hydrographer, 2017).

2.5 Offshore Wind and Waves

Offshore winds and waves were extracted at NWW3 Wind (Wave) 1, located approximately 205 km south of the site (Longitude = 36.0 °S, Latitude = 25 °E), from the National Center for Environmental Prediction (NCEP) WaveWatch III (WW3) global hindcast model, which is developed and administrated by the National Ocean and Atmospheric Administration (NOAA) covering the period between 1997 and 2015 (18 years dataset). For further details, refer to (Advisian, 2018).

Figure 2-4 and Figure 2-5 present a wind and wave rose, respectively, with an annual average breakdown from the extracted hindcast wind and wave dataset.

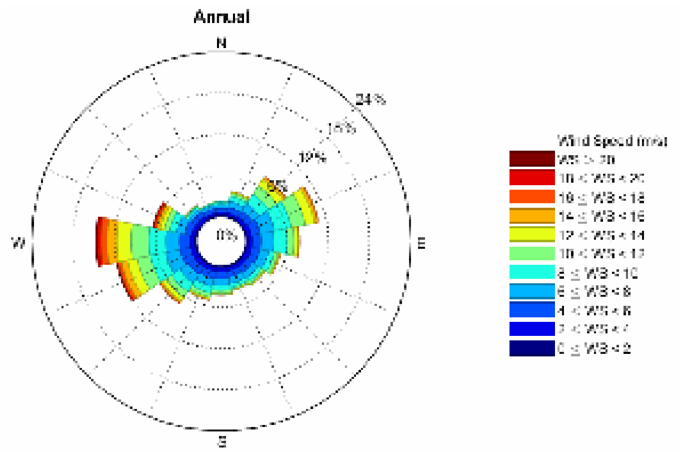


Figure 2-4: Annual wind rose based on the 3-hourly wind time-series extracted at NWW3 Wind 1. Source: (Advisian, 2018)

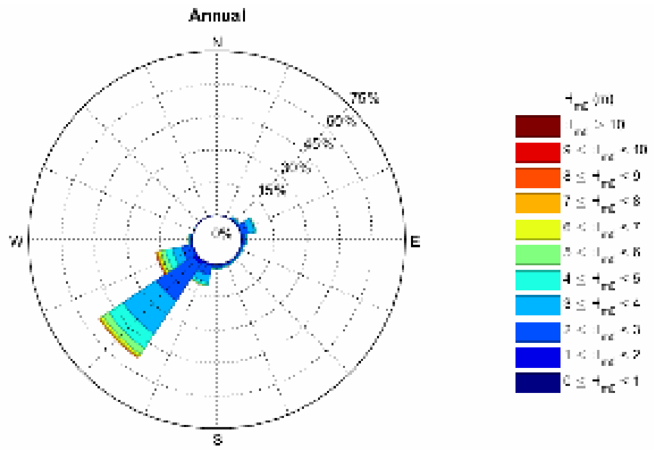


Figure 2-5: Annual wave rose based on the 3-hourly wind time-series extracted at NWW3 Wave 1. Source: (Advisian, 2018)

The wind rose diagram indicates that the principal wind is coming from the western sector. There are also strong winds coming from the east-north-eastern sector.

The wave rose diagram indicates that the waves are predominantly from the southwest directional sector, which is consistent with the main wind direction.

3 St. Francis Bay Long-Term Coastal Protection Layout

3.1 Preliminary Design General Layout

The general layout of the groyne scheme as conceived in (Advisian, 2018), was developed using results from the preliminary beach evolution numerical models (long-term shoreline evolution and short-term beach stability study) in conjunction with guidelines provided in the (USACE, 2002), (CIRIA/CUR/CETMEF, 2007) and (Van Rijn, 2013). The concept layout is shown in Figure 3-1. For further details, refer to the preliminary design report (Advisian, 2018).

Figure 3-1: Preliminary Design General Layout Plan (Advisian, 2018)

The tips of the groynes are within the surf zone allowing for some sand bypassing. The groynes are spaced approximately two to three times their length apart. To prevent outflanking of the groynes during storm events the roots of the groynes are extended to the back of the beach.

Beach nourishment will be placed between the groynes and is extended 50 m further on either side of the groynes in order to reduce possible further erosion of the adjacent unnourished downstream beaches.

3.2 Alternative General Layout

The general layout of the groyne scheme as conceived in (Advisian, 2018), was publicly reviewed. Modifications to that groyne arrangement were proposed, which consisted of relocation of some groynes, inclusion of one additional groyne and change of the groyne orientation. Figure 3-2 presents the alternative layout.

Figure 3-2: Alternative General Layout Plan

4 Description of Coastal Processes Modelling

The sediment transport along the St. Francis Bay shoreline is largely driven by the nearshore wave climate. In the absence of local wave measurements at the project site, a revision of the already set-up numerical wave modelling was undertaken to estimate the nearshore wave conditions.

Possible shoreline changes due to both cross-shore and longshore sediment transport were evaluated through numerical models in the preliminary design report (Advisian, 2018). However, only the longshore evolution of the St. Francis Bay shoreline will be revisited in this study as a consequence of the proposed changes to the general groyne layout as outlined in Section 3.

The modelling tasks are further detailed in Section 5 (wave modelling) and Section 6 (long-term shoreline evolution).

4.1 Wave Modelling - Delft3D-WAVE

The Delft3D modelling suite was used to set up the model domain and simulate the wave climate at the project site. For these simulations Delft3D-WAVE (Deltares, 2017a) modelling module was used.

The Delft3D-WAVE module is an interface for the third-generation SWAN model (SWAN is an acronym for Simulating WAves Nearshore, see e.g. (Booij, Ris, & Holthuijsen, 1999) to simulate the evolution of random, short-crested wind-generated waves in estuaries, tidal inlets, lakes etc. SWAN solves the energy balance equation in the whole computational domain. The wave energy is discretised in a frequency and directional domain at each node of the spatial computational grid and is allowed to propagate in space and evolve in time. The following wave processes are represented in the model:

- Wave refraction over a bottom of variable depth and/or a spatially varying ambient current;
- Depth and current-induced shoaling;
- Wave generation by wind;
- Dissipation by whitecapping;
- Dissipation by depth-induced breaking;
- Dissipation due to bottom friction (three different formulations);
- Nonlinear wave-wave interactions (both quadruplets and triads);
- Wave blocking by flow;
- Transmission through, blockage by or reflection against obstacles; and,
- Diffraction.

4.2 Long-Term Shoreline Modelling - UNIBEST

The UNIBEST (Uniform Beach Sediment Transport) software suite was used to setup the model domain and simulate the coastline change at the project site. The software has been developed by Deltares to study the longshore and cross-shore processes and related morphodynamics of beach profiles and coastline evolution.

UNIBEST-CL is a sediment balance model that computes longshore sediment transports at specific locations along the coast due to various oceanographic forcing like waves and currents. Thereafter, the longshore transports are translated to shoreline evolution by calculating the gradient in the longshore sediment transport as a function of the coastline orientation.

The engines of UNIBEST-CL consist of LT (longshore transport) and CL (coastline). The former computes longshore currents and sediment transports due to various oceanic forcing, like waves and currents, while the latter uses the divergence of transport rates to calculate the actual coastline change by assuming a single line theory.

Longshore transport and its distribution along the coastal profile can be evaluated according to several total-load sediment transport formulae for sand (such as Bijker, Kamphuis, van Rijn, etc.) or gravel (Van der Meer & Pilarczyk). As sections within the coastal cells accrete or erode, shoreline angle changes, and transport rates adjust to the changed wave approach angle.

A background description of the Deltares UNIBEST-CL+ software applied in this study is included in Appendix C.

4.3 Long-Term Shoreline Modelling - Equilibrium Bay Theory (MepBay)

The concept of equilibrium shoreline planforms is widely used in coastal morphodynamics and coastal engineering studies (Yasso, 1965), (Silvester & Hsu, 1997), (Short & Masselink, 1999), (Klein & Menezes, 2001), (Jackson & Cooper, 2010), (Gama, Coelho, Baptista, & Albardeiro, 2011), (Hurst, Barkwith, Ellis, Thomas, & Murray, 2015) to establish the long term expected position of a shoreline through empirical means.

The parabolic bay shaped model is the most widely adopted approach to understanding the stability of headland bay beaches. The parabolic model is based on:

- A single point of diffraction (control point) should exist in the bay.
- The wave height gradients are controlled only by the diffraction point introduced by the control point. As a result, other diffraction points that can be caused by local islands and/or bathymetric anomalies cannot be represented.
- Wave-induced currents cannot be taken into account.
- The availability of sediment and other local geological framework over which the sediment lie is assessed intuitively

Therefore, the limitations presented in the parabolic model include:

- Prediction inaccuracies close to an estuary mouth (from dominant tidal dynamics);
- Inability to predict effect of nearshore islands;
- Uncertainties in defining downcoast limits and end points;
- Omission of other dynamic variables (secondary wave motions, tidal and river currents); and
- The role of the beach grain size characteristics and the underlying geologic framework in shaping the seabed is not considered.

The MepBay software (Klein, Vargas, Raabe, & Hsu, 2003) was used to predict the shoreline position for each pocket beach based on the static equilibrium parabolic model and taking into account the various coastal structure schemes considered in St. Francis Bay (see Section 3).

5 Wave Modelling

5.1 Model Setup

5.1.1 Bathymetry and Computational Grids

The topographic and bathymetric data outlined in Section 2.2 and 2.1 were interpolated into the produced computational grids using the Delft3D-QUICKIN module, giving preference to the most recent and/or highest resolution data, where data overlaps.

A nested spectral wave model was prepared for St. Francis Bay consisting of four (4) grids (Figure 5-1). Figure 5-2 to Figure 5-6 show the bathymetry and computational grids for the models developed as part of this study; namely SFB coarse model (Figure 5-2), SFB medium 1 model (Figure 5-3), SFB medium 2 model (Figure 5-4) and SFB fine model (Figure 5-5 and Figure 5-6).

Also shown in Figure 5-6 are the locations for the selected model result extraction points to characterise the nearshore wave climate at St. Francis Bay; whilst their details are summarised in Table 5-2.

Nesting is a modelling technique in which a larger model encloses a smaller model (see Figure 5-1), and as the larger model runs it generates hydrodynamic and wave boundary conditions that can be applied to the smaller model. A benefit of this technique is the improved resolution provided by the inner, fine-scale model, while not substantially extending the model processing time.

Table 5-1 summarises the details of the computational grids used to establish the nearshore wave climates.

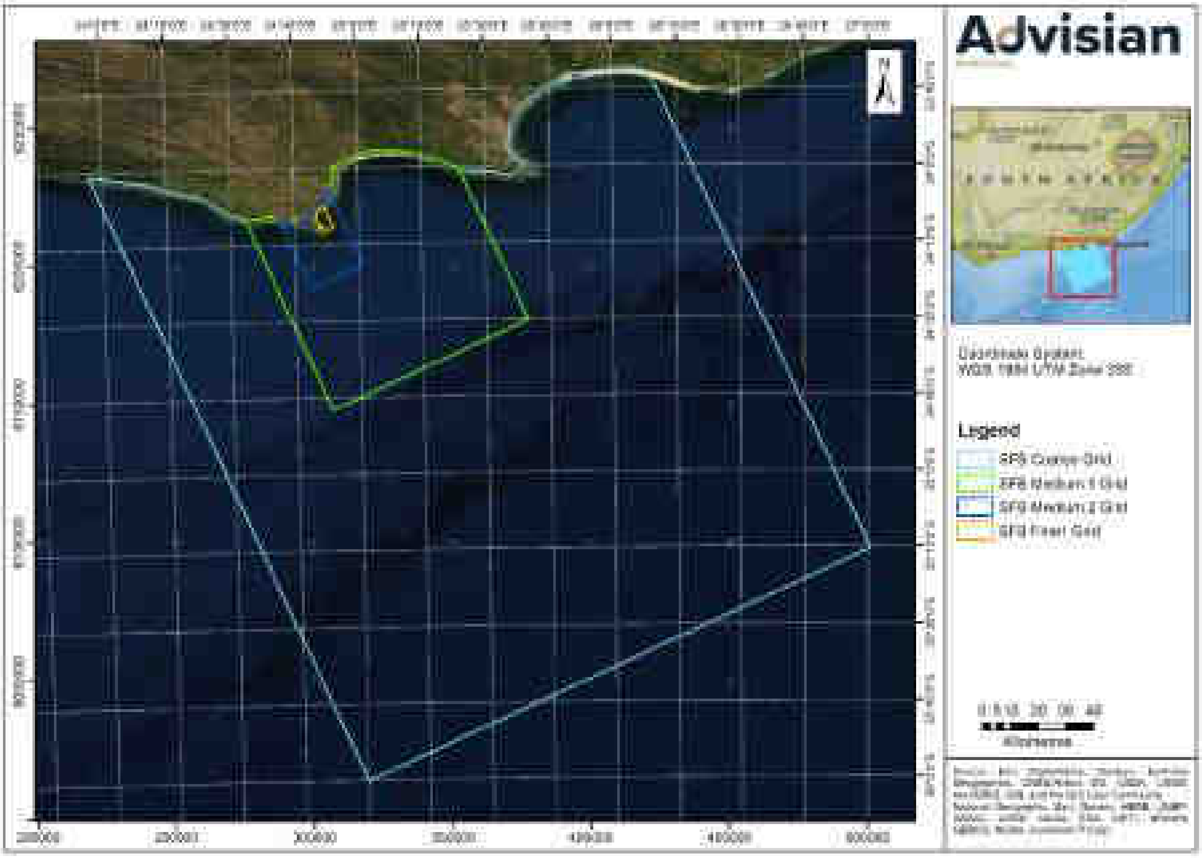
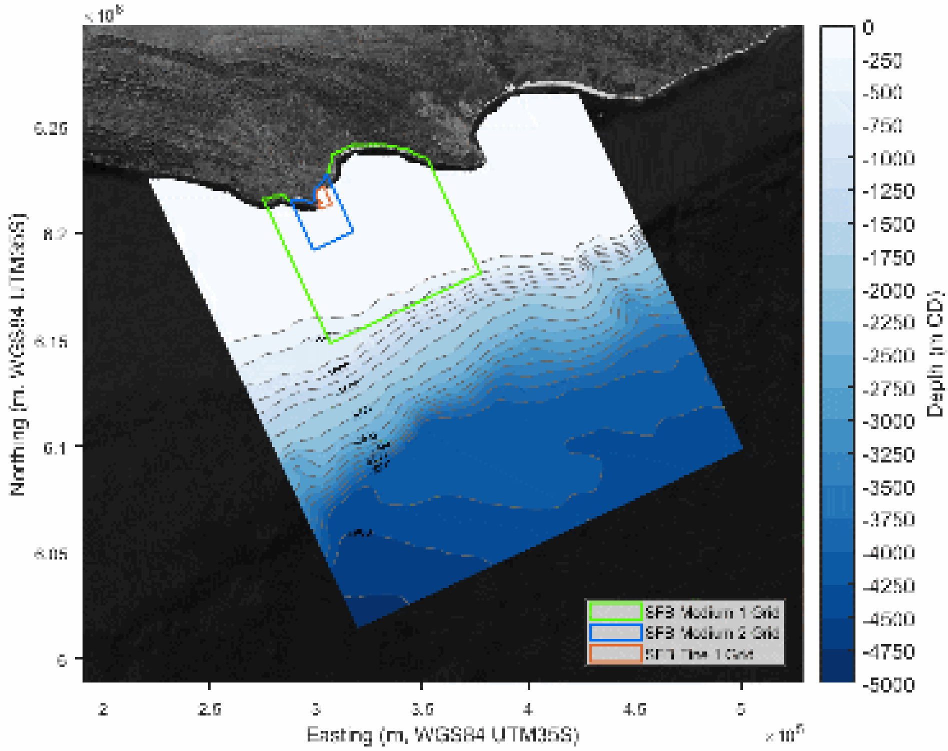


Figure 5-1: Extent of the computational domain for the nested wave model used for St. Francis Bay



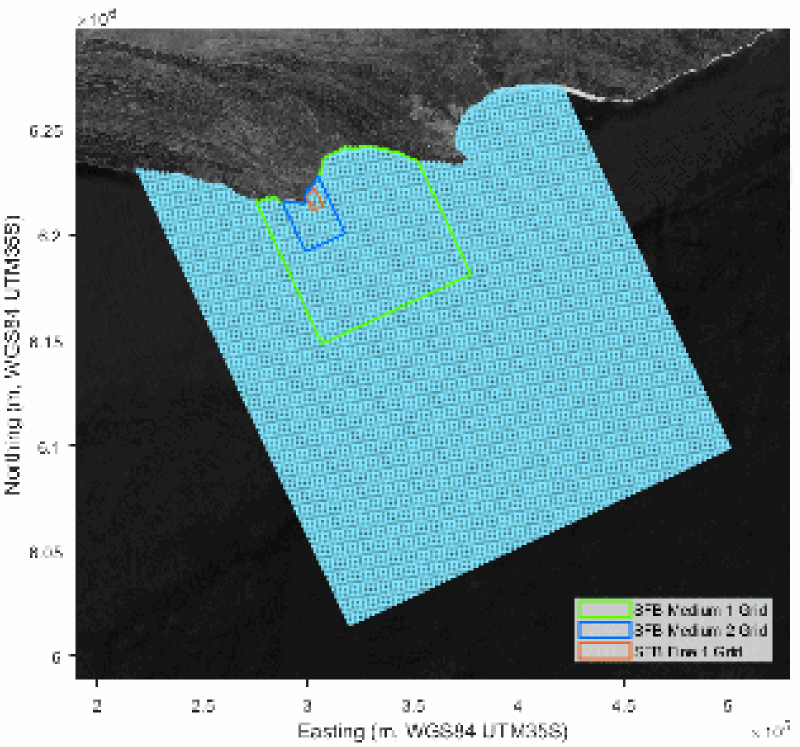


Figure 5-2 Bathymetry and computational grid for the coarse model domain

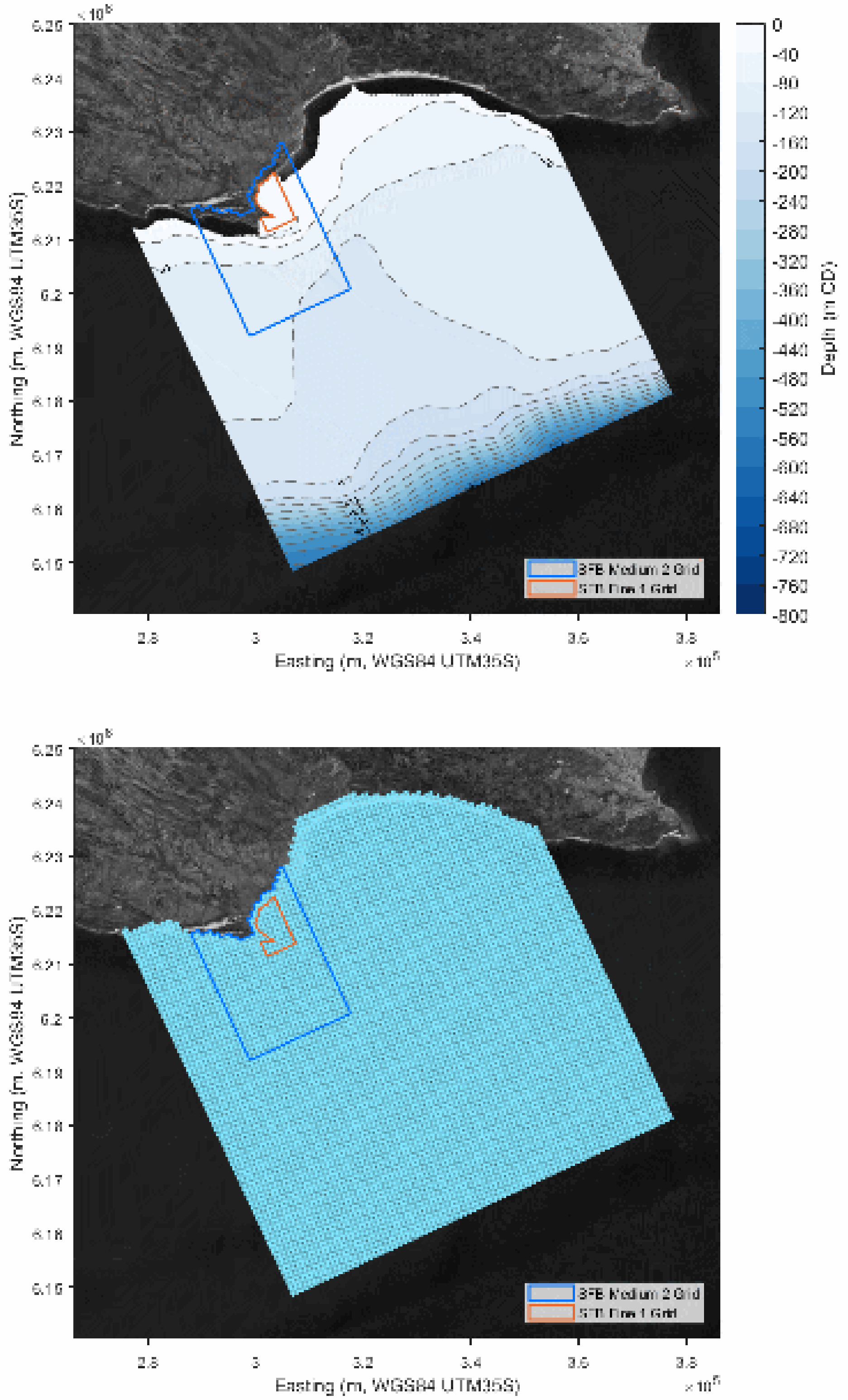
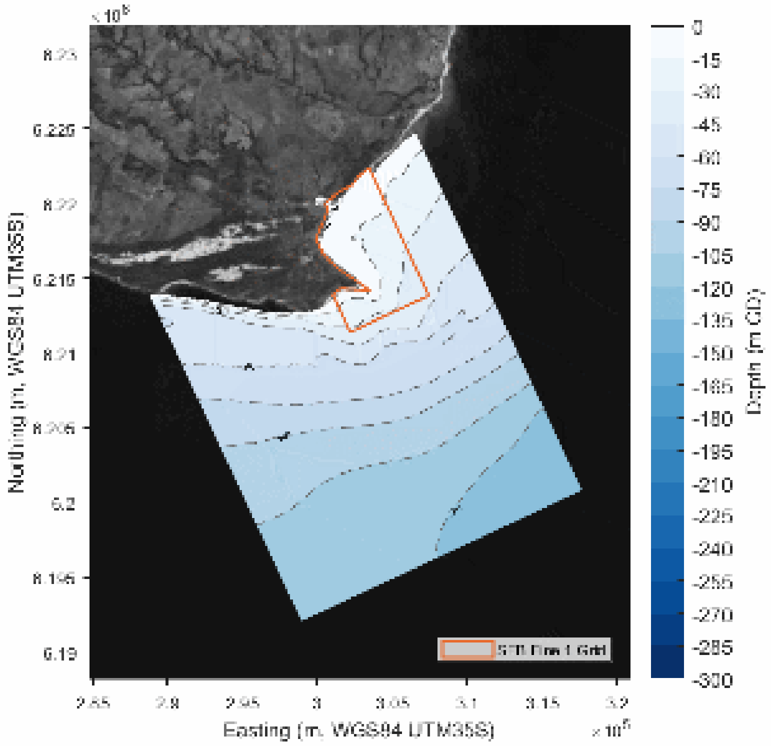


Figure 5-3 Bathymetry and computational grid for the medium 1 model domain



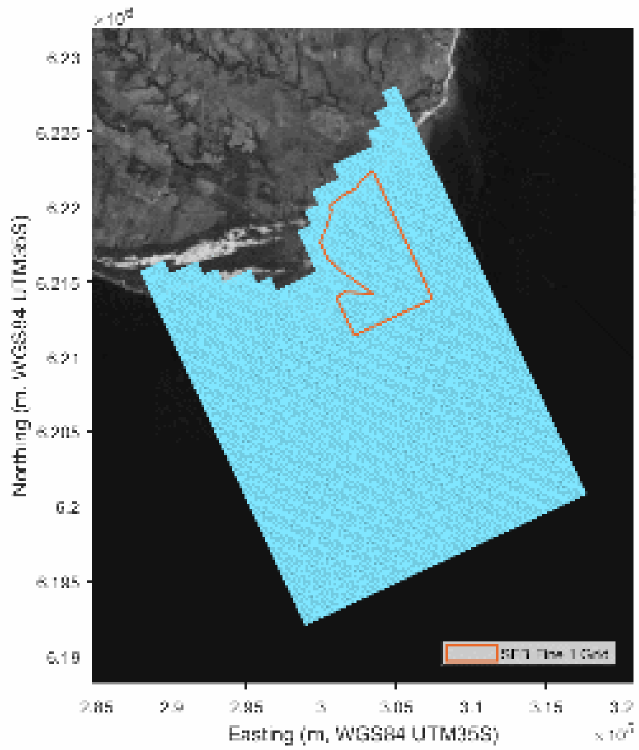


Figure 5-4 Bathymetry and computational grid for the medium 2 model domain

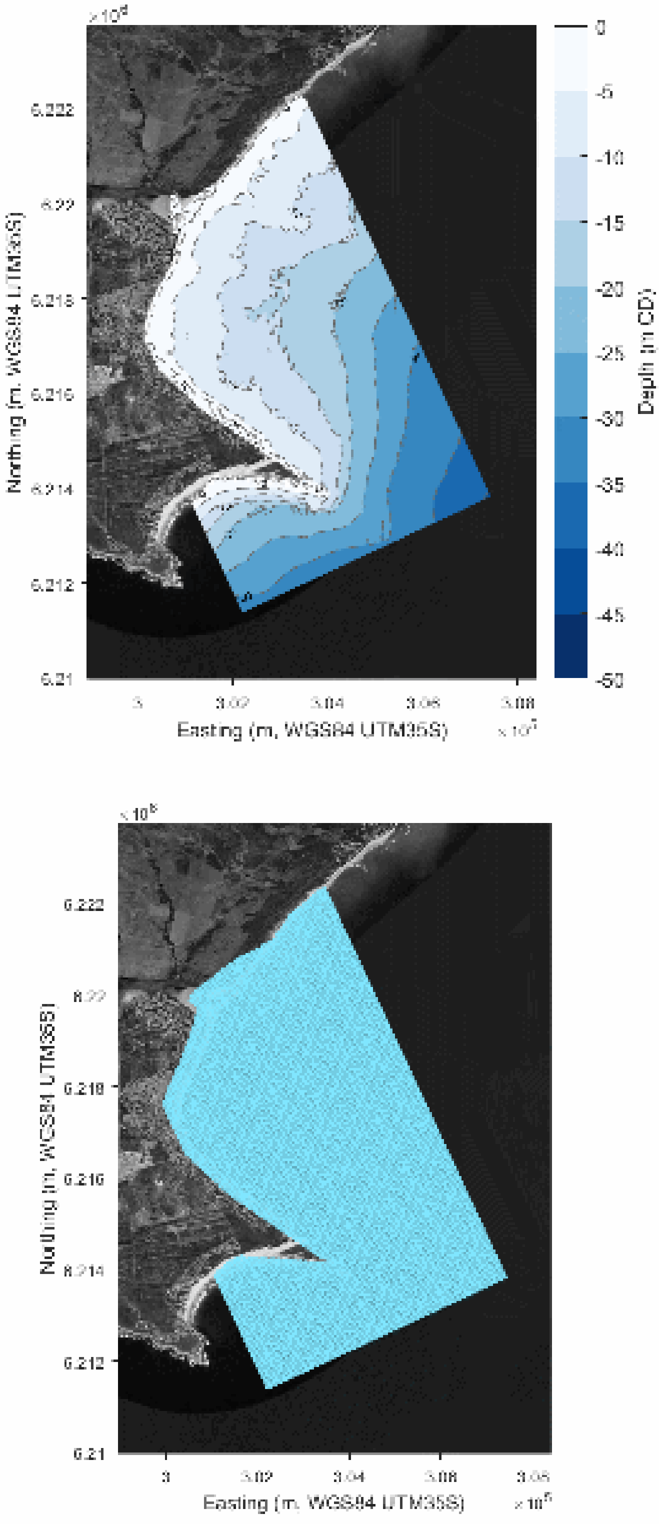


Figure 5-5 Bathymetry and computational grid for the fine model domain

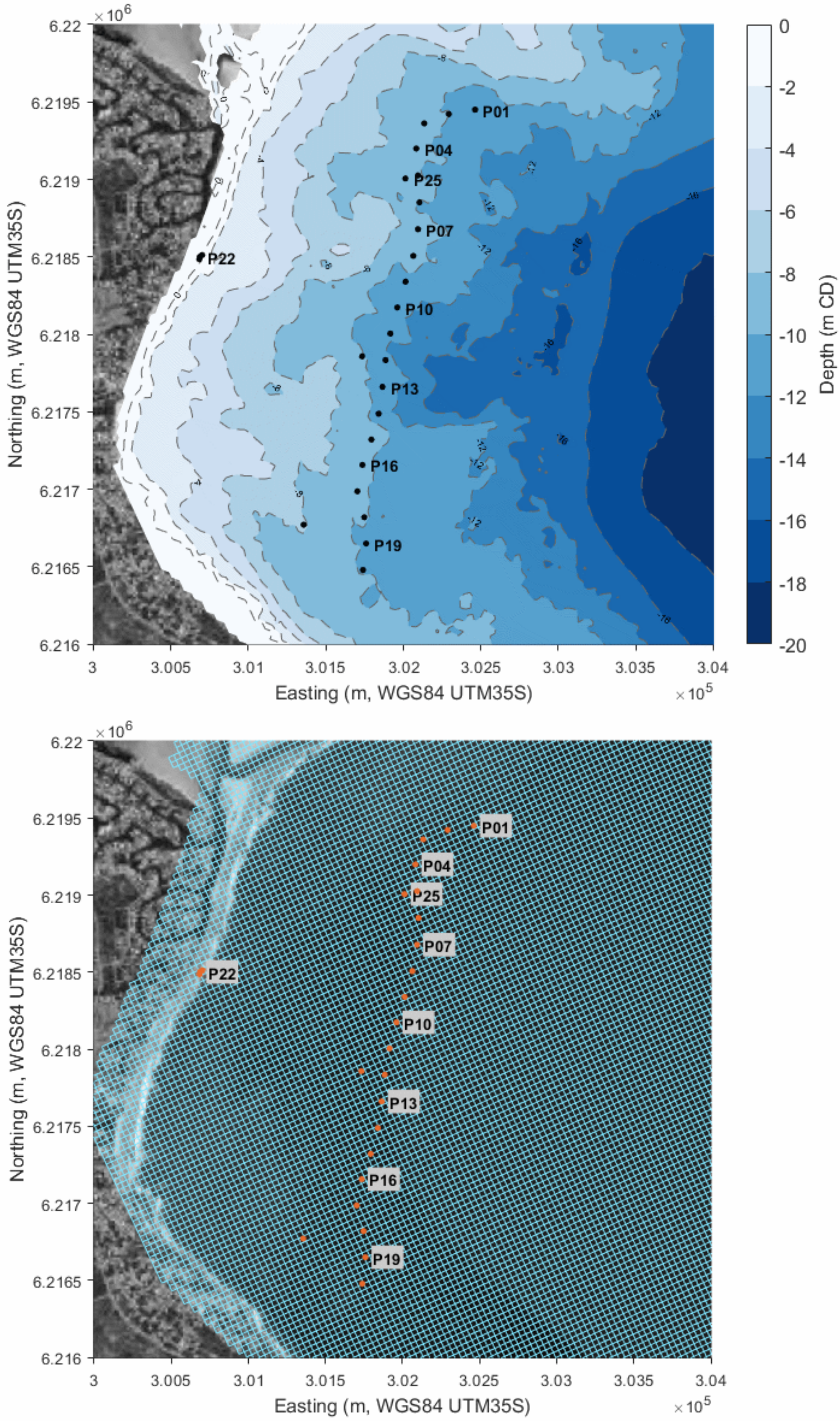


Figure 5-6 Detail of the bathymetry and computational grid for fine model domain

Table 5-1: Delft3D-WAVE computational grid details

Grid Description	Grid Length (km)	Grid Width (km)	Cell resolution (m)
Coarse	200	240	1000 x 1000
Intermediate 1	78	80	333 x 333
Intermediate 2	21	30	111 x 11
Fine 1	5.7	9.0	35 x 35

Table 5-2: Details of the wave extraction points

Point	Easting (m, UTM39N)	Northing (m, UTM39N)	Depth contour (m, CD)
P01	302,463	6,219,451	-10.7
P02	302,293	6,219,423	-10.0
P03	302,134	6,219,361	-9.7
P04	302,083	6,219,200	-9.4
P05	302,094	6,219,026	-9.7
P06	302,103	6,218,852	-10.1
P07	302,094	6,218,678	-8.8
P08	302,063	6,218,507	-9.4
P09	302,014	6,218,340	-10.5
P10	301,960	6,218,174	-11.5
P11	301,916	6,218,005	-11.1
P12	301,885	6,217,834	-11.3
P13	301,865	6,217,661	-10.8
P14	301,840	6,217,488	-10.8
P15	301,793	6,217,320	-9.4
P16	301,735	6,217,156	-9.4
P17	301,703	6,216,986	-9.7
P18	301,747	6,216,819	-9.8
P19	301,759	6,216,650	-10.5
P20	301,739	6,216,477	-10.2

P21	300,702	6,218,512	0.1
P22	300,687	6,218,501	0.4
P23	300,683	6,218,486	0.3
P24	301,733	6,217,858	-9.8
P25	302,013	6,219,006	-9.0
P26	301,356	6,216,770	-7.9

5.1.2 Boundary and Domain Conditions

Offshore wave and wind conditions were extracted from the National Centers for Environmental Prediction (NCEP) WaveWatch III (WW3) global hindcast model (Section 2.5) were applied along the domain boundaries and throughout the model domain of the coarse grid, respectively, and numerically propagated towards the shore.

Instead of running a continuous simulation for the entire 18-year period, combinations of significant wave height, direction, period, wind speed and wind direction were simulated. Sea (locally generated) and swell were simulated separately. The results from the discrete simulations are then linearly interpolated to the continuous time series data at the desired locations nearshore.

The characteristics of the simulated conditions are presented in Table 5-3.

Table 5-3: Simulated conditions

Parameter	Range	Bin size	No. of Bins
H_{m0} (m)	0 – 12	2	6
T_P (s)	0 – 20	4	5
MWD (°)	0 – 315	45	8
WS (m/s)	0 – 28	4	7
WD (°)	0 - 330	30	12

5.1.3 Model Parameters

A spectral discretisation of 36 directions and 24 frequencies was adopted for the wave modelling. The model was run using the third-generation mode for wind input, quadruplet interactions and whitecapping. The formulations proposed in (Komen, Hasselmann, & Hasselmann, 1984) were applied and the model was run in stationary mode. This implies that the model was run as if conditions were stationary, i.e. the conditions last long enough for seas to develop fully. This can be viewed as a conservative approach. Bottom friction was included in the simulations.

All scenarios were run with constant water levels set to Mean Sea Level.

5.2 Nearshore Wave Climate

The wave climate in St. Francis Bay is considered relatively mild since most of the offshore swell wave energy is substantially reduced in wave height due to the shelter offered by Cape St. Francis, as well as refraction and diffraction effects (Figure 5-7). However, local strong winds can generate strong short-period waves throughout St. Francis Bay which enhances the harshness of the coastal environment. This is demonstrated in the wave height vector fields plotted in Figure 5-8 to Figure 5-11, which provide the simulated wave conditions for the strongest easterly and westerly wind conditions in combination with easterly and south-westerly swell, respectively.

The reductions in wave heights in the nearshore are due to the combined effects of offshore shoals, refraction, diffraction, bed friction losses and wave breaking.

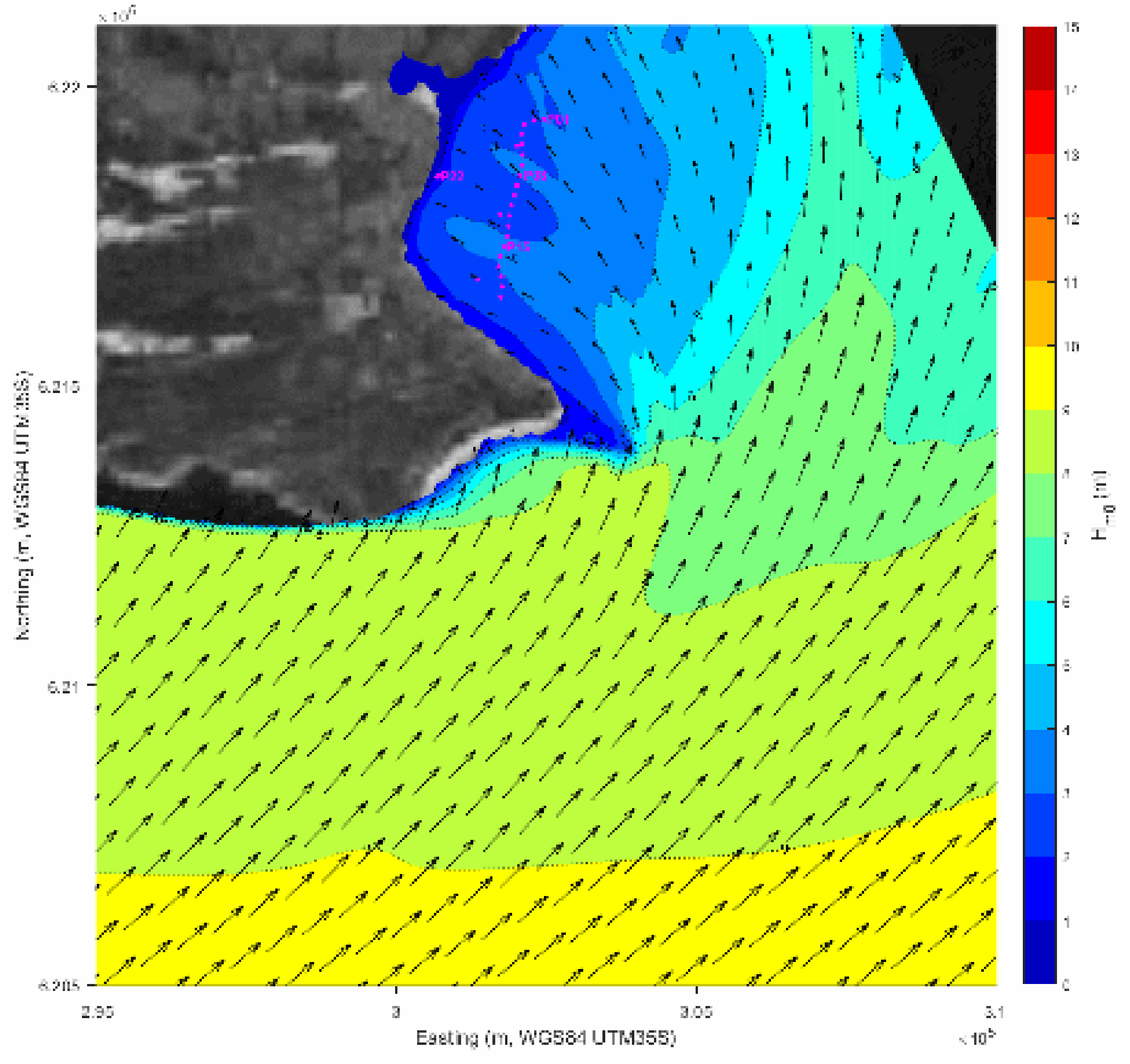


Figure 5-7: Extreme wave condition and direction illustrating sheltering effects of Cape St. Francis at St. Francis Bay

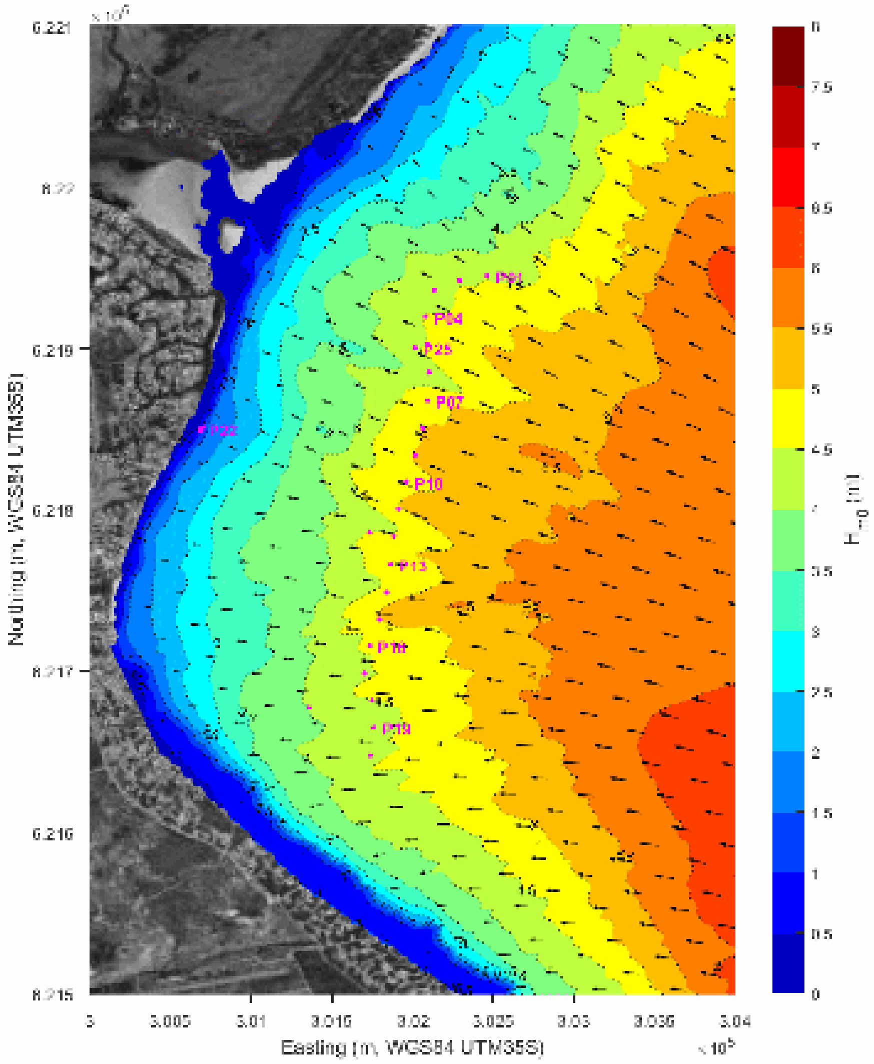


Figure 5-8: Simulated wave conditions and direction for the strongest easterly wind and swell conditions - Offshore swell: H_S = 7.5m, T_P = 12s, Direction = 90 °N and winds: WS = 22.0m/s, Direction = 67.5°N along St. Francis Bay

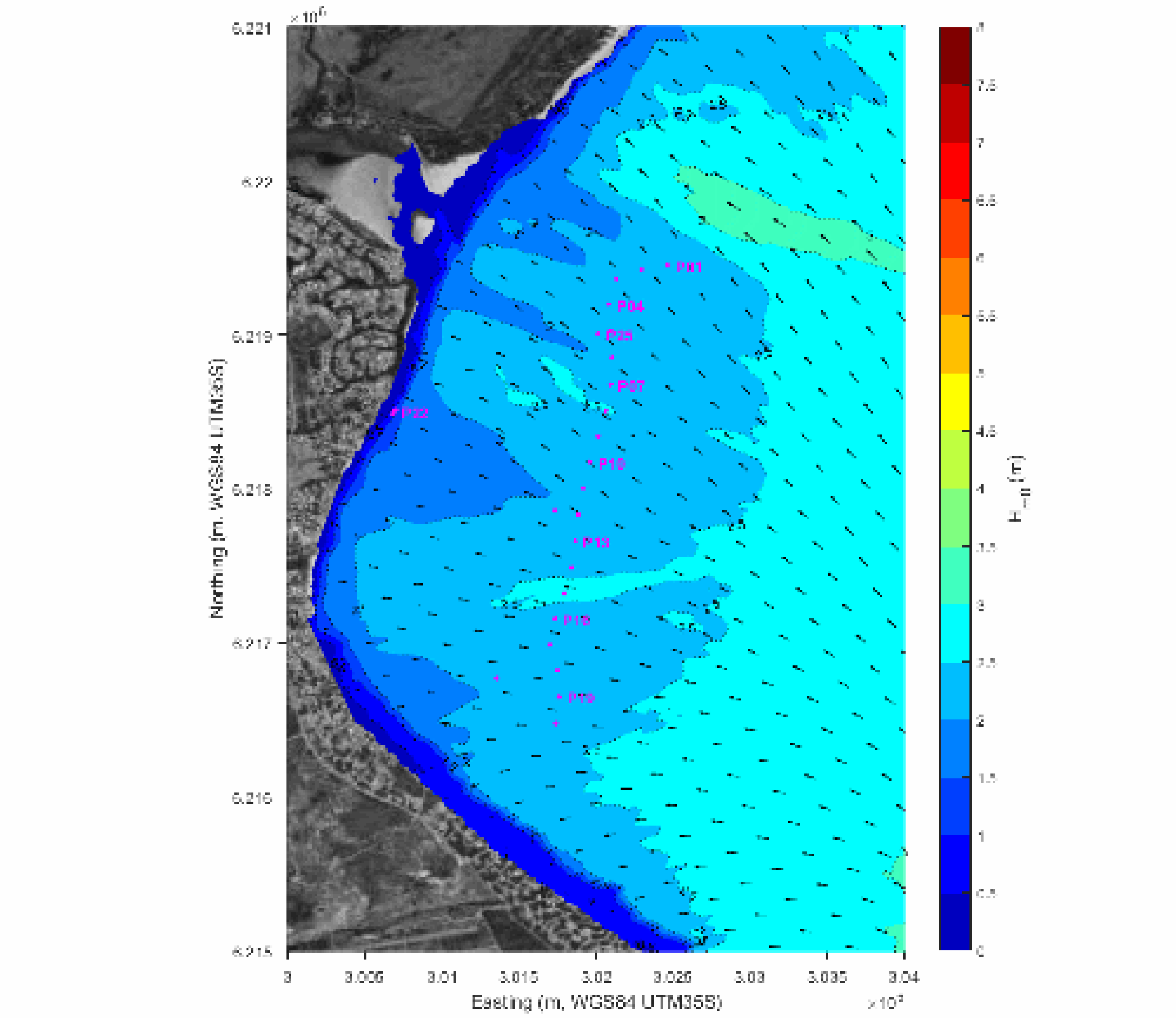


Figure 5-9: *Simulated wave conditions and direction for the strongest westerly wind conditions and easterly swell conditions - Offshore swell: H_S = 7.5m, T_P = 12s, Direction = 90 °N and winds: WS = 26.5m/s, Direction = 270°N along St. Francis Bay*

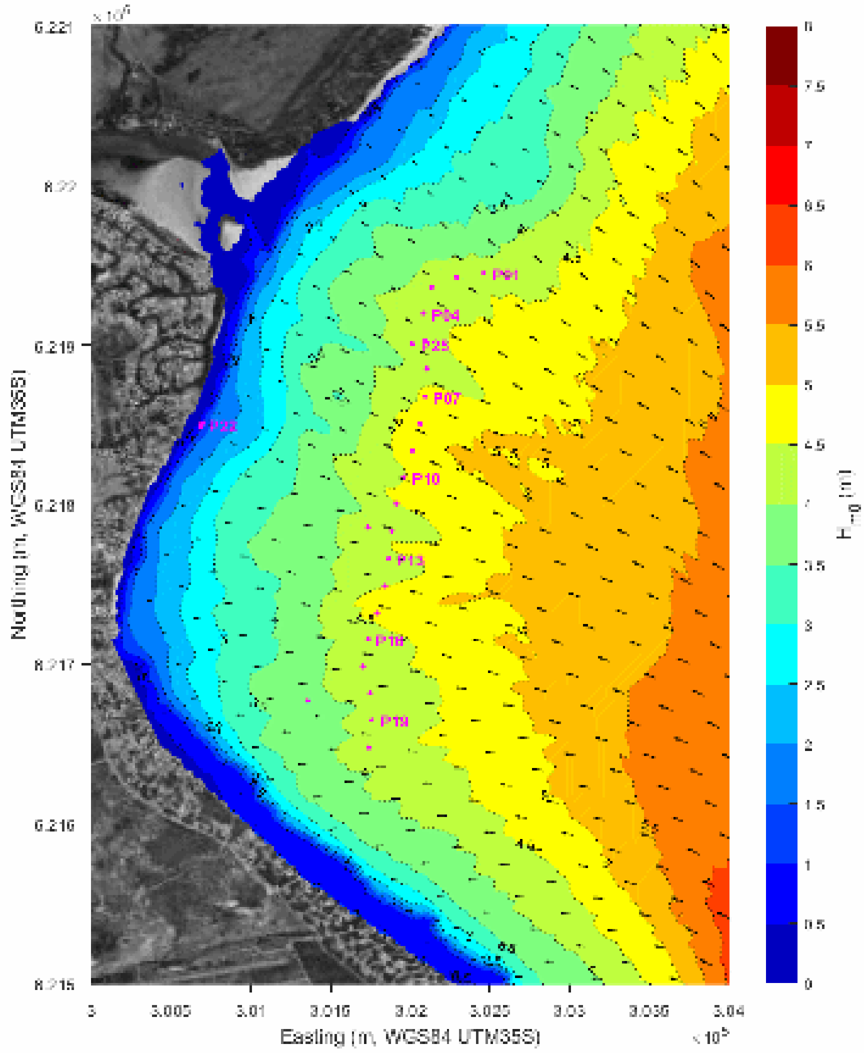


Figure 5-10: Simulated wave conditions and direction for the strongest easterly wind condition and south-westerly swell conditions - Offshore swell: H_S = 11.5m, T_P = 15.6s, Direction = 240.5°N and winds: WS = 22m/s, Direction = 67.5°N along St. Francis Bay

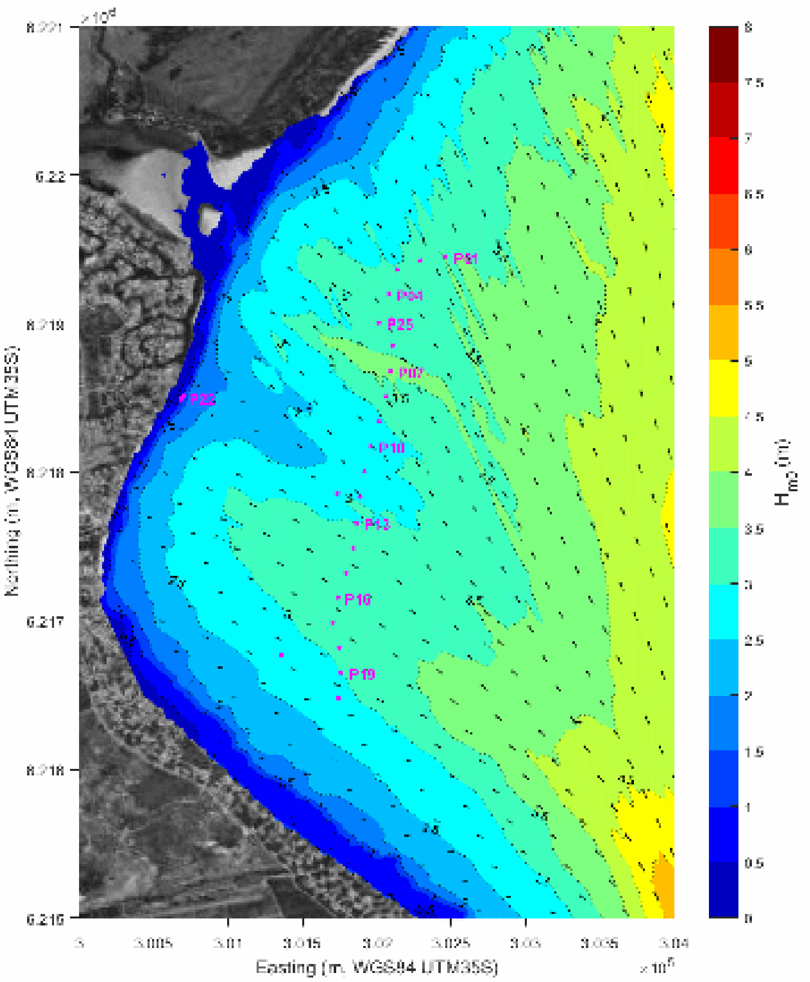
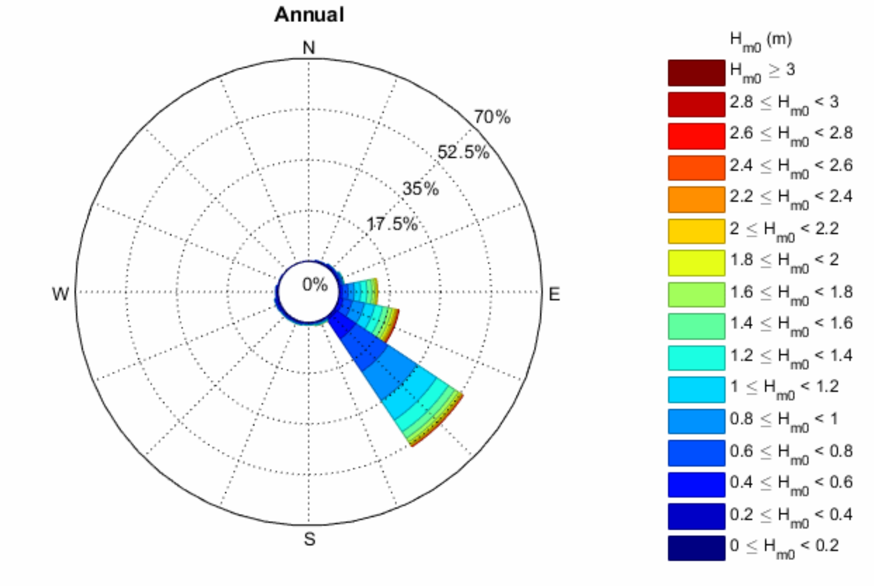


Figure 5-11: Simulated wave conditions and direction for the strongest westerly wind condition and south-westerly swell conditions - Offshore swell: H_S = 11.5m, T_P = 15.6s, Direction = 240.5°N and winds: WS = 26.5m/s, Direction = 270°N along St. Francis Bay

Wave roses (H_s – MWD), non-exceedance curves for the significant wave heights, histograms (H_s and T_P) and annual frequency tables of wave components (T_P – MWD, H_s – MWD and H_s – T_P) were produced for each location of interest and included in Appendix B.

As an example, the annual wave roses and exceedance curves for the total significant wave height at P06 extraction location (see Figure 5-6, Table 5-2 and Figure 5-8 to Figure 5-11) are provided in Figure 5-12; whilst Figure 5-13 provided the total significant wave height and peak wave period histograms. The annual frequency tables of wave components (T_P – MWD, H_s – MWD and H_s – T_P) is provided in Table 5-4 and Table 5-5 summarises the maximum and average wave climate conditions at each of the wave extraction locations.

The dominant wave direction is from the south-east with a smaller component approaching the shoreline from the east-southeast and east. The average significant wave height, estimated over the 17-year dataset, is 1.1 m; whilst the maximum significant wave height in the simulated time series is 4.5 m.



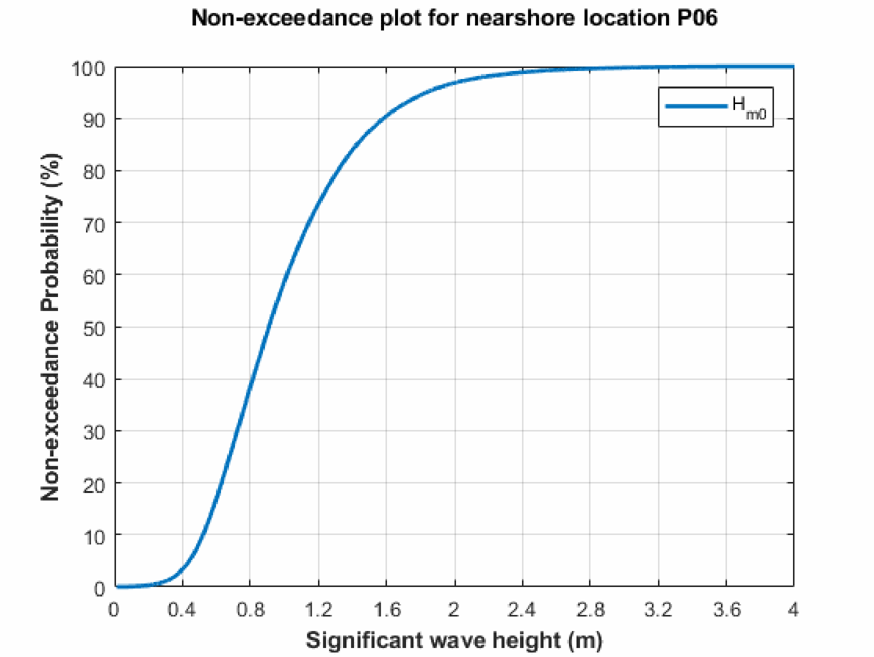


Figure 5-12: Annual wave rose and non-exceedance plot of H_s at Point P06 (approximately -10 m CD) covering the 17-year time series (1997 – 2015) of 3-hourly wave components

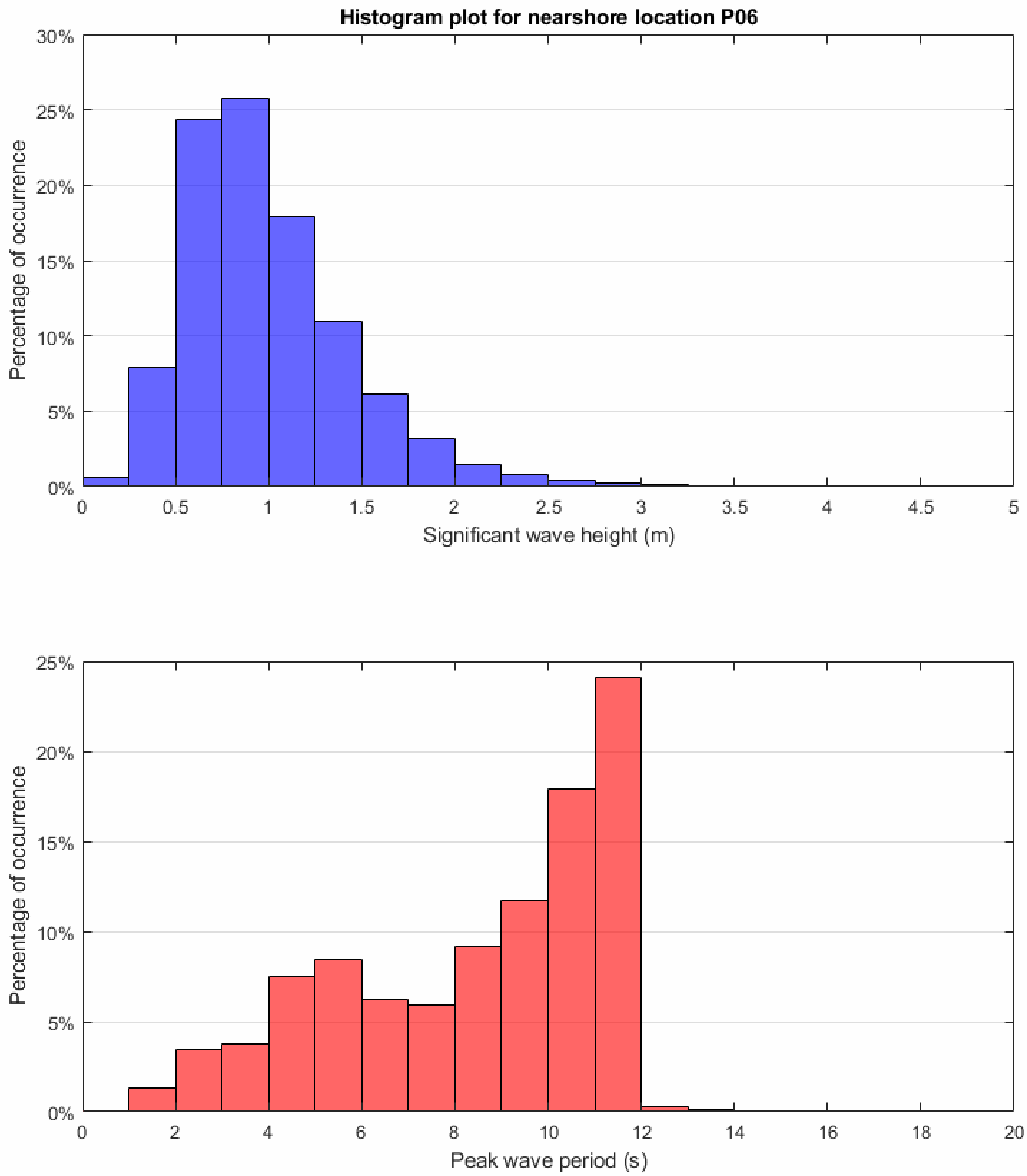


Figure 5-13: Histograms of significant wave height (top) and peak wave period (bottom) at Point P06 (approximately -10 m CD) covering the 17-year time series (1997 – 2015) of 3-hourly wave components

Table 5-4: *Annual frequency tables (shown in percentage) at extraction location P06. T_P – MWD frequency table (top), H_s – MWD frequency table (middle) and H_s – T_P frequency table (bottom).*

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.068	0.059	0	0	0	0	0	0	0	0	0	0.13	0.13
	NNE	0.017	0.355	0.268	0	0	0	0	0	0	0	0	0.64	0.77
	NE	0.019	0.096	1.044	0.043	0	0	0	0	0	0	0	1.20	1.97
	ENE	0.006	0.424	0.946	0.677	0.006	0	0	0	0	0	0	2.06	4.03
	E	0.009	0.990	7.454	4.495	0.318	0.004	0	0	0	0	0	13.27	17.30
	ESE	0	1.134	3.660	4.634	10.574	1.120	0.146	0.015	0	0	0	21.28	38.58
	SE	0.004	0.285	1.064	1.421	9.691	40.901	0.217	0.026	0	0	0	53.61	92.19
	SSE	0.002	0.198	0.588	0.452	0.155	0	0	0	0	0	0	1.40	93.58
	S	0.041	0.274	0.331	0.228	0.109	0	0	0	0	0	0	0.98	94.57
	SSW	0.135	0.603	0.231	0.222	0.017	0	0	0	0	0	0	1.21	95.77
	SW	0.224	0.753	0.322	0	0	0	0	0	0	0	0	1.30	97.07
	WSW	0.322	1.216	0	0	0	0	0	0	0	0	0	1.54	98.61
	W	0.266	0.650	0	0	0	0	0	0	0	0	0	0.92	99.53
	WNW	0.163	0.174	0	0	0	0	0	0	0	0	0	0.34	99.86
	NW	0.072	0.031	0	0	0	0	0	0	0	0	0	0.10	99.97
	NNW	0.031	0.002	0	0	0	0	0	0	0	0	0	0.03	100.00
	All PWD	1.38	7.24	15.91	12.17	20.87	42.02	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	1.38	8.62	24.53	36.70	57.57	99.60	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.118	0.009	0	0	0	0	0	0	0	0	0	0.13	0.13
	NNE	0.379	0.226	0.035	0	0	0	0	0	0	0	0	0.64	0.77
	NE	0.496	0.642	0.057	0.006	0	0	0	0	0	0	0	1.20	1.97
	ENE	0.328	1.306	0.398	0.024	0.002	0	0	0	0	0	0	2.06	4.03
	E	0.426	4.778	5.224	2.454	0.357	0.030	0.002	0	0	0	0	13.27	17.30
	ESE	0.666	8.436	7.496	3.101	1.055	0.376	0.135	0.017	0	0	0	21.28	38.58
	SE	3.845	30.563	14.556	3.457	0.853	0.239	0.072	0.022	0.002	0	0	53.61	92.19
	SSE	0.070	0.655	0.513	0.124	0.030	0.004	0	0	0	0	0	1.40	93.58
	S	0.131	0.529	0.254	0.061	0.007	0	0	0	0	0	0	0.98	94.57
	SSW	0.229	0.749	0.209	0.020	0	0	0	0	0	0	0	1.21	95.77
	SW	0.374	0.818	0.100	0.007	0	0	0	0	0	0	0	1.30	97.07
	WSW	0.707	0.785	0.046	0	0	0	0	0	0	0	0	1.54	98.61
	W	0.413	0.483	0.020	0	0	0	0	0	0	0	0	0.92	99.53
	WNW	0.194	0.141	0.002	0	0	0	0	0	0	0	0	0.34	99.86
	NW	0.085	0.019	0	0	0	0	0	0	0	0	0	0.10	99.97
	NNW	0.031	0.002	0	0	0	0	0	0	0	0	0	0.03	100.00
	All PWD	8.49	50.14	28.91	9.25	2.30	0.65	0.21	0.04	0.00	0.00	0.00		
	Cum PWD	8.49	58.63	87.54	96.80	99.10	99.75	99.96	100.00	100.00	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	1.355	1.667	0.735	0.890	2.446	1.401	0	0	0	0	0	8.49	8.49
	0.5 - 1	0.024	5.489	5.059	4.354	10.692	24.523	0	0	0	0	0	50.14	58.63
	1 - 1.5	0	0.089	8.483	2.396	5.474	12.435	0.030	0.004	0	0	0	28.91	87.54
	1.5 - 2	0	0	1.630	3.038	1.717	2.717	0.130	0.022	0	0	0	9.25	96.80
	2 - 2.5	0	0	0.002	1.182	0.331	0.672	0.109	0.007	0	0	0	2.30	99.10
	2.5 - 3	0	0	0	0.265	0.115	0.202	0.065	0.002	0	0	0	0.65	99.75
	3 - 3.5	0	0	0	0.044	0.072	0.057	0.030	0.006	0	0	0	0.21	99.96
	3.5 - 4	0	0	0	0	0.020	0.019	0	0	0	0	0	0.04	100.00
	4 - 4.5	0	0	0	0	0.002	0	0	0	0	0	0	0.00	100.00
	4.5 - 5	0	0	0	0	0	0	0	0	0	0	0	0.00	100.00
	> 5	0	0	0	0	0	0	0	0	0	0	0	0.00	100.00
	All H_s	1.38	7.24	15.91	12.17	20.87	42.02	0.36	0.04	0.00	0.00	0.00		
	Cum H_s	1.38	8.62	24.53	36.70	57.57	99.60	99.96	100.00	100.00	100.00	100.00		

Table 5-5: Summary of nearshore wave conditions at the selected model result extraction locations

Point	Maximum modelled significant wave height (m)	Average modelled significant wave height (m)	Maximum modelled peak wave period (s)	Average modelled peak wave period (s)
P01	4.4	1.0	15.7	8.4
P02	4.3	1.0	15.7	8.2
P03	4.2	1.0	15.7	8.3
P04	4.2	1.0	15.7	8.3
P05	4.1	1.0	15.7	8.4
P06	4.0	1.0	15.7	8.5
P07	4.5	1.1	15.7	8.6
P08	4.6	1.0	15.7	8.4
P09	4.4	1.0	15.7	8.3
P10	4.0	0.9	15.7	8.2
P11	4.0	0.9	15.7	8.0
P12	3.8	1.0	15.7	8.4
P13	4.0	1.0	15.7	8.4
P14	4.0	1.0	15.7	8.6
P15	4.8	1.1	15.7	8.6
P16	4.2	1.0	15.7	8.6
P17	4.2	1.0	15.7	8.6
P18	4.4	1.0	15.7	8.6
P19	4.3	1.0	15.7	8.4
P20	4.2	1.0	15.7	8.3
P21	1.1	0.6	15.7	9.5
P22	0.9	0.5	15.7	9.6
P23	1.0	0.6	15.7	9.6
P24	3.7	1.0	15.7	8.5
P25	4.1	1.0	15.7	8.5
P26	4.1	0.9	15.7	8.4

6 Long Term Shoreline Modelling

6.1 Introduction

It is necessary to understand the movement or evolution of the shoreline in the long-term to establish shoreline response to beach protection schemes.

The long-term patterns of shoreline movement observed in nature can be classified as follows:

- Slow retreat of the shoreline due to long term erosion (shoreline moving landwards),
- Build-up of sediment over the long term pushing the shoreline seawards,
- Short-term back and forth movement of the shoreline in cycles due to episodic events and seasonal wave climate influences (shoreline is dynamically stable), and
- No signs of significant movement (shoreline is dynamically stable).

The long-term response of the shoreline is fundamentally dependant on the day-to-day environmental conditions influencing the longshore and cross-shore processes and related morphodynamics of beach profiles. These processes and the resulting shoreline response were estimated using numerical modelling and equilibrium bay theory, outlined in the sub-sections that follow.

6.2 Modelling Approach

A revision of the existing shoreline model, which was developed to support the design of the preferred groyne scheme outlined in Advisian (2018), was undertaken with regular beach maintenance considered. The revisited shoreline model was run with the updated wave climates (derived in Section 5) to validate its performance and confirm setup parameters to be applied in the updated shoreline model.

It should be noted that erosion caused by extreme storm events are excluded from the shoreline evolution model as these events usually produce short-term variations to the beach profiles, i.e. during such storm events sediment is temporarily transported seaward causing localised erosion; and during calmer conditions, the beach profile typically tends to recover as the sediment is shifted towards the shoreline and deposited on the beach.

The original shoreline model did not extend a significant distance north of the Kromme river. In order to provide an indication of potential impacts of the long-term coastal protection scheme north of the Kromme mouth, the extent of the shoreline model was expanded in this study.

To assess the shoreline evolution due to the existing rock revetment and future beach control structures (Preliminary Design layout and Alternative proposed layout changes) a combined approach comprising of the UNIBEST single line theory and the equilibrium bay theory was used in this study.

UNIBEST single line theory results were used to define the control points and shoreline orientation required to estimate the equilibrium bay shape. To account for the excessive erosion (accretion) computed by UNIBEST when compared to the initial equilibrium bay shape, a manual adjustment of the equilibrium bay shape was undertaken, which consisted of moving the shoreline laterally along the shore's normal axis until the erosion and accretion areas were balanced.

6.3 Validation of Original Shoreline Model

A validation exercise of the initial shoreline model (developed to support the long-term coastal protection preliminary design concepts) was undertaken, which used the updated wave climates derived in Section 5 and the setup parameters discussed in the preliminary design report (Advisian, 2018).

Details of the shoreline model validation are provided in the following sub-sections.

6.3.1 UNIBEST Model Setup.

6.3.1.1 *Water Levels*

Three water level conditions, based on the tidal levels as outlined in Section 2.4, were applied in the coastline evolution model namely Mean High Water (MHW), Mean Sea Level (MSL) and Mean Low Water (MLW). These tidal levels together with their associated percentage of occurrence are listed in Table 6-1.

The percentage of occurrence at MHW and MLW are conservative and will tend to lead to slightly higher transport rates especially at the upper beach.

Table 6-1: Representative water level conditions for UNIBEST-LT model

Water level (m CD)	Percentage of occurrence (%)
1.57 (MHW)	25
1.04 (MSL)	50
0.50 (MLW)	25

SLR was not considered in the initial shoreline modelling as the intent is to investigate the shoreline response in the first 15 to 20 years after completion of the coastal protection scheme.

6.3.1.2 *Wave Conditions*

Based on the coastline orientation of St. Francis Bay and the number of existing coastal structures (revetments), 12 nearshore wave climate datasets, based on the numerical wave modelling outlined in Section 5.2, were used to define the wave forcing conditions along the beach and drive the shoreline evolution modelling as depicted in Figure 6-1.

Appendix B provides the annual wave roses for each local wave dataset.

Figure 6-1: Location map of the nearshore wave conditions extracted for the original shoreline modelling at St. Francis Bay (Advisian, 2018)

6.3.1.3 Beach Profiles

Based on the bathymetric, topographic and beach profile data summarised in Section 2.1 and 2.2, cross-shore profiles were derived along St. Francis Bay for each of the local wave climate locations depicted above (Section 6.3.1.2).

The beach profile extends from a water depth of -10 m MSL to a beach elevation ranging between 0.5 m MSL and 3.3 m MSL for the profiles extracted south of the Kromme river mouth; similarly, the beach profile extends from a water depth of -7.5 m MSL to a beach elevation of 15 m MSL for the profiles extracted north of the Kromme river mouth, as depicted in Figure 6-2.

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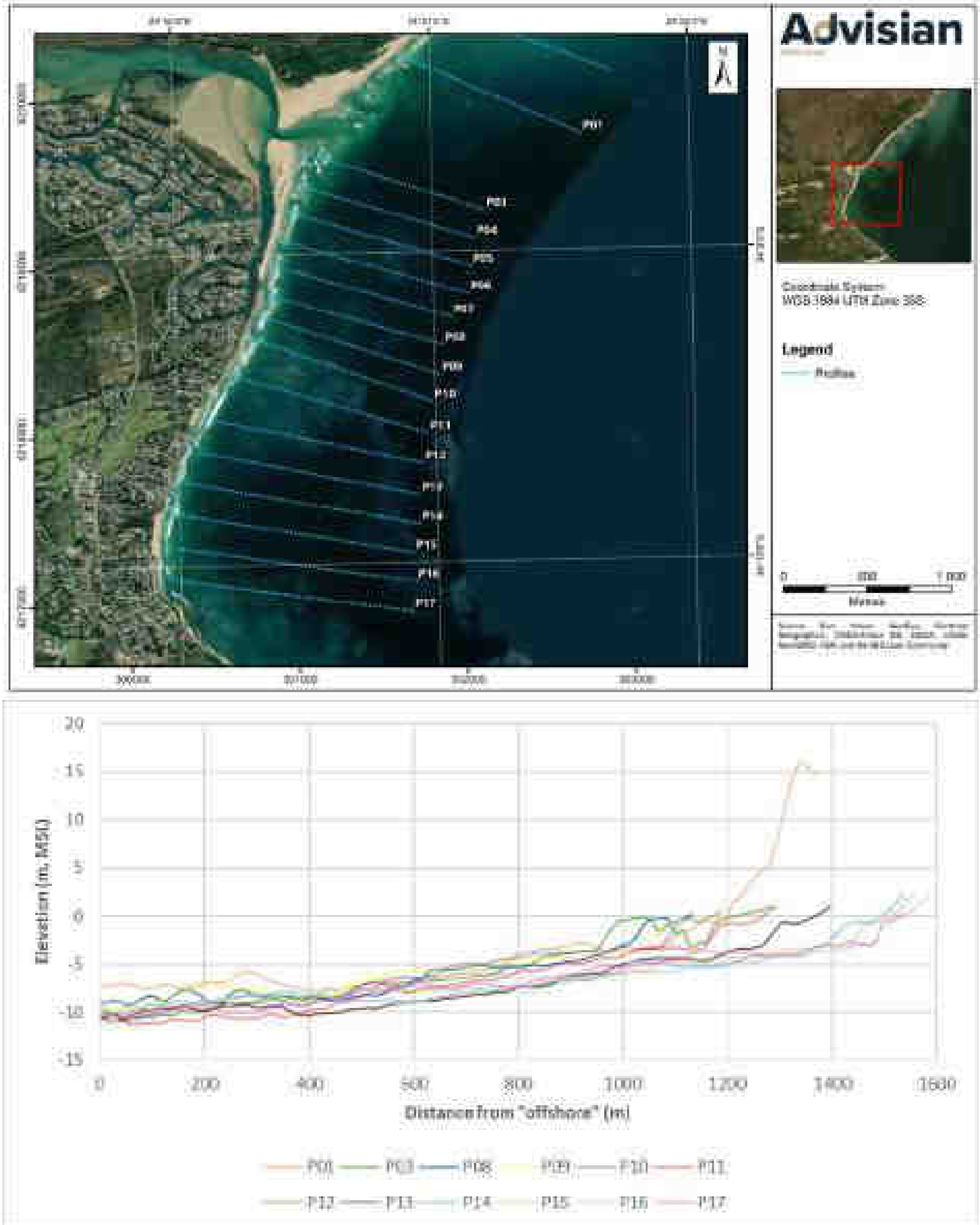

Figure 6-2: Beach Profiles along shoreline of St. Francis Bay

6.3.1.4 *Sediment Grain Diameter*

An average grain diameter size of 0.20 mm was applied in the shoreline model, as outlined in Section 2.3.

6.3.1.5 *Sediment Transport Formulation and Parameters*

In coastal waters, sediment transport processes are strongly affected by waves and currents. Waves generally act as sediment stirring agents, while the mean currents will transport the stirred sediments.

Two main modes of sand transport are observed in nature:

- Suspended-load transport. Suspended sediments in the water column, which may have been stirred by waves and/or currents, will typically settle when the current speeds are reduced. This transport mode is dominated by turbulence-induced drag forces on the particles.
- Bed-load transport. When the sediment is coarser, or the fine sediment is in a cohesive form, strong currents will generate a mud layer that will move along the seabed bottom. This transport mode is dominated by flow-induced drag forces and gravity forces acting on the particles.

Several formulations have been developed over the years to estimate the sediment transport in coastal waters, which combine the abovementioned transport mechanisms.

For this study, the Soulsby – van Rijn formulation (Soulsby, 1997) were applied. The sediment transport parameters used in the formulation are ideally defined based on local field data. As data was limited at the time of undertaking this study, the default parameters provided in the UNIBEST software were adopted.

6.3.1.6 *Shoreline Definition*

UNIBEST-CL presents the position of the coastline using a single line, which is defined via two components: a reference line (that remains unmodified during the entire simulation) and the distance between this reference line and the coastline position at each time step. Therefore, Geographic Information System (GIS) software was used to establish the location of the reference line and the initial coastal position for St. Francis Bay beach. The initial coastline was established as the 1 m CD contour.

A curvilinear grid was used in the model to distribute cross-shore profiles, which allows for higher resolution in the areas of interest, including the rock revetments and the sand spit. The shoreline model consisted of 193 grid points from the southern boundary to the northern boundary, stretching over a distance of approximately 4.5 km. The locations of the reference line, initial coastline position and computational grid applied in the model are shown in Figure 6-3.

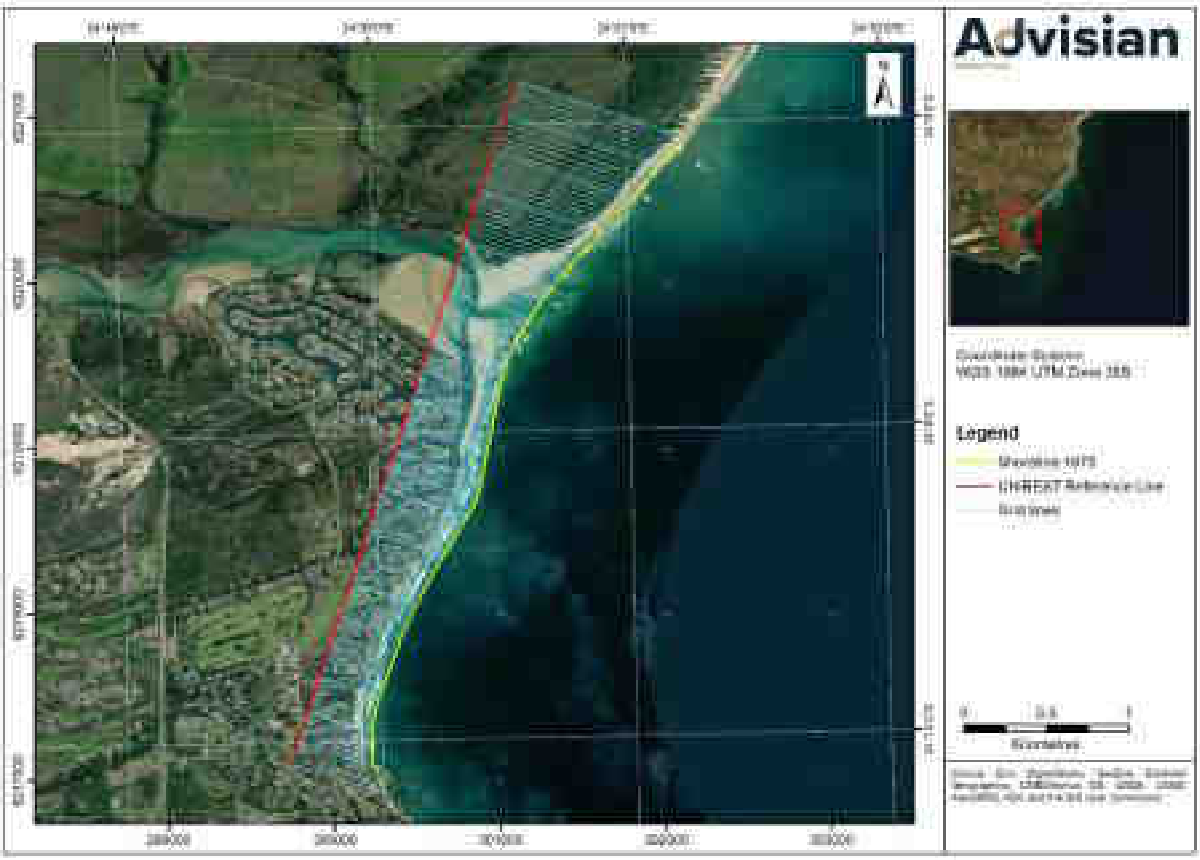

Figure 6-3: Location map of the UNIBEST-CL reference line, initial coastline and computational grid for the original shoreline model of St. Francis Bay (Advisian, 2018)

6.3.1.7 *Existing Coastal Structures*

The sandy beach at St. Francis Bay has suffered from significant erosion events over the past few decades. This has effectively reduced the beach width and threatened to undermine beach properties and infrastructure, which lead to the placement of rock revetments along the beach.

The existing coastal protection structures consisting of rock revetments (outlined in previous studies (PRDW, March 2015), (PRDW., July 2015) were used to validate the existing coastline model and derive the present-day shoreline situation. Figure 6-4 show the location of these coastal protection structures in relation to the UNIBEST reference line.

Figure 6-4: Location map of the UNIBEST-CL rock revetments for the original shoreline model of St. Francis Bay (Advisian, 2018)

6.3.2 Results of the Validation of Original Shoreline Model

The sediment transport along the coast is defined by the angle of incidence of the dominant wave direction and the energy in the waves. This information is computed in UNIBEST-LT module for the studied coastal stretches and then applied in the UNIBEST-CL module to determine the changes along the coastlines.

The validation of the shoreline evolution assessment was undertaken using the input parameters of the original shoreline model outlined in (Advisian, 2018) to derive the initial changes in the shoreline position due to the revised annual nearshore wave conditions along St. Francis Bay beach (see Section 5) in combination with the existent rock revetments.

The transport rate at the boundaries was assumed to be 0 m^3/year for the southern boundary and 60,000 m^3/year for the northern boundary.

Figure 6-5 provides the shoreline evolution of St. Francis Bay beach for the 45-year modelling period considered (1975 – 2020).

Figure 6-5: Simulated shorelines along St. Francis Bay for the considered simulation period (1975 – 2020)

The UNIBEST model for St. Francis reproduces the historical shoreline changes due to the reduction of available sand supply (damming of the Kromme river and stabilization of Santereme dunes) over the past decades and the effect of the constructed rock revetments sufficiently well to allow its application in the assessment of the proposed coastal protection scheme.

It should be noted that the coastline along the river mouth is not accurately estimated by the shoreline evolution model, as the model uses single line theory, and discontinuities caused by rivers cannot be resolved.

6.4 Updated Shoreline Modelling

6.4.1 UNIBEST Model Setup

The UNIBEST model setup as described in section 6.3.1 was used for assessing the shoreline response due to the construction of the long-term coastal protection schemes discussed in Section 3. Only specific modelling features that were modified in this updated shoreline assessment are included in the following sub-sections, e.g. extent of the shoreline model, groyne layouts, etc.

6.4.1.1 Shoreline Definition

UNIBEST-CL presents the position of the coastline using a single line, which is defined via two components: a reference line (that remains unmodified during the entire simulation) and the distance between this reference line and the coastline position at each time step. Therefore, Geographic Information System (GIS) software was used to establish the location of the reference line and the initial coastal position for St. Francis Bay beach. The initial coastline was referenced as the 1 m CD contour.

A curvilinear grid was used in the model to distribute cross-shore profiles, which allows for higher resolution in the areas of interest, including the rock revetments and the sand spit. The shoreline model consisted of 251 grid points from the southern boundary to the northern boundary, stretching over a distance of approximately 8 km. The locations of the reference line, initial coastline position and computational grid applied in the model are shown in Figure 6-6.

Figure 6-6: Location map of the updated UNIBEST-CL reference line, initial coastline and computational grid for the updated shoreline model of St. Francis Bay

6.4.1.2 Coastal Structure Options

In addition to the existing coastal protection structures consisting of rock revetments as outlined in previous studies (PRDW, March 2015), (PRDW., July 2015), the preferred long-term coastal protection layout considered several factors (e.g. aesthetics, capital/construction costs, beach width, constructability, existing revetments, beach stability, etc.) and client's requirements regarding constructability and costs. For further details on the concept and preferred groyne layout, refer to the preliminary design report (Advisian, 2018).

The sub-sections that follow describe the considered groyne schemes.

Preliminary Design Proposed Coastal Protection Scheme

The general layout of the groyne scheme as conceived in Preliminary Design Report (Advisian, 2018) is shown in Figure 3-1. Figure 6-7 provides the location of the proposed long-term coastal protection in relation to the existing revetments.

Figure 6-7: Coastal structures along St. Francis Bay shoreline according to the Preliminary Design Report (Advisian, 2018)

Alternative Coastal Protection Scheme

This groynes scheme is similar to Preliminary Design Report layout but including proposed modifications to the groyne arrangement consisting of relocation of some of the groynes, inclusion of one additional groyne and changes in the groyne orientation. The location of alternative beach control scheme is depicted in Figure 6-8.

Figure 6-8: Coastal structures along St. Francis Bay shoreline for alternative protection scheme layout

6.4.1.3 Beach nourishment

The beach nourishment plans were defined in the preliminary design report (Advisian, 2018), which comprised the following:

- Initial nourishment (capital nourishment): large volume of sand to be placed on the beach to allow the creation of a sufficiently wide beach crest. To withstand extreme storm events, the required beach width was found to be 40 m.
- Maintenance nourishment: volume of sand to be placed on the beach in a regular basis (e.g. annually) to account for losses of sediment caused by littoral drift. The proposed maintenance nourishment consists of 6,000 m^3/year for each of the embayments south of the spit and 10,000 m^3/year for the remaining embayment at the spit.

For further details, refer to the preliminary design report (Advisian, 2018).

6.4.2 UNIBEST Model Results

Figure 6-9 and Figure 6-10 present the shoreline evolution results for the two long-term coastal protection schemes considered, i.e. Preliminary general layout and Alternative general layout.

Figure 6-9: Shoreline evolution results for the Preliminary Design general layout considered as the long-term coastal protection scheme

Figure 6-10: Shoreline evolution results for the Alternative general layout

It should be noted that even though a diffraction approximation was applied in UNIBEST, the shoreline planform does not result in a curved shoreline shape in the downdrift areas of the coastal structures (jetty and groynes), but rather an orientation of each beach segment to the transport equilibrium direction. This is a well-documented aspect of the UNIBEST model (see e.g. van der Salm (2013) and USACE (2014)) and therefore, in order to assess the expected response immediately behind the groynes in the diffraction shadow, use was made of the equilibrium bay theory to derive empirical shorelines in conjunction with UNIBEST results as outlined in the modelling approach (Section 6.2) and in Section 6.3.2.

The littoral drift extent, i.e. seaward distance from shore where sediment can be stirred-up and transported due to wave and tidal action, was also determined by UNIBEST model. It was found that most of the sediment transport occurs between the upper limit of the foreshore (upper limit of wave run-up due to normal wave conditions) and 160 m to 900 m offshore. As it can be seen, the seaward limit is highly variable and its position is dependent on local bathymetric features as depicted in Figure 5-6 and Figure 6-11 (nearshore bathymetry) and wave conditions (Figure 5-8 provides an example of nearshore wave field). This means that shallow areas extending further offshore will have a wider active extent where the sediment is affected by coastal processes.

Figure 6-11 depicts the percentage of littoral drift occurring along St. Francis Bay for the wave climates and profiles used in the updated shoreline model.

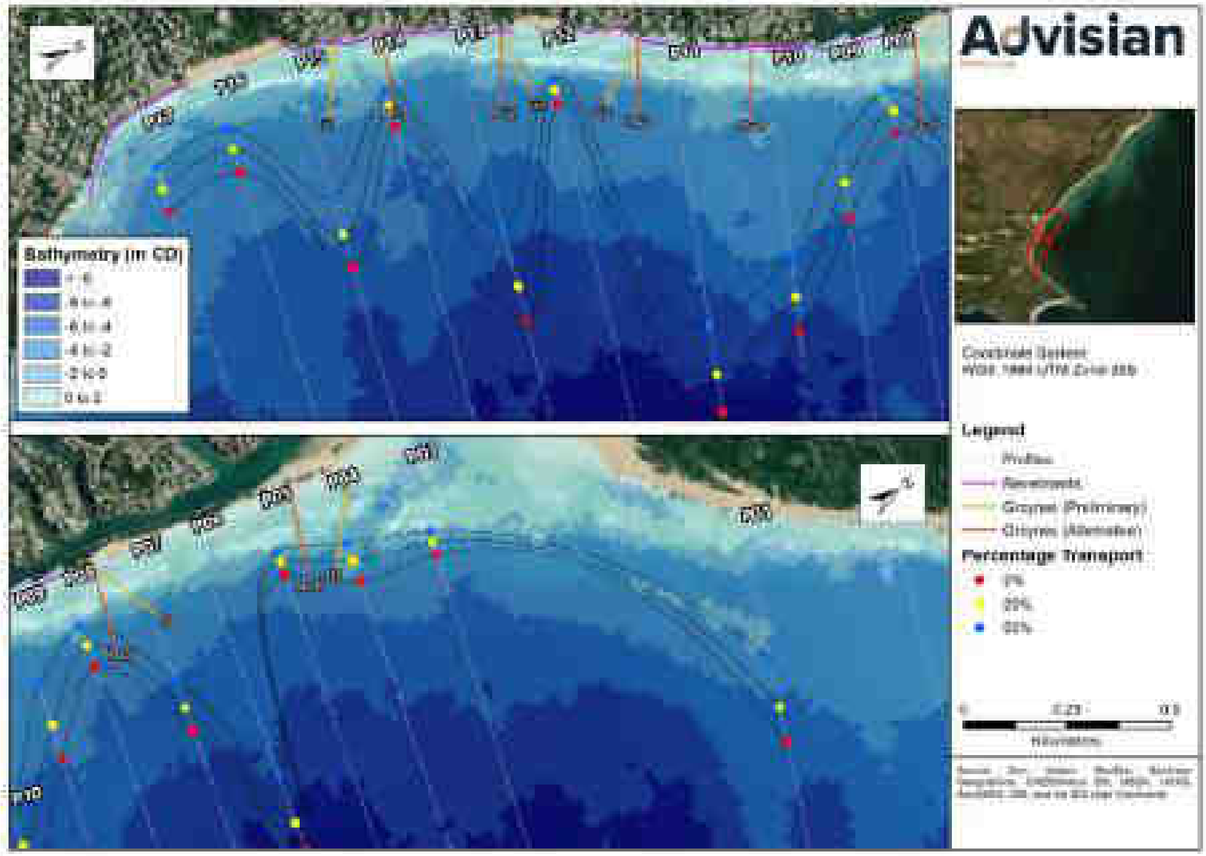

Figure 6-11: Percentage of longshore transport along St. Francis Bay (0% transport occurring in deep water and 100% transport at the shoreline)

Taking into account the proposed coastal protection schemes, i.e. groyne length and location, the performance of each groyne as sand retention structure can be inferred with relation to the effective blockage of littoral drift (sand longshore transport).

Table 6-2 and Table 6-3 summarise the groyne characteristics and required distance to block 50% of the littoral drift.

Table 6-2: Preliminary Design groyne layout vs effective blockage of littoral drift

Groyne No.	Groyne length (m)	Approx. percentage blockage for proposed groyne length (%)	Needed groyne length to achieve 50% sand blockage (m)	Depth at the seaward end of the groyne (m CD)
Groyne 1 (G1)	170	43.5	185	-2.06
Groyne 2 (G2)	170	27.5	230	-2.35
Groyne 3 (G3)	170	33.8	205	-1.69
Groyne 4 (G4)	200	41.4	220	-2.69
Groyne 5 (G5)	200	50.0	200	-2.02

The overall percentage blockage achieved with the original groyne positions is approx.40%.

Table 6-3: Alternative groyne layout vs effective blockage of littoral drift

Groyne No.	Groyne length (m)	Approx. percentage blockage for proposed groyne length (%)	Needed groyne length to achieve 50% sand blockage (m)	Depth at the seaward end of the groyne (m CD)
Groyne 1 (NG1)	170	52.5	165	-2.69
Groyne 2 (NG2)	170	27.5	230	-2.59
Groyne 3 (NG3)	170	12.5	270	-3.05
Groyne 4 (NG4)	170	12.5	270	-2.12
Groyne 5 (NG5)	200	41.4	220	-2.82
Groyne 6 (NG6)	200	50.0	200	-2.48

The overall percentage blockage achieved with the alternative groyne positions is 33%.

6.4.3 Adjusted modelling approach

To assess the long-term evolution (e.g. 25 years) of both beach control schemes, groynes were defined with sufficient length to avoid any sand by-pass between embayments and simulated in UNIBEST.

As UNIBEST shoreline planform does not result in a curved shoreline shape downdrift of the coastal structures (groynes), but rather an orientation of each beach segment to the transport equilibrium direction. The UNIBEST results were used to define the control points and shoreline orientation required to estimate the empirical bay shape immediately behind the groynes in the diffraction shadow (downdrift area) by means of the equilibrium bay theory.

To account for the excess erosion/accretion computed in UNIBEST when compared to the equilibrium bay shape, a manual adjustment of the empirical shape was undertaken, which consisted of moving the shoreline laterally along the shore's normal axis until the erosion and accretion areas were balanced.

6.4.3.1 *Preliminary Design Coastal Protection Scheme*

Figure 6-12 depicts the long-term shoreline planform (with and without nourishment) in response to the primary incident wave direction based on the combined approach (i.e. UNIBEST single line and equilibrium bay concept) for the Preliminary Design long-term coastal protection scheme, refer to Section 3.1, 6.4.1.2 and Advisian (2018).

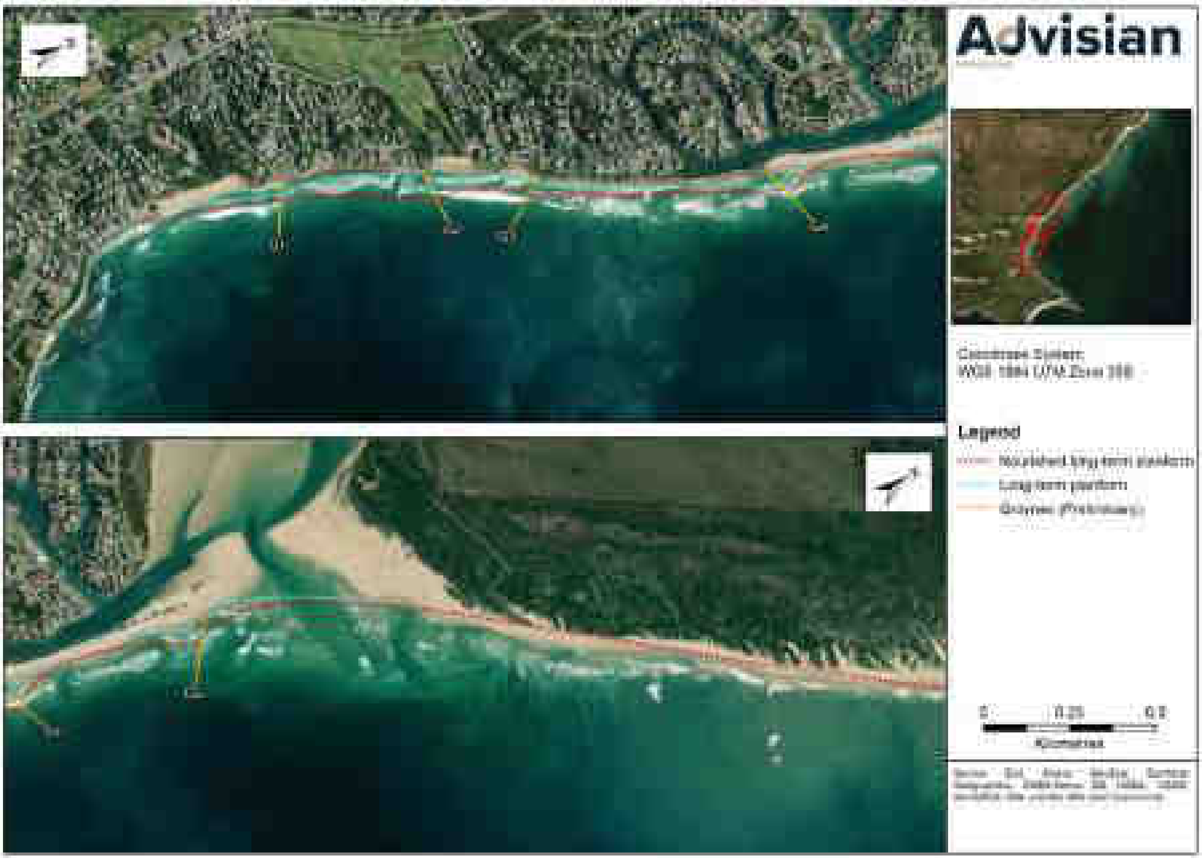

Figure 6-12: Long-term shoreline planform according to the Preliminary Design

6.4.3.2 *Alternative Proposed Coastal Protection Scheme*

Figure 6-13 depicts the long-term shoreline planform (with and without nourishment) in response to the primary incident wave direction based on the combined approach (i.e. UNIBEST single line and equilibrium bay concept) for the Alternative long-term coastal protection scheme, refer to Section 3.2 and 6.4.1.2.

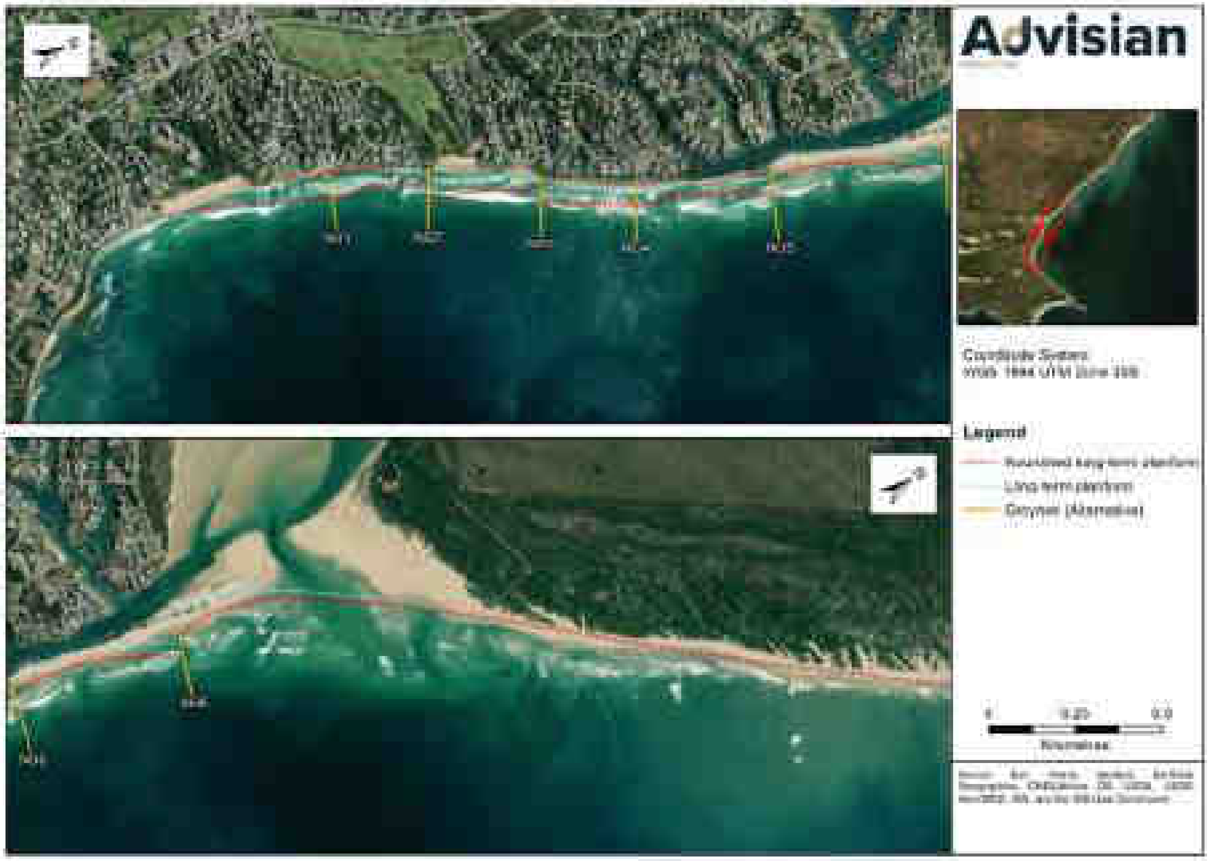

Figure 6-13: Long-term shoreline planform for Alternative long-term coastal protection scheme

6.4.4 Comparison of the Shoreline Planform

The following snapshots (Figure 6-14 to Figure 6-18) provide the future shoreline position at each embayment (i.e. bay created between groynes) to assist with the comparison of the considered schemes.

Figure 6-14: Long-term shoreline planform at the southernmost embayment

Figure 6-15: Long-term shoreline planform at the embayment between G1 (NG1) and G2 (NG2)

Figure 6-16: Long-term shoreline planform at the embayment between G2 (NG2) and G3 (NG3)

Figure 6-17: Long-term shoreline planform at the embayment between G3 (NG3) and G4 (NG5)

Figure 6-18: Long-term shoreline planform at the embayment between G4 (NG5) and G6 (NG7)

6.5 Summary of the Shoreline Evolution Modelling

With reference to the shoreline evolution modelling results, the following is noted:

- The longshore transport along St. Francis Bay has a net north-easterly direction. This is clearly seen in the shoreline evolution modelled as part of the validation exercise, prior to the construction of the groynes.
- Slight differences in the future shoreline planform are observed between the two long-term coastal protection layouts (as depicted in Figure 6-14 to Figure 6-18), even though the Alternative layout has one additional groyne at the coastal revetment located immediately south of the Kromme river mouth.
- It is recommended that newly proposed Groyne 5 of the Alternative layout be constructed at an oblique angle (similar to Groyne 4 from the Preliminary Design proposed layout) as this will assist in protecting the sand spit of breaches if no nourishment is undertaken nor revetments are constructed.
- The inclusion of the additional groyne (newly proposed Groyne 4 in the Alternative layout) will only marginally assist in stabilising the beach in front of the revetment when regular nourishment of the beach is undertaken; however, its construction can be delayed if required.

- The total length of the groynes ranges between 170 m and 200 m for both coastal protection layouts. These lengths were established as follows:
  - The seaward end of the groynes was located as far as practically possible bearing in mind constructability of such structures going towards "deeper" waters versus effective blockage of littoral drift. It should be noted that approximately 50% of sand by-passing around these structures should be expected.
  - To ensure the stability of the rock groynes against toe scouring, the root of the groynes was embedded in the nourished beach slope or existing coastal revetments.
- The long-term planform when considering maintenance beach nourishment evolves in a similar manner to the long-term shoreline presented in this study but shifted seawards (see Figure 6-12 and Figure 6-13), as long as maintenance nourishment of 6,000 m^3/year for the embayments south of the spit and 10,000 m^3/year for the remaining embayment at the spit takes place on a regular basis.
- Even though the construction of any of the long-term coastal protection schemes assessed in this study will have an impact on the northern coast, this effect is considered relatively limited as the length of the groynes do not extend that far offshore to fully block the entire littoral drift and, thus, the existing and future imported sand will still travel towards this northern beach area due to longshore processes.
- The proposed groyne scheme in combination with beach maintenance will provide a continues supply of sediment of approx. 28,000m^3 per year that will be transported towards the northern coastline when the complete solution is implemented. This is considered to be more beneficial to the northern coastline than allowing the St Frances Beach to erode to the extent where negligible sediment transport can occur which would result in the northern beaches experiencing accelerated erosion.

6.6 Cost Estimate

A cost estimate was undertaken for the Preliminary Design layout (Figure 3-1) and Alternative layout (Figure 3-2) for both a staged and non-staged approach. It may cost between 10-15% more to implement the solution in stages rather than one complete solution. Additional costs due to inflation must also be considered.

The basis of the cost estimate provided in the Preliminary Design Report (Advisian, 2018) has been updated to account for inflation and new rock prices were obtained for the proposed rock gradings from a local quarry.

Table 6-4: Cost Estimate

Phase	Preliminary Design Layout (Figure 3-1)	Alternative Layout (Figure 3-2)
Area 1 – Phased	R46 000 000	R46 000 000
Area 2 – Phased	R31 000 000	R27 000 000
Area 3 – Phased	R35 000 000	R35 000 000
Area 4 – Phased	R13 000 000	R10 000 000
Area 5 – Phased	*R22 000 000	R28 000 000
Complete Solution (Not phased)	**R111 000 000	R130 000 000

*Optional Area which may experience high levels of erosion and require significantly more beach maintenance than the other 4 areas. This area is not recommended for further development.

**The Complete Solution excludes the development of Area 5 for the Preliminary Design Layouts.

6.6.1 Cost estimate assumptions

It should be noted that the following assumptions were made in preparing the preliminary cost estimate:

- The base date for the rates is October 2020;
- All rates are exclusive of VAT;
- Beach nourishment rate – dredged and pumped to the beach: R 69.96/m^3;
- Supply of rock to site (larger than 2t): R 442/t;
- Supply of rock to site (larger than 1t and up to 2t): R 402/t;
- Supply of rock (smaller than 1t): R 315/t;
- P&Gs: 10%;
- Contingency: 10%.

7 Conclusions and Recommendations

This report presents the revision of the numerical modelling carried out as part of the preliminary design (Task i) to accommodate for the requested changes on the overall groyne layout of the proposed protection scheme.

Available information on bathymetry, topography, wave and wind conditions, tidal levels and sediment characteristics was used to establish the metocean and seabed conditions at the project site.

The numerical models previously used to define the preferred long-term coastal protection layout (Advisian, 2018) were updated using more recent and refined bathymetric and topographic data. As a result, more accurate nearshore wave climates were established to assess the shoreline evolution along the project site due to the construction of the two long-term coastal protection schemes considered, i.e. Advisian general layout and SFPO modifications to the proposed general layout.

With reference to the wave modelling results, the following was found:

- The wave climate in St. Francis Bay is considered mild since most of the swell wave energy is substantially reduced in wave height due to the shelter offered by Cape St. Francis, as well as refraction and diffraction effects.
- Local strong easterly winds can generate strong short-period waves throughout St. Francis Bay enhancing the harshness of the coastal environment.

A shoreline evolution assessment was carried out to compare the two long-term coastal protection schemes considered in this study. The following was noted from this assessment:

- The longshore transport along St. Francis Bay has a net northerly direction. This is clearly seen in the shoreline evolution modelled as part of the validation exercise, prior to the construction of the groynes.
- Slight differences on the future shoreline planform were observed between the two long-term coastal protection layouts, even though the SFPO layout has one additional groyne at the coastal revetment located immediately south of the Kromme river mouth.
- It is recommended that newly proposed Groyne 5 of SFPO’s layout be constructed in an oblique angle (similar to Groyne 4 from Advisian’s proposed layout) as this will assist in protecting the sand spit of breaches if no nourishment is undertaken nor revetments are constructed.
- The inclusion of the additional groyne (newly proposed Groyne 4 in SFPO’s layout) will only marginally assist in stabilising the beach in front of the revetment when regular nourishment of the beach is undertaken; however, its construction can be delayed if required.
- The total length of the groynes ranges between 170 m and 200 m for both coastal protection layouts. These lengths were established as follows:
  - The seaward end of the groynes was located as far as practically possible bearing in mind constructability of such structures going towards “deeper” waters versus effective blockage of littoral drift. It should be noted that approximately 50% of sand by-passing around these structures should be expected.
  - To ensure the stability of the rock groynes against toe scouring, the root of the groynes was embedded in the nourished beach slope or existing coastal revetments.

- The long-term planform when considering maintenance beach nourishment evolves in a similar manner to the long-term shoreline presented in this study but shifted seawards (see Figure 6-12 and Figure 6-13), as long as maintenance nourishment of 6,000 m^3/year for the embayments south of the spit and 10,000 m^3/year for the remaining embayment at the spit takes place on a regular basis.
- Even though the construction of any of the long-term coastal protection schemes assessed in this study will have an impact on the northern coast, this effect is considered relatively limited as the length of the groynes do not extend that far offshore to fully block the entire littoral drift and, thus, the existing and future imported sand will still travel towards this northern beach area due to longshore processes.
- The proposed groyne scheme in combination with beach maintenance will provide a continues supply of sediment of approx. 28,000m^3 per year that will be transported towards the northern coastline when the complete solution is implemented. This is considered to be more beneficial to the northern coastline than allowing the St Frances Beach to erode to the extent where negligible sediment transport can occur which would result in the northern beaches experiencing accelerated erosion.

Recommendation

Further refinement of the groyne layout could consist of a combination between the two long-term coastal protection schemes tested, is depicted in Figure 7-1. Details of the refined layout are provided in Table 7-1. The overall percentage blockage achieved with these groyne positions is approx. 52%. This layout would be investigated further during the Detailed Design.

Figure 7-1: Coastal structures along St. Francis Bay shoreline for the refined protection scheme

Table 7-1: Refined groyne layout vs effective blockage of littoral drift

Groyne No.	Long-term scheme from which refined groyne was selected	Groyne length (m)	Approx. percentage blockage for proposed groyne length (%)	Depth at the seaward end of the groyne (m CD)
Groyne 1 (RG1)	SFPO layout (NG1)	200	68	-3.2
Groyne 2 (RG2)	Advisian layout (G3)	205	50	-2.9
Groyne 3 (RG3)	Advisian layout (G4)	200	41	-2.7
Groyne 4 (RG4)	SFPO layout (NG6)	200	50	-2.5

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Appendix A
Offshore Conditions

A.1 Annual and monthly wind roses

A.2 Frequency tables for wind components

A.3 Annual and monthly wave roses

A.4 Frequency tables for wave components

A.1 Annual and monthly wind roses

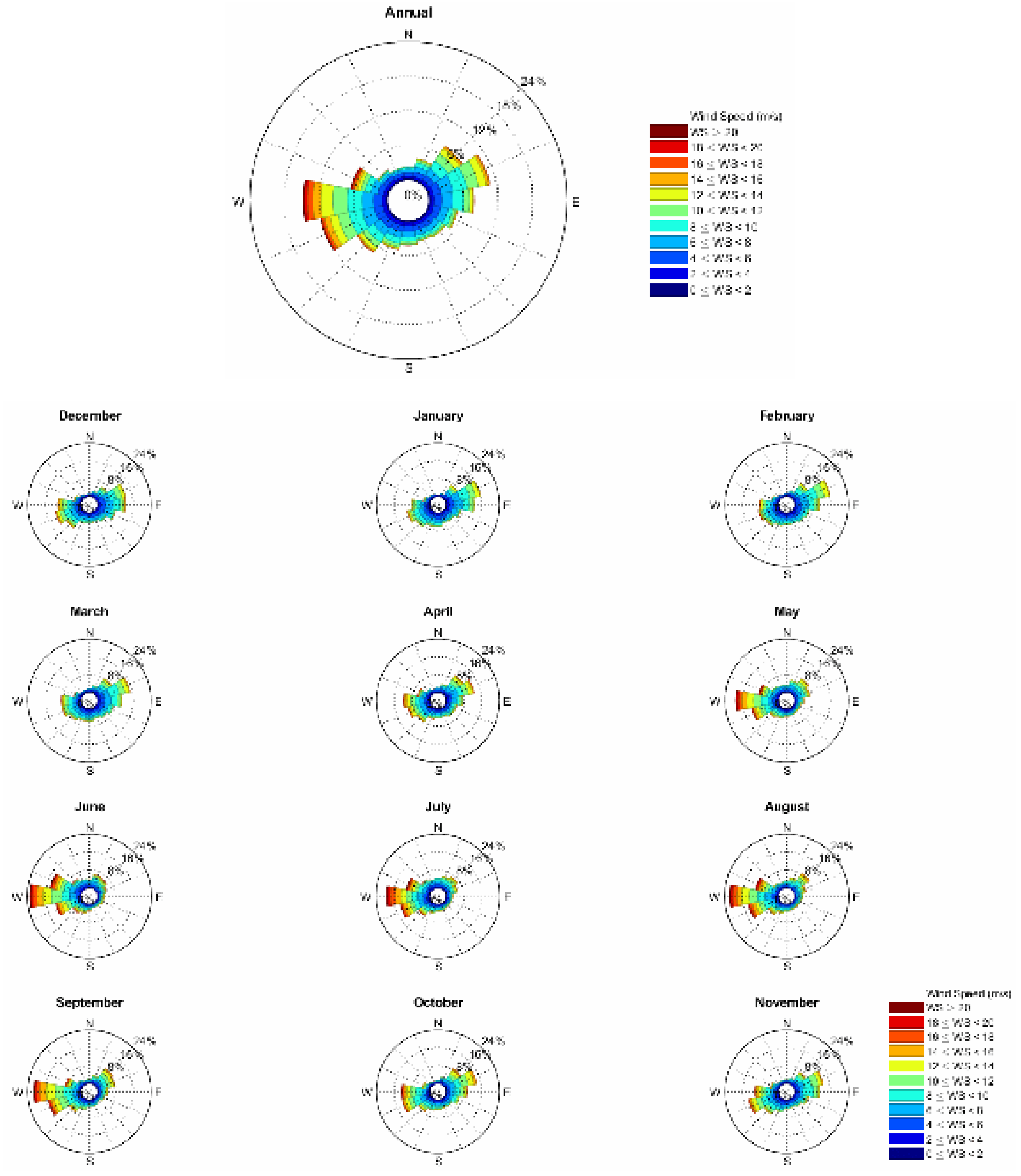


Figure A-1 NWW3 Wind 1. Annual and monthly wind roses

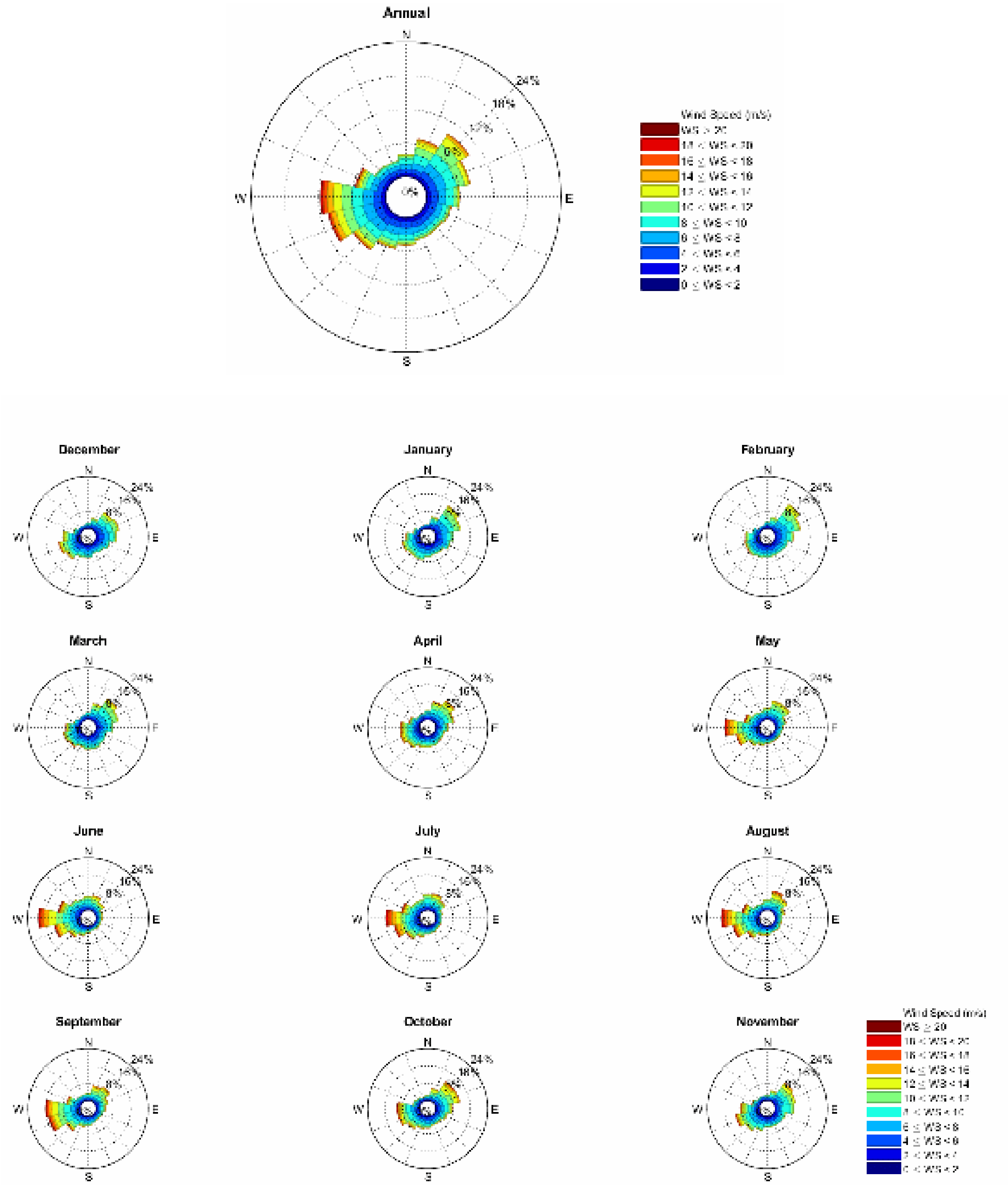
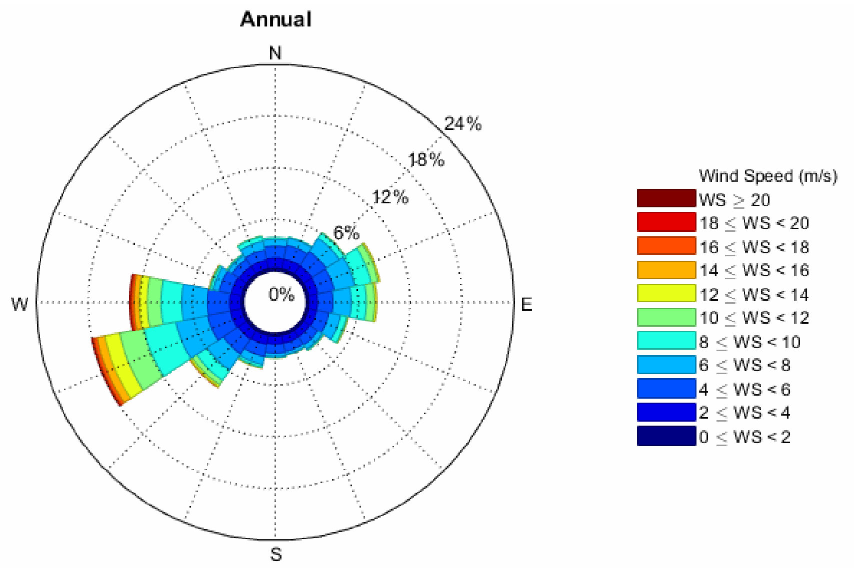


Figure A-2 NWW3 Wind 2. Annual and monthly wind roses



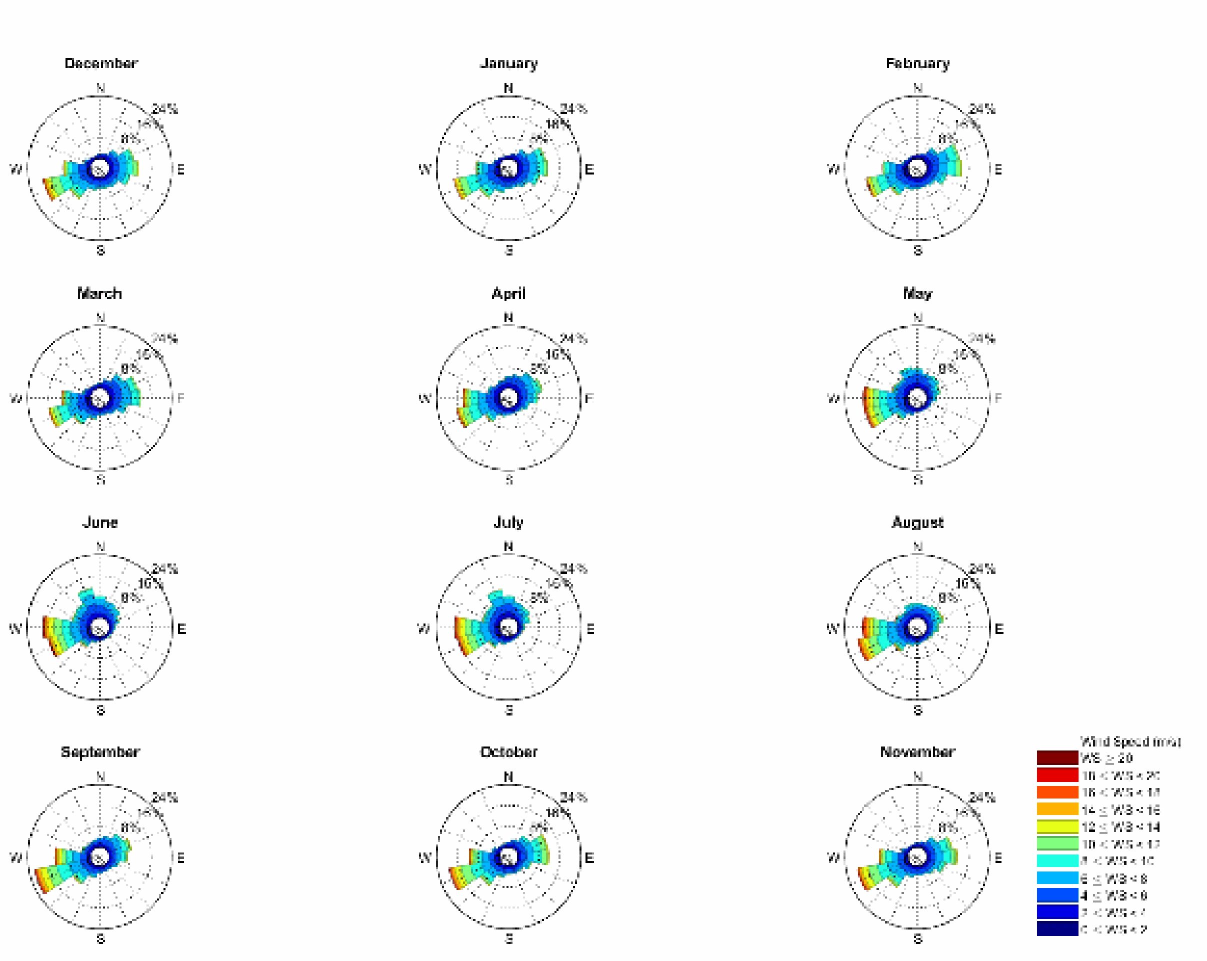


Figure A-3 GDAS Wind. Annual and monthly wind roses

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A.2 Frequency tables for wind components

Table A-1 NWW3 Wind 1. Annual wind speed – wind direction frequency table

Annual		Wind speed, WS (m/s)										
		0	> 0 - 4	> 4 - 8	> 8 - 12	> 12 - 16	> 16 - 20	> 20 - 24	> 24 - 28	> 28	All WS	Cum WS
Wind Direction, WD (°N)	N		0.583	1.157	0.498	0.026	0	0	0	0	2.26	2.26
	NNE		0.633	1.693	1.192	0.274	0.015	0.002	0	0	3.81	6.07
	NE		0.711	2.337	3.083	1.477	0.111	0.006	0	0	7.72	13.80
	ENE		0.844	3.453	4.524	1.850	0.115	0.006	0	0	10.79	24.59
	E		0.862	3.187	2.953	0.670	0.087	0.002	0	0	7.76	32.35
	ESE		0.901	2.498	1.419	0.294	0.028	0	0	0	5.14	37.49
	SE		0.823	1.969	1.051	0.229	0.022	0	0	0	4.10	41.58
	SSE		0.781	1.878	0.896	0.155	0.009	0.004	0	0	3.72	45.31
	S		0.792	2.026	1.131	0.207	0.031	0.004	0	0	4.19	49.50
	SSW		0.836	2.226	1.595	0.372	0.050	0.002	0	0	5.08	54.58
	SW		0.903	2.770	2.485	0.936	0.163	0.006	0	0	7.26	61.84
	WSW		0.925	3.742	4.228	2.346	0.670	0.070	0	0	11.98	73.82
	W		0.984	3.484	5.080	3.499	1.384	0.215	0.007	0	14.65	88.48
	WNW		0.809	2.243	1.839	1.088	0.518	0.094	0.002	0	6.59	95.07
	NW		0.753	1.362	0.563	0.115	0.022	0.006	0.004	0	2.82	97.90
	NNW		0.607	1.164	0.313	0.013	0.002	0	0	0	2.10	99.99
	All WD	0.01	12.75	37.19	32.85	13.55	3.23	0.41	0.01	0.00		
	Cum WD	0.01	12.75	49.94	82.79	96.35	99.57	99.99	100.00	100.00		

Table A-2 NWW3 Wind 2. Annual wind speed – wind direction frequency table

Annual		Wind speed, WS (m/s)										
		0	> 0 - 4	> 4 - 8	> 8 - 12	> 12 - 16	> 16 - 20	> 20 - 24	> 24 - 28	> 28	All WS	Cum WS
Wind Direction, WD (°N)	N		0.607	1.608	1.456	0.257	0.007	0	0	0	3.94	3.94
	NNE		0.618	1.921	2.852	1.401	0.150	0.002	0	0	6.94	10.88
	NE		0.731	2.803	4.138	2.060	0.126	0	0	0	9.86	20.74
	ENE		0.766	2.983	3.259	0.953	0.050	0	0	0	8.01	28.75
	E		0.851	2.670	2.039	0.370	0.024	0	0	0	5.95	34.70
	ESE		0.825	2.283	1.192	0.255	0.022	0	0	0	4.58	39.28
	SE		0.796	2.048	1.038	0.235	0.026	0	0	0	4.14	43.42
	SSE		0.853	2.126	1.034	0.215	0.017	0	0	0	4.25	47.67
	S		0.803	2.348	1.434	0.348	0.022	0.004	0	0	4.96	52.63
	SSW		0.807	2.457	1.908	0.527	0.070	0.002	0	0	5.77	58.40
	SW		0.972	2.898	2.628	0.986	0.222	0.011	0	0	7.72	66.12
	WSW		0.870	3.355	3.640	2.056	0.561	0.068	0.002	0	10.55	76.67
	W		0.872	3.161	3.866	2.543	1.051	0.122	0.004	0	11.62	88.28
	WNW		0.672	2.169	1.636	0.777	0.287	0.035	0.002	0	5.58	93.86
	NW		0.670	1.569	0.809	0.105	0.015	0	0	0	3.17	97.03
	NNW		0.568	1.564	0.770	0.061	0.002	0	0	0	2.96	99.99
	All WD	0.01	12.28	37.96	33.70	13.15	2.65	0.24	0.01	0.00		
	Cum WD	0.01	12.29	50.25	83.95	97.10	99.75	99.99	100.00	100.00		

Table A-3 GDAS Wind. Annual wind speed – wind direction frequency table

December		Wind speed, WS (m/s)											
		0	> 0 - 3	> 3 - 6	> 6 - 9	> 9 - 12	> 12 - 15	> 15 - 18	> 18 - 21	> 21 - 24	> 24	All WS	Cum WS
Wind Direction, WD (°N)	N		1.531	2.150	0.233	0	0	0	0	0	0	3.91	3.91
	NNE		1.494	2.505	0.113	0	0	0	0	0	0	4.11	8.03
	NE		1.493	3.808	0.796	0.009	0.000	0	0	0	0	6.11	14.13
	ENE		1.422	4.368	2.708	0.234	0.004	0	0	0	0	8.74	22.87
	E		1.286	3.903	2.663	0.299	0.003	0	0	0	0	8.15	31.02
	ESE		1.276	2.839	0.832	0.043	0.004	0	0	0	0	4.99	36.02
	SE		1.200	1.737	0.189	0.014	0.005	0	0	0	0	3.15	39.16
	SSE		1.213	1.352	0.087	0.011	0.005	0.000	0	0	0	2.67	41.83
	S		1.252	1.478	0.131	0.020	0.003	0	0	0	0	2.88	44.71
	SSW		1.379	2.385	0.385	0.056	0.006	0.000	0	0	0	4.21	48.93
	SW		1.513	4.334	2.075	0.346	0.027	0.001	0	0	0	8.30	57.22
	WSW		1.649	6.431	6.622	2.668	0.577	0.041	0.004	0	0	17.99	75.21
	W		1.659	5.539	3.950	1.530	0.465	0.055	0.007	0.000	0	13.20	88.42
	WNW		1.517	2.192	0.404	0.059	0.016	0.001	0	0	0	4.19	92.61
	NW		1.391	1.532	0.210	0.014	0.001	0	0	0	0	3.15	95.76
	NNW		1.400	2.197	0.640	0.007	0	0	0	0	0	4.24	100.00
	All WD	0.00	22.67	48.75	22.04	5.31	1.12	0.10	0.01	0.00	0.00		
	Cum WD	0.00	22.67	71.43	93.47	98.77	99.89	99.99	100.00	100.00	100.00		

A.3 Annual and monthly wave roses

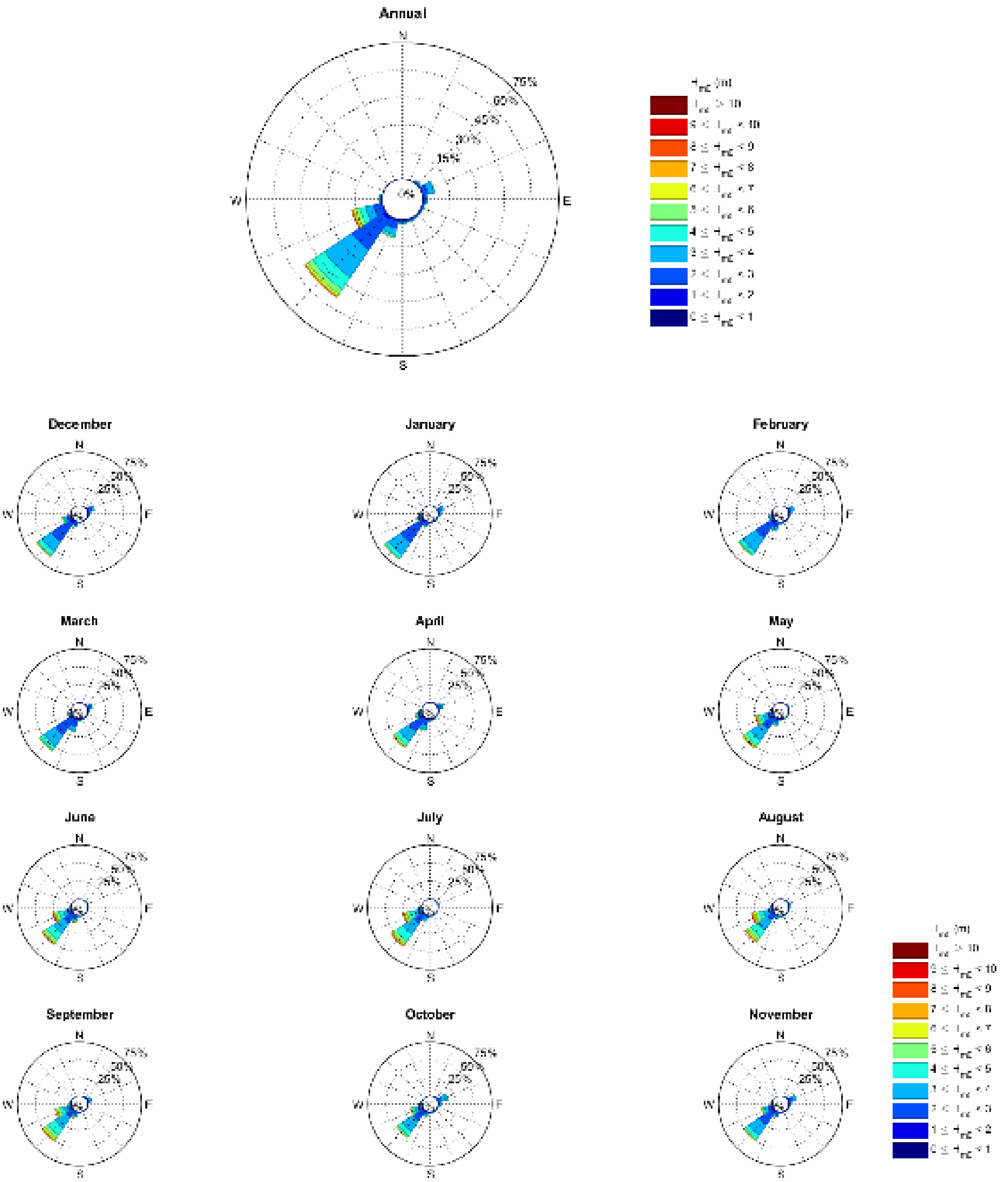

Figure A-4 NWW3 Wave 1. Annual and monthly significant wave height roses

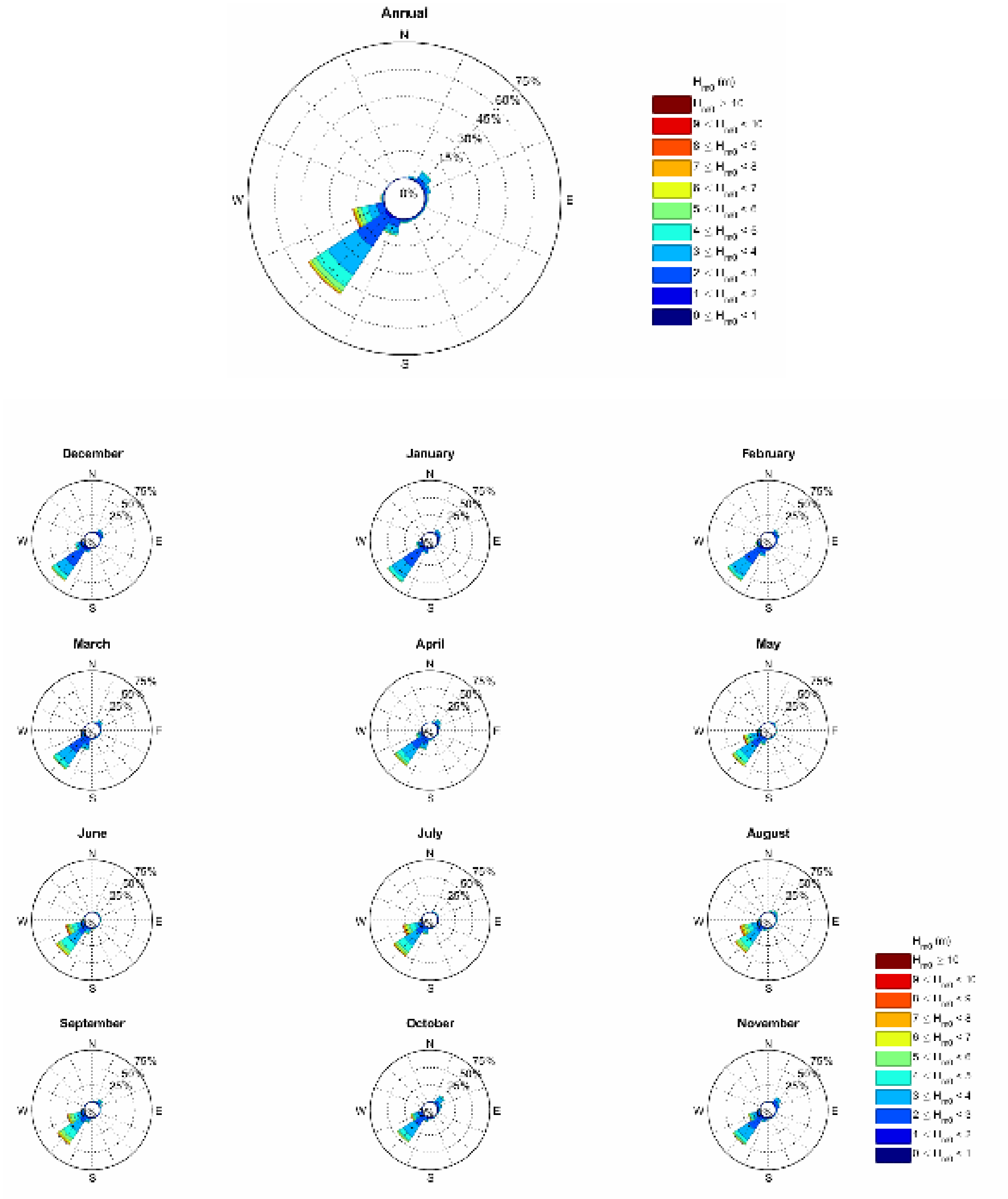

Figure A-5 NWW3 Wave 2. Annual and monthly significant wave height roses

A.4 Frequency tables for wave components

Table A-4 NWW3 Wave 1. Annual frequency tables. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual	Wave Peak Period, T_P (s)											
Mean Wave Direction, MWD (°N, from)	< 2	> 2 - 4	> 4 - 6	> 6 - 8	> 8 - 10	> 10 - 12	> 12 - 14	> 14 - 16	> 16 - 18	> 18 - 20	> 20	All T_P	Cum T_P
N	0	0	0	0.006	0.006	0.002	0	0	0	0	0	0.01	0.01
NNE	0	0	0.017	0.017	0.009	0.002	0	0	0	0	0	0.04	0.06
NE	0	0	0.155	0.875	0.278	0.011	0	0	0	0	0	1.32	1.38
ENE	0	0.002	0.320	3.255	3.266	0.172	0	0.013	0	0	0	7.03	8.40
E	0	0	0.107	0.687	1.301	0.228	0.076	0.002	0	0	0	2.40	10.80
ESE	0	0	0.024	0.309	0.648	0.344	0.043	0	0	0	0	1.37	12.17
SE	0	0	0.017	0.191	0.616	0.366	0.048	0	0	0	0	1.24	13.41
SSE	0	0	0.017	0.141	0.714	0.551	0.048	0.013	0	0	0	1.48	14.89
S	0	0	0.015	0.133	0.859	0.944	0.141	0.041	0	0	0	2.13	17.03
SSW	0	0	0.013	0.194	1.897	5.089	2.374	0.640	0.061	0	0	10.27	27.29
SW	0	0	0.026	0.333	5.294	25.261	18.707	3.594	0.276	0.013	0	53.50	80.80
WSW	0	0	0.046	0.651	2.628	7.182	4.961	1.436	0.183	0.011	0	17.10	97.90
W	0	0	0.118	0.662	0.759	0.339	0.026	0.002	0	0	0	1.91	99.80
WNW	0	0.002	0.024	0.089	0.054	0.004	0	0	0	0	0	0.17	99.97
NW	0	0	0	0.006	0.009	0	0	0	0	0	0	0.01	99.99
NNW	0	0	0	0.006	0.006	0	0	0	0	0	0	0.01	100.00
All Dir	0.00	0.00	0.90	7.55	18.34	40.49	26.42	5.74	0.52	0.02	0.00		
Cum Dir	0.00	0.00	0.90	8.46	26.80	67.29	93.72	99.46	99.98	100.00	100.00		

Annual	Significant Wave Height, H_s (m)													
Mean Wave Direction, MWD (°N, from)	< 1	> 1 - 2	> 2 - 3	> 3 - 4	> 4 - 5	> 5 - 6	> 6 - 7	> 7 - 8	> 8 - 9	> 9 - 10	> 10 - 11	> 11 - 12	> 12	All Hs	Cum Hs
N	0	0	0.007	0.004	0	0.002	0	0	0	0	0	0	0	0.01	0.01
NNE	0	0.004	0.022	0.019	0	0	0	0	0	0	0	0	0	0.04	0.06
NE	0	0.026	0.474	0.694	0.124	0.002	0	0	0	0	0	0	0	1.32	1.38
ENE	0	0.272	3.155	2.994	0.538	0.054	0.015	0	0	0	0	0	0	7.03	8.40
E	0	0.205	1.182	0.761	0.185	0.046	0.011	0.009	0	0	0	0	0	2.40	10.80
ESE	0	0.089	0.622	0.450	0.168	0.039	0	0	0	0	0	0	0	1.37	12.17
SE	0	0.063	0.640	0.376	0.115	0.037	0.007	0	0	0	0	0	0	1.24	13.41
SSE	0	0.115	0.681	0.490	0.157	0.031	0.009	0	0	0	0	0	0	1.48	14.89
S	0	0.124	1.007	0.637	0.231	0.091	0.028	0.015	0	0	0	0	0	2.13	17.03
SSW	0	0.622	4.539	3.453	1.099	0.389	0.131	0.022	0.013	0	0	0	0	10.27	27.29
SW	0	1.939	20.333	18.177	7.802	3.203	1.323	0.476	0.179	0.054	0.013	0.004	0	53.50	80.80
WSW	0	0.520	4.471	4.532	3.181	2.228	1.099	0.637	0.254	0.107	0.057	0.013	0	17.10	97.90
W	0	0.050	0.374	0.674	0.457	0.205	0.105	0.033	0.004	0.004	0	0	0	1.91	99.80
WNW	0	0.007	0.043	0.094	0.022	0.004	0.002	0	0	0	0	0	0	0.17	99.97
NW	0	0.002	0.004	0.009	0	0	0	0	0	0	0	0	0	0.01	99.99
NNW	0	0.002	0.006	0.004	0	0	0	0	0	0	0	0	0	0.01	100.00
All Dir	0.00	4.04	37.56	33.37	14.08	6.33	2.73	1.19	0.45	0.16	0.07	0.02	0.00		
Cum Dir	0.00	4.04	41.60	74.96	89.05	95.38	98.11	99.30	99.75	99.91	99.98	100.00	100.00		

Annual	Wave Peak Period, T_P (s)											
Significant Wave Height, Hs (m)	< 2	> 2 - 4	> 4 - 6	> 6 - 8	> 8 - 10	> 10 - 12	> 12 - 14	> 14 - 16	> 16 - 18	> 18 - 20	> 20	All T_P	Cum T_P
< 1	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
> 1 - 2	0	0.004	0.122	0.518	1.801	1.334	0.207	0.039	0.015	0	0	4.04	4.04
> 2 - 3	0	0	0.727	3.317	8.347	18.732	5.378	0.925	0.133	0.006	0	37.57	41.61
> 3 - 4	0	0	0.050	3.485	5.193	12.147	10.474	1.854	0.152	0.017	0	33.37	74.98
> 4 - 5	0	0	0	0.235	2.456	4.583	5.436	1.260	0.111	0.002	0	14.08	89.06
> 5 - 6	0	0	0	0	0.518	2.391	2.539	0.822	0.061	0	0	6.33	95.39
> 6 - 7	0	0	0	0	0.030	1.016	1.266	0.396	0.024	0	0	2.73	98.12
> 7 - 8	0	0	0	0	0	0.276	0.685	0.218	0.013	0	0	1.19	99.32
> 8 - 9	0	0	0	0	0	0.022	0.316	0.111	0	0	0	0.45	99.76
> 9 - 10	0	0	0	0	0	0	0.096	0.067	0.002	0	0	0.16	99.93
> 10 -11	0	0	0	0	0	0	0.026	0.043	0.002	0	0	0.07	100.00
> 11 -12	0	0	0	0	0	0	0.004	0.006	0.007	0	0	0.02	100.02
> 12	0	0	0	0	0	0	0	0	0	0	0	0.00	100.02
All H_s	0.00	0.00	0.90	7.55	18.35	40.50	26.43	5.74	0.52	0.02	0.00		
Cum H_s	0.00	0.00	0.90	8.46	26.80	67.30	93.73	99.47	99.99	100.02	100.02		

Table A-5 NWW3 Wave 2. Annual frequency tables. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual	Wave Peak Period, T_P (s)												
Mean Wave Direction, MWD (°N, from)	< 2	> 2 - 4	> 4 - 6	> 6 - 8	> 8 - 10	> 10 - 12	> 12 - 14	> 14 - 16	> 16 - 18	> 18 - 20	> 20	All T_P	Cum T_P
N	0	0	0.019	0.050	0.048	0.006	0	0	0	0	0	0.12	0.12
NNE	0	0	0.120	0.990	0.302	0.002	0	0	0	0	0	1.41	1.54
NE	0	0	0.217	3.357	2.879	0.070	0	0.004	0	0	0	6.53	8.06
ENE	0	0	0.155	1.725	1.405	0.137	0.002	0.013	0	0	0	3.44	11.50
E	0	0	0.039	0.383	0.688	0.331	0.087	0.002	0	0	0	1.53	13.03
ESE	0	0	0.013	0.265	0.526	0.368	0.043	0	0	0	0	1.21	14.24
SE	0	0	0.011	0.183	0.537	0.376	0.033	0	0	0	0	1.14	15.38
SSE	0	0	0.004	0.154	0.683	0.463	0.063	0.006	0	0	0	1.37	16.75
S	0	0	0.024	0.137	0.764	0.916	0.152	0.044	0	0	0	2.04	18.79
SSW	0	0	0.017	0.194	1.839	4.650	2.280	0.622	0.065	0	0	9.67	28.46
SW	0	0	0.028	0.276	4.306	24.215	19.062	3.810	0.313	0.017	0	52.03	80.48
WSW	0	0	0.028	0.396	2.444	7.617	5.440	1.519	0.192	0.013	0	17.65	98.13
W	0	0	0.050	0.483	0.620	0.337	0.039	0.004	0	0	0	1.53	99.67
WNW	0	0	0.019	0.109	0.067	0.007	0	0	0	0	0	0.20	99.87
NW	0	0	0.007	0.046	0.020	0.002	0	0.002	0	0	0	0.08	99.95
NNW	0	0	0.002	0.019	0.026	0.007	0	0	0	0	0	0.05	100.00
All Dir	0.00	0.00	0.75	8.77	17.15	39.50	27.20	6.03	0.57	0.03	0.00		
Cum Dir	0.00	0.00	0.75	9.52	26.67	66.18	93.38	99.40	99.97	100.00	100.00		

Annual	Significant Wave Height, H_s (m)													
Mean Wave Direction, MWD (°N, from)	< 1	> 1 - 2	> 2 - 3	> 3 - 4	> 4 - 5	> 5 - 6	> 6 - 7	> 7 - 8	> 8 - 9	> 9 - 10	> 10 - 11	> 11 - 12	> 12	All Hs	Cum Hs
N	0	0.009	0.063	0.048	0.002	0	0	0	0	0	0	0	0	0.12	0.12
NNE	0	0.031	0.415	0.755	0.204	0.009	0	0	0	0	0	0	0	1.41	1.54
NE	0	0.213	2.450	3.050	0.718	0.087	0.009	0	0	0	0	0	0	6.53	8.06
ENE	0	0.167	1.652	1.338	0.224	0.048	0.007	0	0	0	0	0	0	3.44	11.50
E	0	0.072	0.724	0.542	0.157	0.011	0.006	0.007	0.011	0	0	0	0	1.53	13.03
ESE	0	0.056	0.581	0.372	0.148	0.048	0.009	0	0	0	0	0	0	1.21	14.24
SE	0	0.059	0.579	0.326	0.115	0.056	0.006	0	0	0	0	0	0	1.14	15.38
SSE	0	0.085	0.594	0.522	0.141	0.028	0.002	0	0	0	0	0	0	1.37	16.75
S	0	0.137	0.857	0.629	0.287	0.104	0.017	0.004	0.004	0	0	0	0	2.04	18.79
SSW	0	0.551	4.226	3.283	1.114	0.340	0.115	0.026	0.007	0.004	0	0	0	9.67	28.46
SW	0	1.721	18.991	18.738	7.713	2.968	1.240	0.433	0.144	0.059	0.015	0.004	0	52.03	80.48
WSW	0	0.350	4.073	4.867	3.531	2.409	1.271	0.651	0.292	0.131	0.052	0.022	0	17.65	98.13
W	0	0.031	0.303	0.540	0.350	0.179	0.089	0.028	0.006	0.002	0.004	0	0	1.53	99.67
WNW	0	0	0.087	0.085	0.028	0.002	0	0	0	0	0	0	0	0.20	99.87
NW	0	0.007	0.048	0.019	0.004	0	0	0	0	0	0	0	0	0.08	99.95
NNW	0	0.002	0.022	0.022	0.007	0	0	0	0	0	0	0	0	0.05	100.00
All Dir	0.00	3.49	35.67	35.14	14.74	6.29	2.77	1.15	0.46	0.20	0.07	0.03	0.00		
Cum Dir	0.00	3.49	39.16	74.29	89.03	95.32	98.09	99.24	99.71	99.90	99.97	100.00	100.00		

Annual	Wave Peak Period, T_P (s)												
Significant Wave Height, Hs (m)	< 2	> 2 - 4	> 4 - 6	> 6 - 8	> 8 - 10	> 10 - 12	> 12 - 14	> 14 - 16	> 16 - 18	> 18 - 20	> 20	All T_P	Cum T_P
< 1	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
> 1 - 2	0	0	0.107	0.579	1.447	1.162	0.152	0.039	0.006	0	0	3.49	3.49
> 2 - 3	0	0	0.605	3.983	7.389	17.771	4.985	0.813	0.122	0.007	0	35.68	39.17
> 3 - 4	0	0	0.039	3.876	5.471	12.498	11.074	1.962	0.205	0.019	0	35.14	74.31
> 4 - 5	0	0	0	0.326	2.410	4.629	5.847	1.423	0.106	0.004	0	14.74	89.06
> 5 - 6	0	0	0	0.004	0.433	2.291	2.625	0.864	0.074	0	0	6.29	95.35
> 6 - 7	0	0	0	0	0.007	0.924	1.386	0.424	0.030	0	0	2.77	98.12
> 7 - 8	0	0	0	0	0	0.228	0.698	0.211	0.013	0	0	1.15	99.27
> 8 - 9	0	0	0	0	0	0.011	0.309	0.144	0	0	0	0.46	99.73
> 9 - 10	0	0	0	0	0	0	0.107	0.087	0.002	0	0	0.20	99.93
> 10 -11	0	0	0	0	0	0	0.022	0.044	0.004	0	0	0.07	100.00
> 11 -12	0	0	0	0	0	0	0.002	0.015	0.009	0	0	0.03	100.03
> 12	0	0	0	0	0	0	0	0	0	0	0	0.00	100.03
All H_s	0.00	0.00	0.75	8.77	17.16	39.51	27.21	6.03	0.57	0.03	0.00		
Cum H_s	0.00	0.00	0.75	9.52	26.68	66.19	93.40	99.43	100.00	100.03	100.03		

Appendix B
Nearshore Wave Climate Results

B.1 Wave Roses

B.2 Frequency Tables

B.3 Non-Exceedance Plots

B.4 Histograms

B.1 Wave Roses

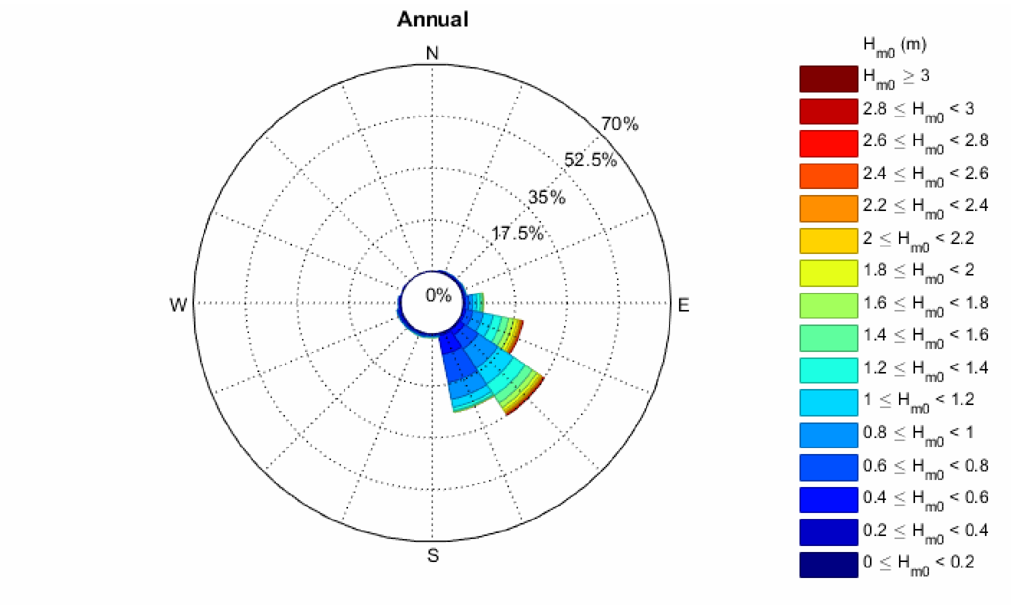

Figure B-1 Annual wave rose based at P01

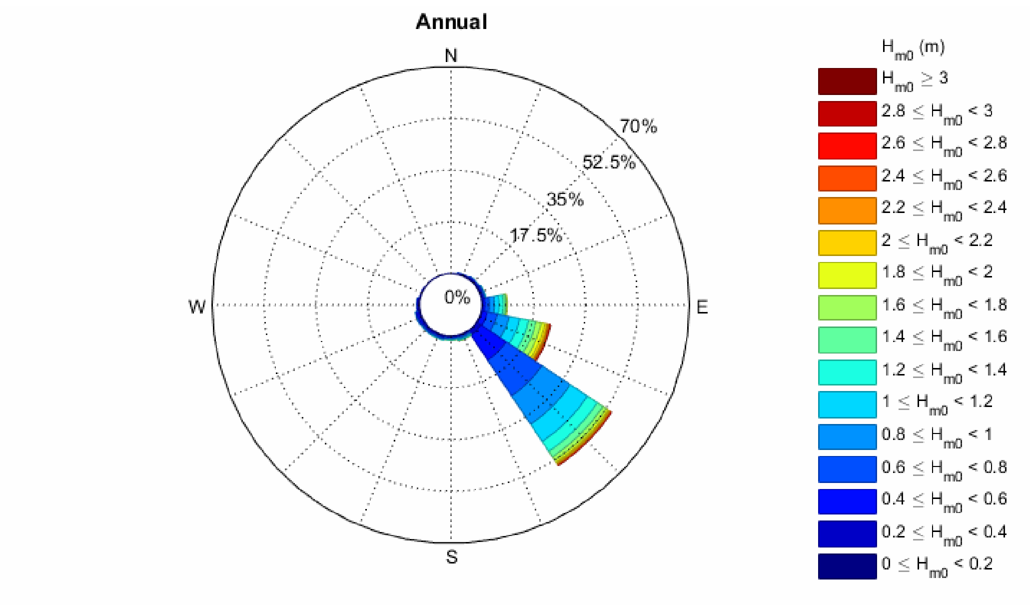

Figure B-2 Annual wave rose based at P02

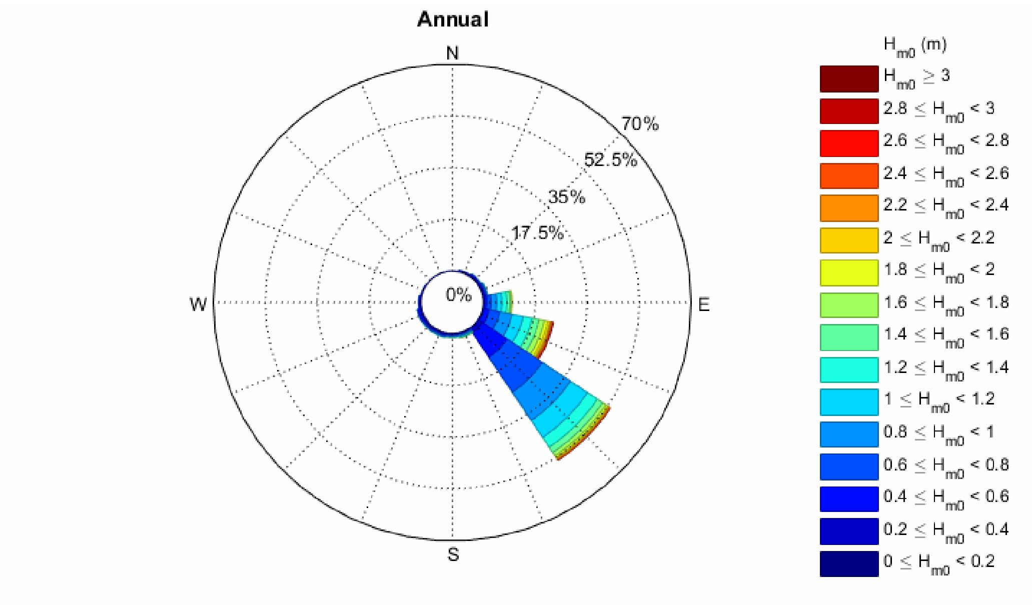

Figure B-3 Annual wave rose based at P03

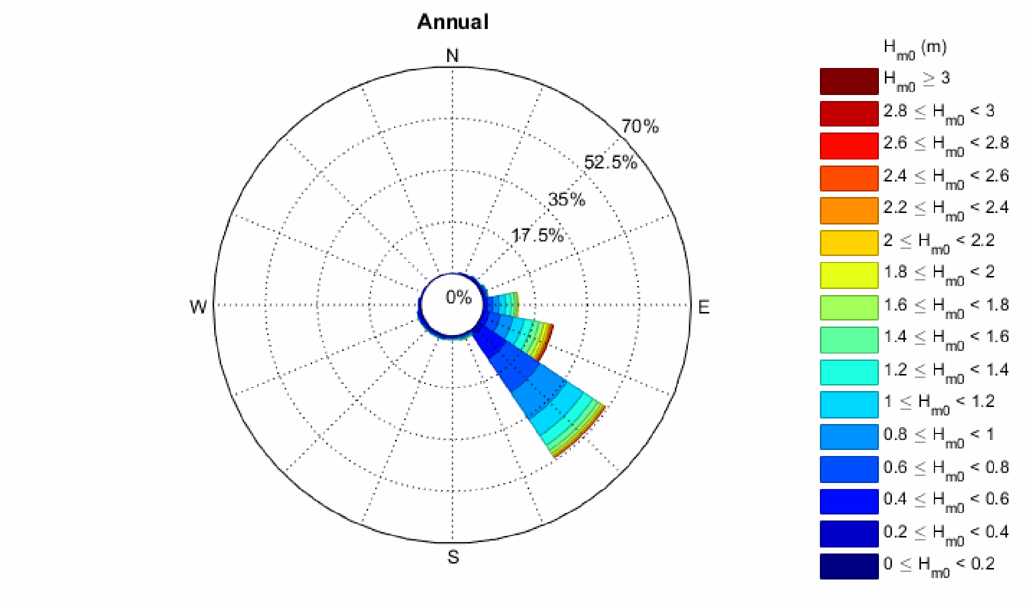

Figure B-4 Annual wave rose based at P04

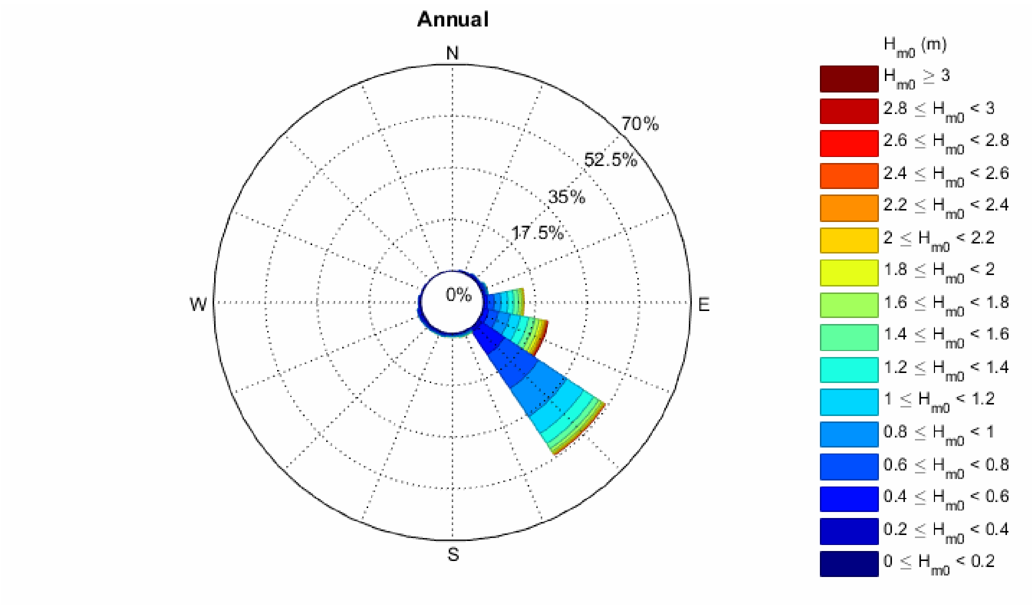

Figure B-5 Annual wave rose based at P05

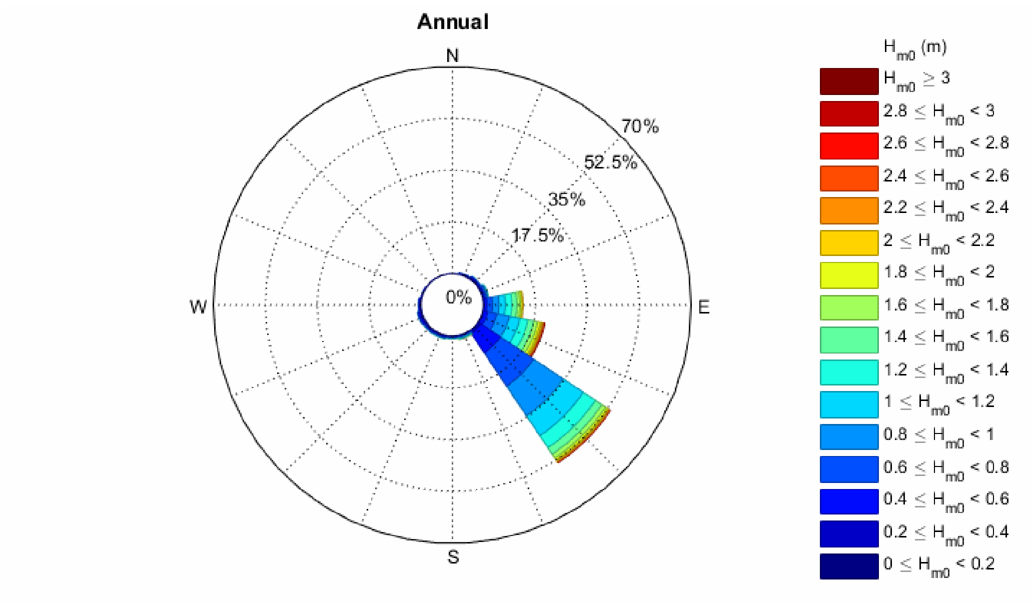

Figure B-6 Annual wave rose based at P06

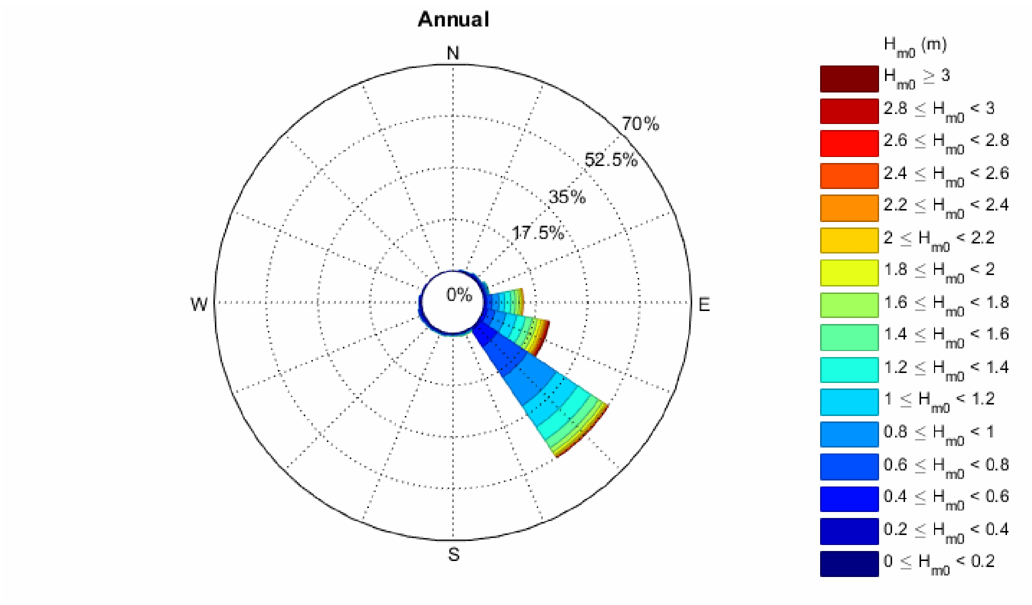

Figure B-7 Annual wave rose based at P07

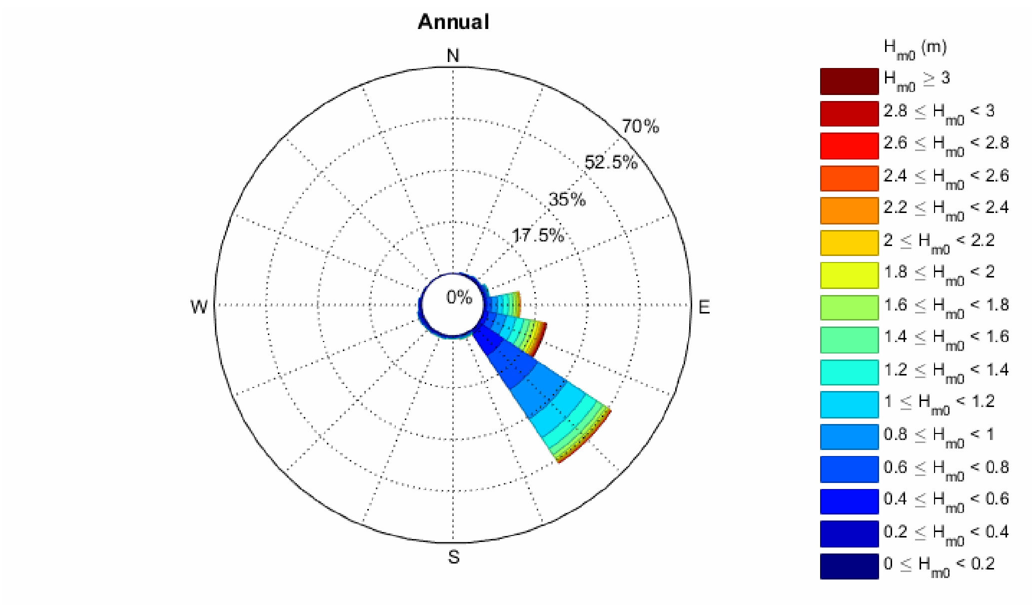

Figure B-8 Annual wave rose based at P08

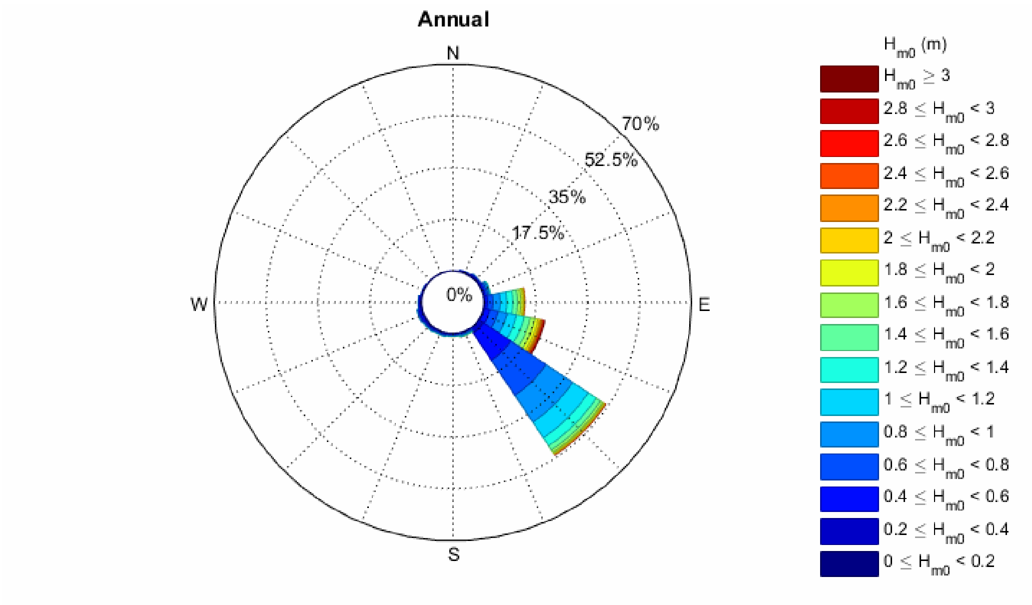

Figure B-9 Annual wave rose based at P09

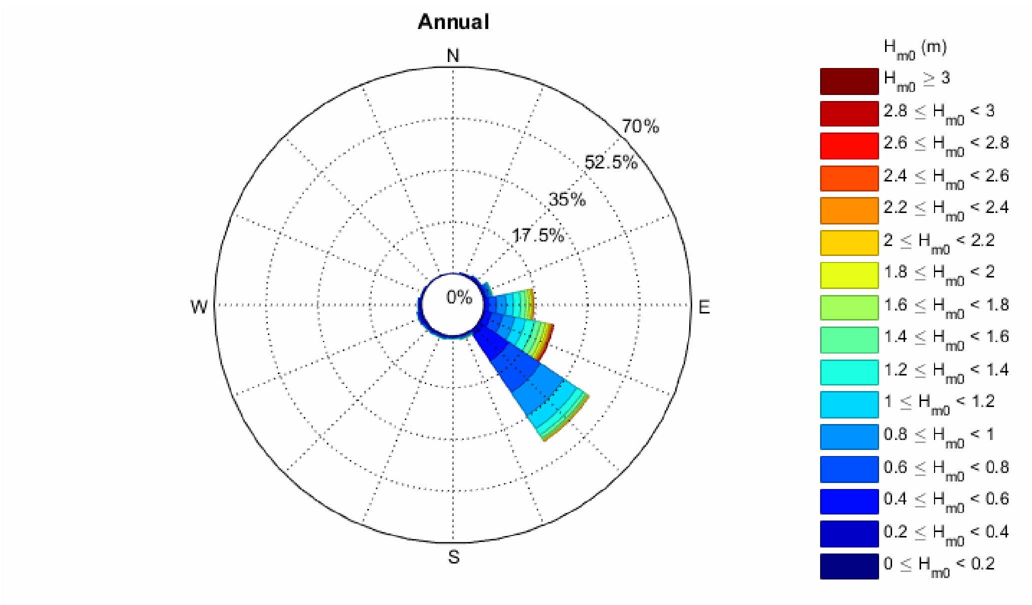

Figure B-10 Annual wave rose based at P10

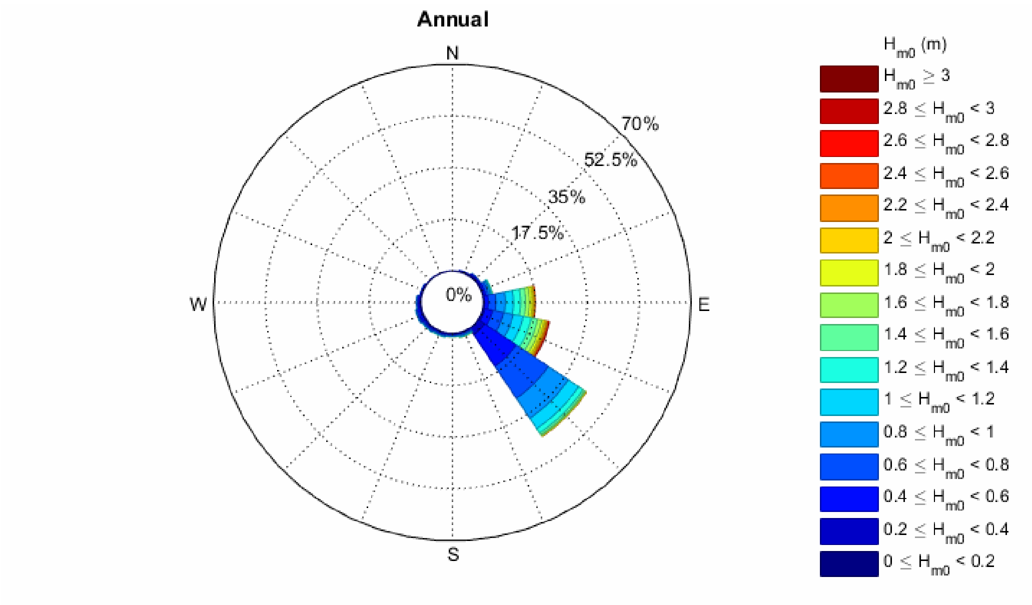

Figure B-11 Annual wave rose based at P11

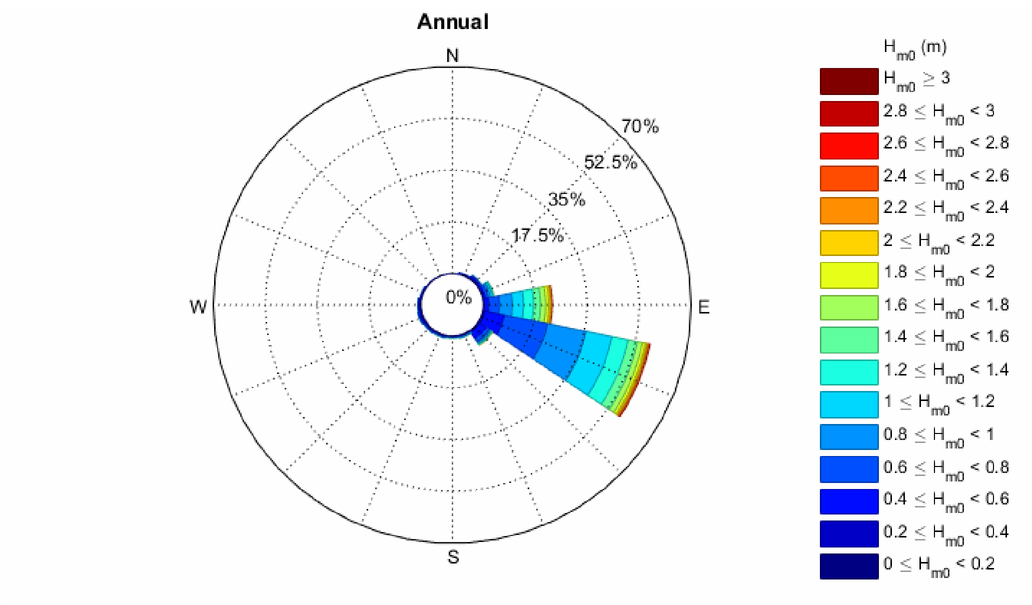

Figure B-12 Annual wave rose based at P12

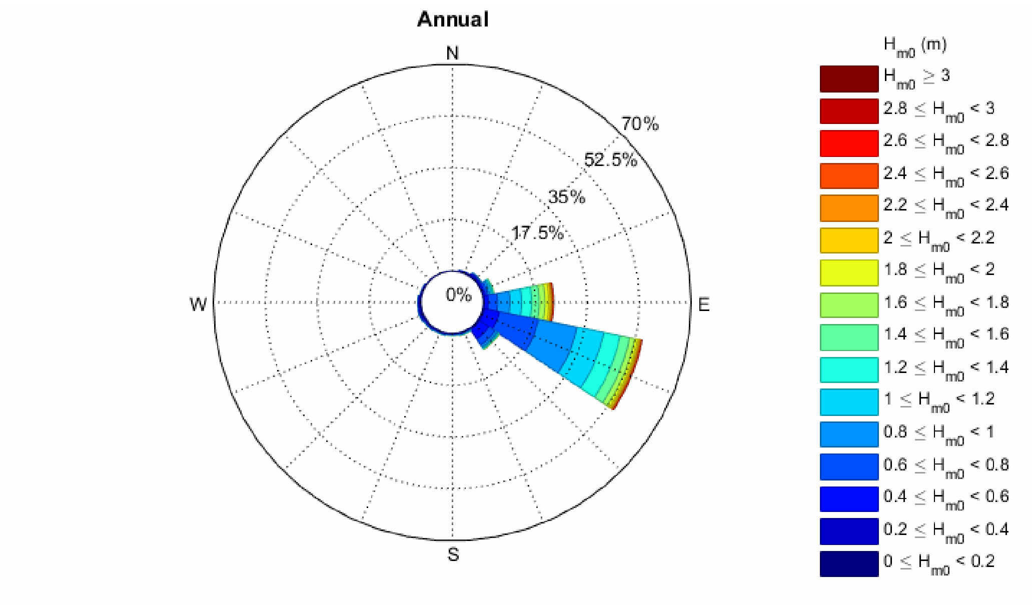

Figure B-13 Annual wave rose based at P13

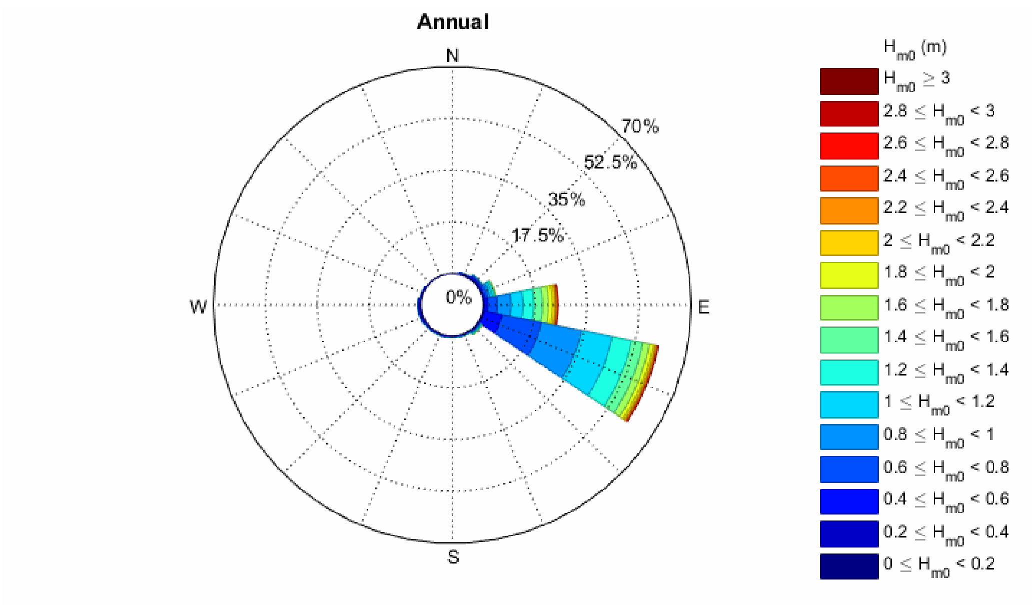

Figure B-14 Annual wave rose based at P14

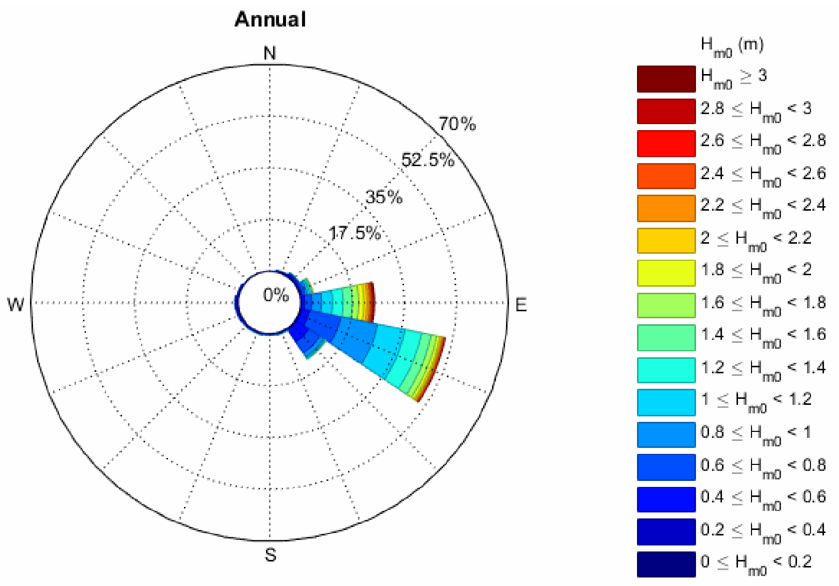

Figure B-15 Annual wave rose based at P15

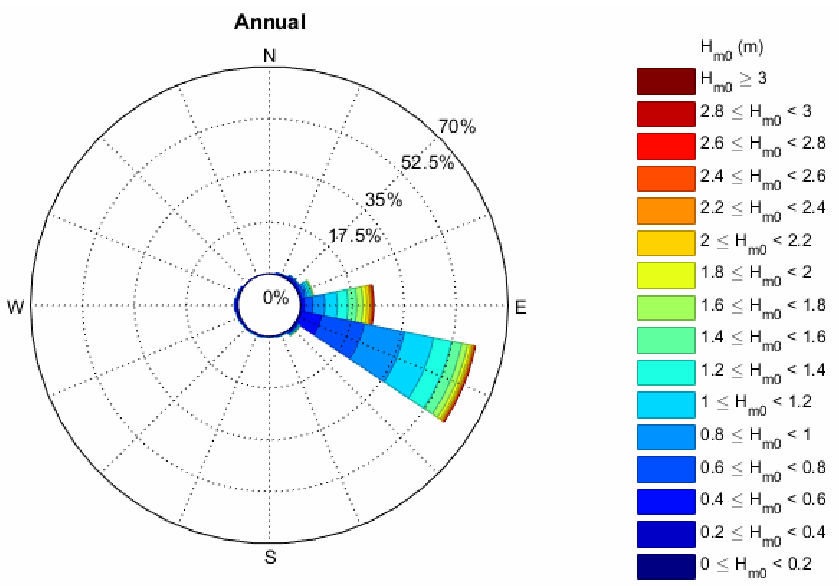

Figure B-16 Annual wave rose based at P16

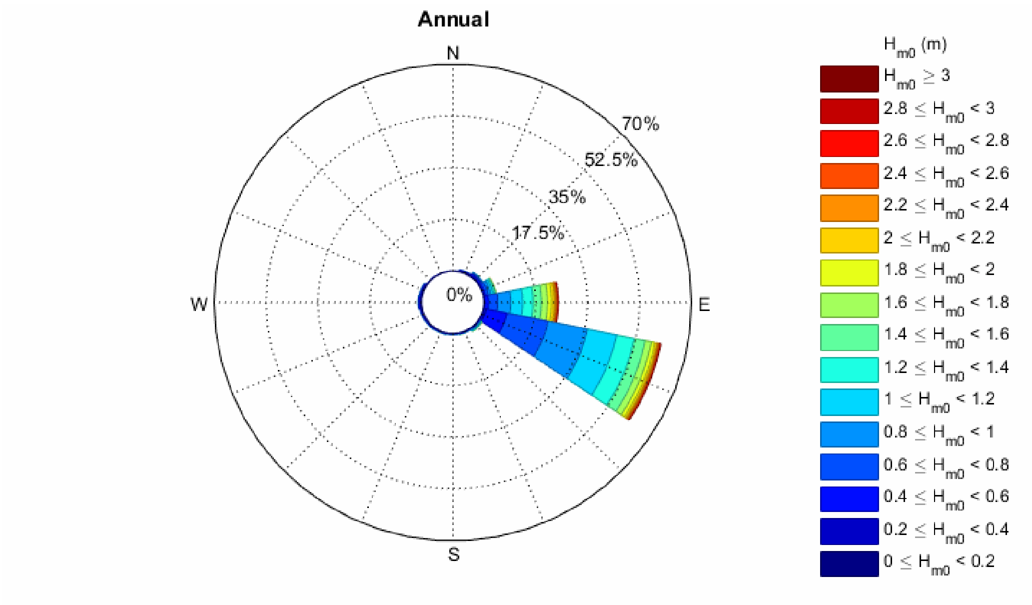

Figure B-17 Annual wave rose based at P17

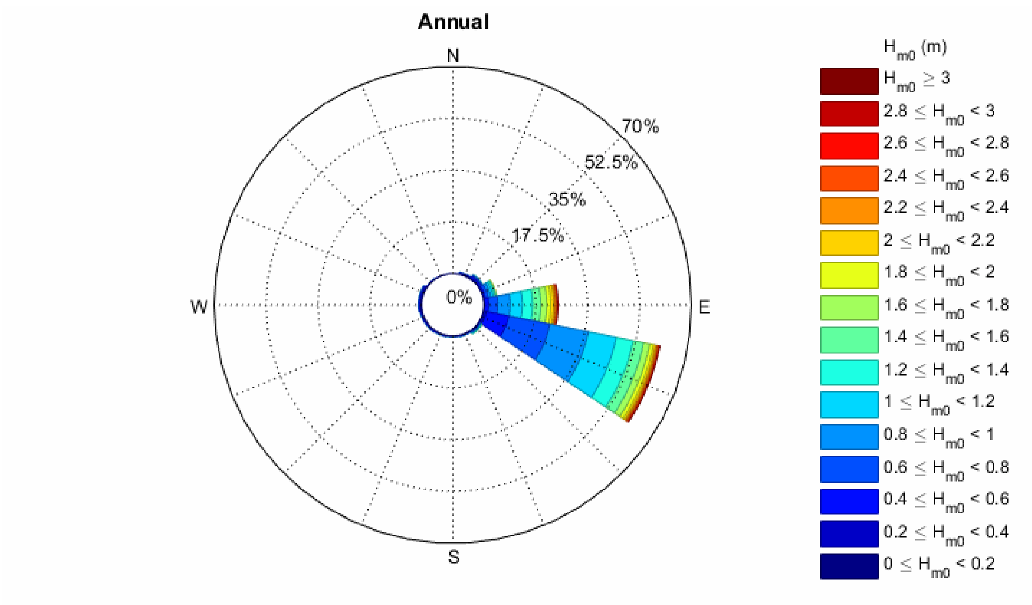

Figure B-18 Annual wave rose based at P18

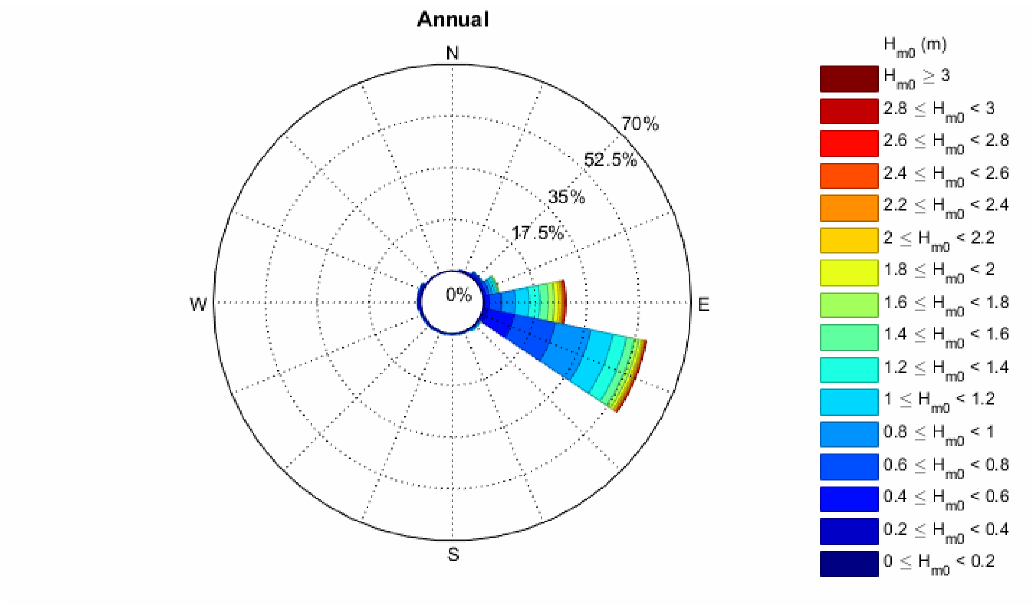

Figure B-19 Annual wave rose based at P19

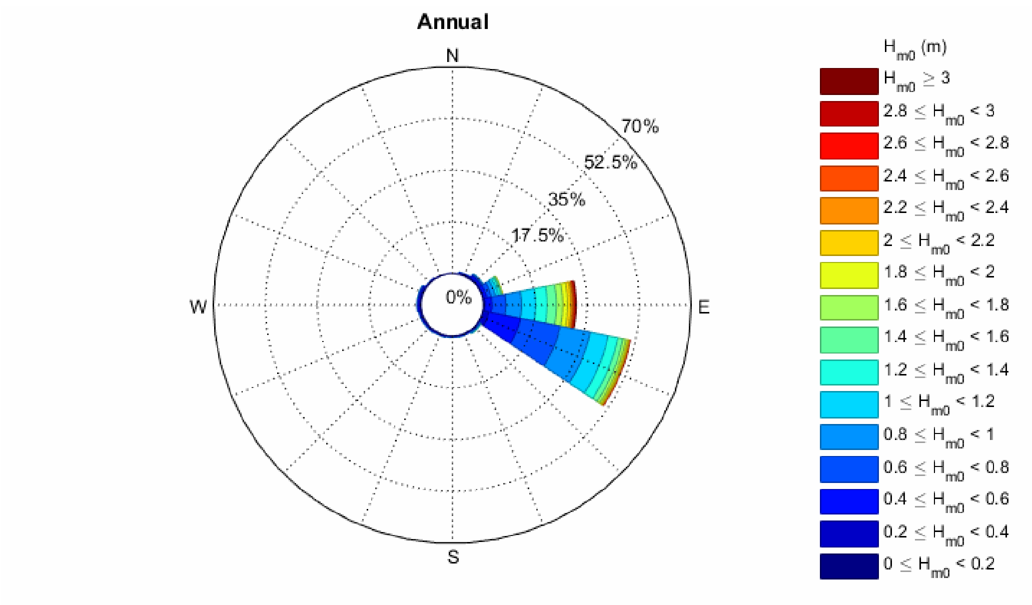

Figure B-20 Annual wave rose based at P20

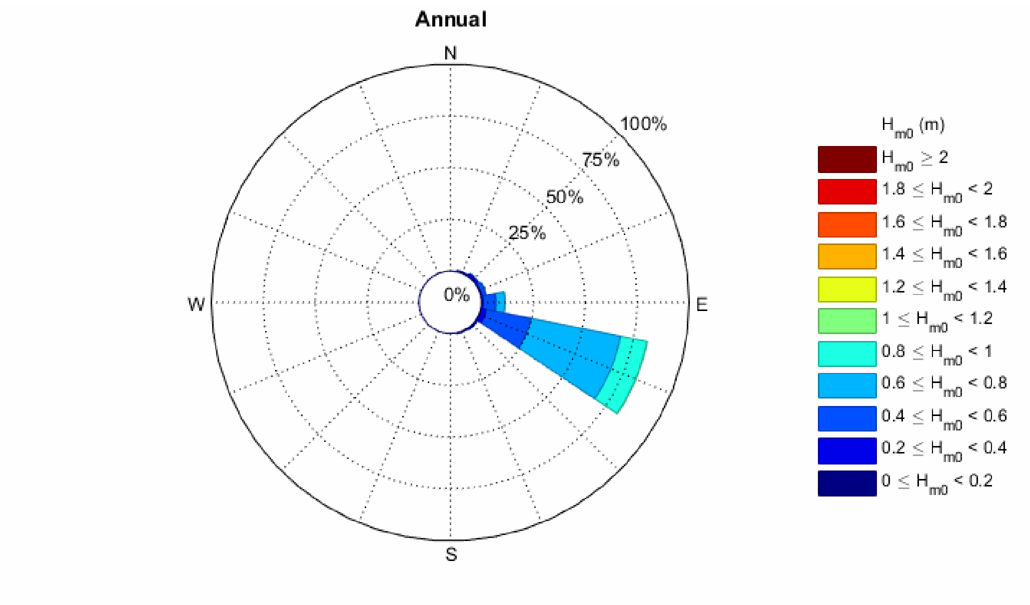

Figure B-21 Annual wave rose based at P21

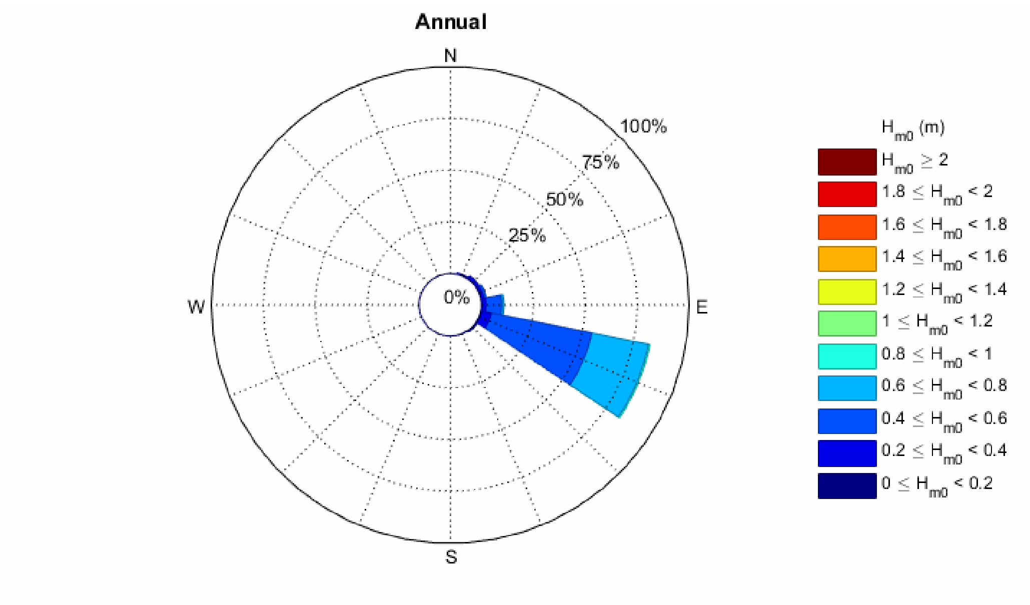

Figure B-22 Annual wave rose based at P22

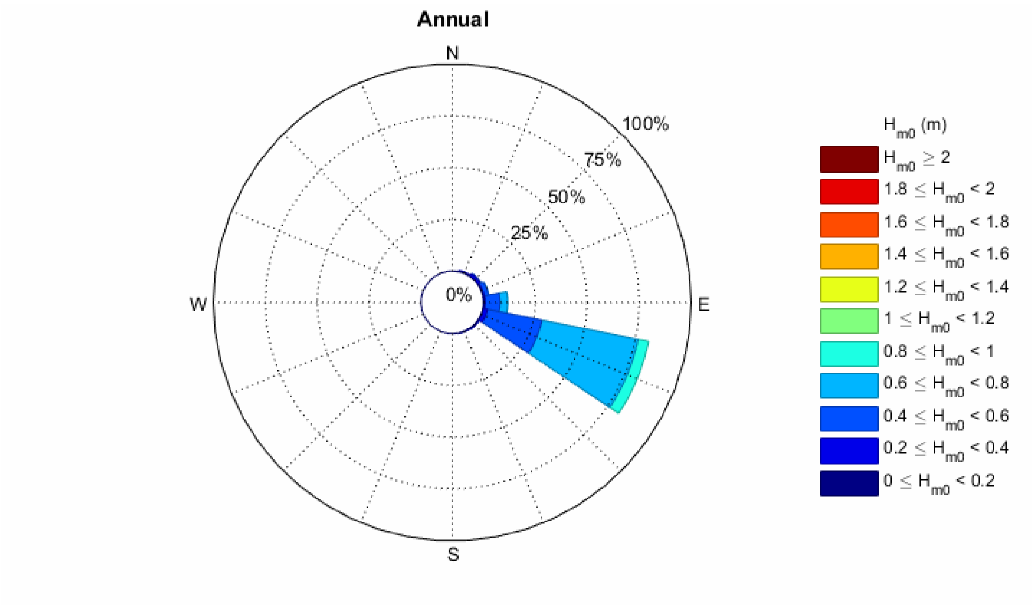

Figure B-23 Annual wave rose based at P23

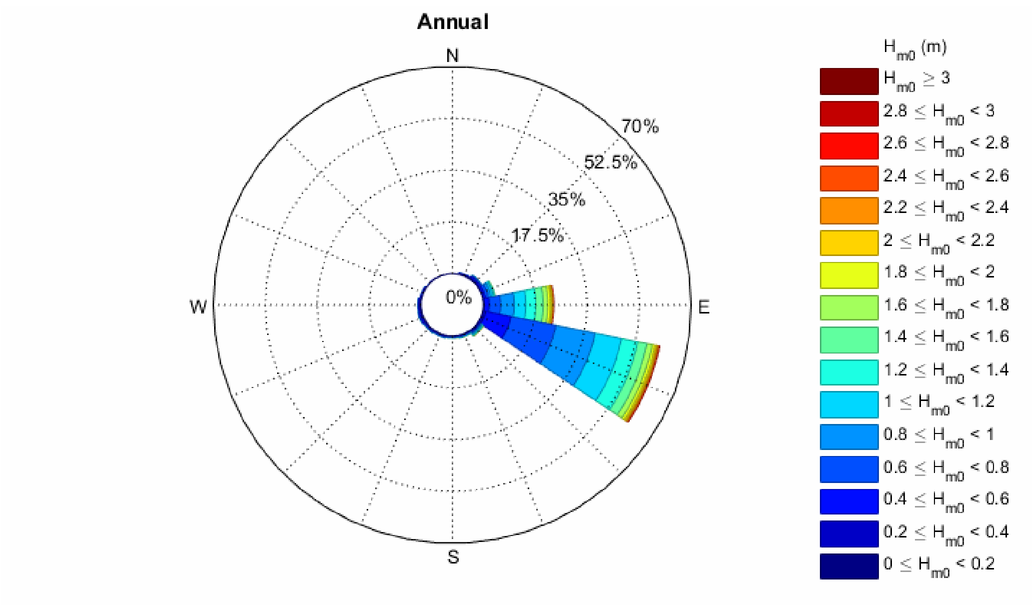

Figure B-24 Annual wave rose based at P24

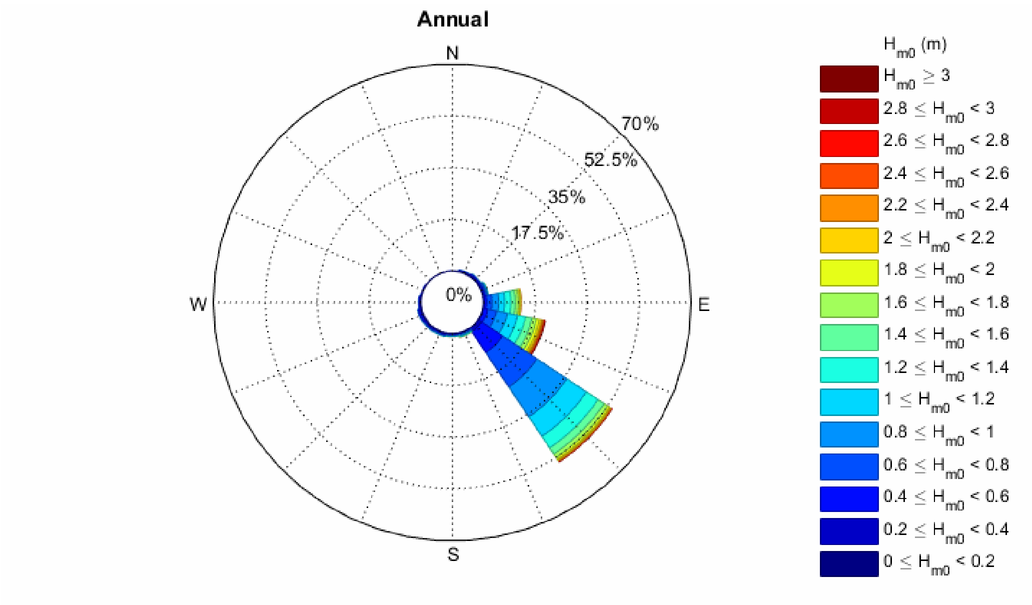

Figure B-25 Annual wave rose based at P25

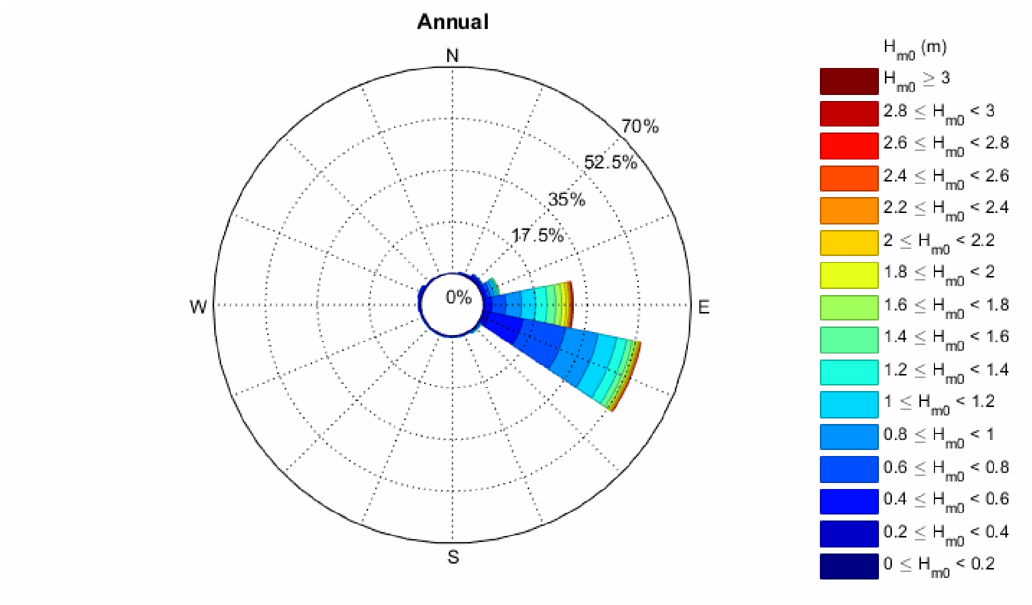

Figure B-26 Annual wave rose based at P26

B.2 Frequency Tables

Table B-1 Annual frequency of occurrence tableat P01. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual	Peak Wave Period, T_P (s)												
Mean Wave Direction, MWD (oN)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
N	0.081	0.081	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.16	0.16
NNE	0.035	0.309	0.359	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.70	0.87
NE	0.013	0.104	0.811	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.96	1.83
ENE	0.009	0.307	0.629	0.377	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.32	3.15
E	0.007	0.846	4.704	1.273	0.020	0.000	0.000	0.000	0.000	0.000	0.000	6.85	10.00
ESE	0.002	1.447	6.721	7.611	4.602	0.353	0.035	0.002	0.000	0.000	0.000	20.77	30.78
SE	0.004	0.431	1.382	1.440	10.133	21.279	0.328	0.039	0.000	0.000	0.000	35.04	65.81
SSE	0.002	0.407	0.690	0.811	5.611	19.560	0.000	0.000	0.000	0.000	0.000	27.08	92.89
S	0.026	0.440	0.557	0.198	0.019	0.000	0.000	0.000	0.000	0.000	0.000	1.24	94.13
SSW	0.078	1.162	0.091	0.061	0.006	0.000	0.000	0.000	0.000	0.000	0.000	1.40	95.53
SW	0.120	1.214	0.081	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.42	96.95
WSW	0.318	1.353	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.67	98.62
W	0.331	0.657	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.99	99.61
WNW	0.157	0.159	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.32	99.92
NW	0.039	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	99.98
NNW	0.019	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.02	100.00
All PWD	1.24	8.94	16.03	11.81	20.39	41.19	0.36	0.04	0.00	0.00	0.00		
Cum PWD	1.24	10.18	26.20	38.01	58.40	99.60	99.96	100.00	100.00	100.00	100.00		

Annual	Significant Wave Height, H_s (m)												
Mean Wave Direction, MWD (oN)	0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
N	0.148	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.16	0.16
NNE	0.420	0.261	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.70	0.87
NE	0.389	0.522	0.052	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.96	1.83
ENE	0.307	0.855	0.146	0.013	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.32	3.15
E	0.302	2.850	2.963	0.707	0.028	0.002	0.000	0.000	0.000	0.000	0.000	6.85	10.00
ESE	0.420	6.597	7.559	4.193	1.440	0.394	0.137	0.031	0.002	0.000	0.000	20.77	30.78
SE	1.188	14.858	12.768	4.280	1.255	0.468	0.157	0.068	0.017	0.000	0.000	35.04	65.81
SSE	3.070	19.515	4.068	0.361	0.050	0.013	0.004	0.002	0.000	0.000	0.000	27.08	92.89
S	0.152	0.650	0.333	0.093	0.013	0.000	0.000	0.000	0.000	0.000	0.000	1.24	94.13
SSW	0.218	0.885	0.252	0.041	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.40	95.53
SW	0.335	0.940	0.131	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.42	96.95
WSW	0.648	0.966	0.057	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.67	98.62
W	0.427	0.542	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.99	99.61
WNW	0.178	0.139	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.32	99.92
NW	0.041	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	99.98
NNW	0.019	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.02	100.00
All PWD	8.26	49.61	28.37	9.68	2.79	0.88	0.30	0.10	0.02	0.00	0.00		
Cum PWD	8.26	57.87	86.24	95.92	98.71	99.58	99.88	99.98	100.00	100.00	100.00		

Annual	Peak Wave Period, T_P (s)												
Significant Waved Height, H_s (m)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
0 - 0.5	1.212	1.684	0.714	0.840	2.367	1.443	0.000	0.000	0.000	0.000	0.000	8.26	8.26
0.5 - 1	0.030	6.926	4.252	4.204	10.222	23.975	0.000	0.000	0.000	0.000	0.000	49.61	57.87
1 - 1.5	0.000	0.324	8.584	2.039	5.291	12.093	0.031	0.004	0.000	0.000	0.000	28.37	86.24
1.5 - 2	0.000	0.002	2.437	2.641	1.797	2.665	0.118	0.022	0.000	0.000	0.000	9.68	95.92
2 - 2.5	0.000	0.000	0.037	1.540	0.403	0.692	0.109	0.007	0.000	0.000	0.000	2.79	98.71
2.5 - 3	0.000	0.000	0.000	0.457	0.124	0.217	0.074	0.004	0.000	0.000	0.000	0.88	99.58
3 - 3.5	0.000	0.000	0.000	0.091	0.111	0.080	0.013	0.004	0.000	0.000	0.000	0.30	99.88
3.5 - 4	0.000	0.000	0.000	0.000	0.059	0.026	0.017	0.000	0.000	0.000	0.000	0.10	99.98
4 - 4.5	0.000	0.000	0.000	0.000	0.017	0.002	0.000	0.000	0.000	0.000	0.000	0.02	100.00
4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
All H_s	1.24	8.94	16.03	11.81	20.39	41.19	0.36	0.04	0.00	0.00	0.00		
Cum H_s	1.24	10.18	26.20	38.01	58.40	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-2 Annual frequency of occurrence tableat P02. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.067	0.065	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.035	0.298	0.274	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.61	0.74
	NE	0.019	0.109	0.873	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.04	1.78
	ENE	0.011	0.381	0.598	0.524	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.52	3.29
	E	0.007	1.160	5.489	1.751	0.078	0.000	0.000	0.000	0.000	0.000	0.000	8.48	11.78
	ESE	0.002	1.758	6.704	7.095	7.644	0.544	0.083	0.015	0.000	0.000	0.000	23.85	35.62
	SE	0.004	0.563	1.416	1.427	11.738	39.247	0.278	0.026	0.000	0.000	0.000	54.69	90.32
	SSE	0.006	0.816	0.759	0.231	0.076	0.002	0.000	0.000	0.000	0.000	0.000	1.89	92.21
	S	0.030	1.018	0.213	0.078	0.026	0.002	0.000	0.000	0.000	0.000	0.000	1.37	93.57
	SSW	0.094	1.318	0.111	0.068	0.004	0.000	0.000	0.000	0.000	0.000	0.000	1.60	95.17
	SW	0.118	1.384	0.085	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.59	96.75
	WSW	0.361	1.447	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.81	98.56
	W	0.392	0.659	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.05	99.61
	WNW	0.141	0.157	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.30	99.91
	NW	0.052	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.07	99.98
	NNW	0.017	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.02	100.00
	All PWD	1.35	11.15	16.52	11.21	19.57	39.79	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	1.35	12.51	29.03	40.24	59.80	99.60	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.124	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.389	0.194	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.61	0.74
	NE	0.489	0.509	0.039	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.04	1.78
	ENE	0.398	0.940	0.163	0.013	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.52	3.29
	E	0.479	3.658	3.451	0.853	0.039	0.004	0.000	0.000	0.000	0.000	0.000	8.48	11.78
	ESE	0.879	8.603	8.087	4.243	1.442	0.394	0.159	0.039	0.000	0.000	0.000	23.85	35.62
	SE	5.585	32.300	12.309	3.140	0.892	0.339	0.087	0.033	0.009	0.000	0.000	54.69	90.32
	SSE	0.141	0.936	0.620	0.152	0.037	0.004	0.000	0.000	0.000	0.000	0.000	1.89	92.21
	S	0.200	0.738	0.328	0.093	0.007	0.000	0.000	0.000	0.000	0.000	0.000	1.37	93.57
	SSW	0.291	0.988	0.287	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.60	95.17
	SW	0.416	1.038	0.130	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.59	96.75
	WSW	0.811	0.955	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.81	98.56
	W	0.550	0.492	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.05	99.61
	WNW	0.187	0.111	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.30	99.91
	NW	0.054	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.07	99.98
	NNW	0.017	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.02	100.00
	All PWD	11.01	51.49	25.49	8.53	2.42	0.74	0.25	0.07	0.01	0.00	0.00		
	Cum PWD	11.01	62.50	87.98	96.51	98.93	99.67	99.92	99.99	100.00	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	1.338	2.198	0.792	1.047	3.057	2.574	0.000	0.000	0.000	0.000	0.000	11.01	11.01
	0.5 - 1	0.017	8.436	4.230	3.962	9.715	25.130	0.000	0.000	0.000	0.000	0.000	51.49	62.50
	1 - 1.5	0.000	0.516	9.380	1.532	4.717	9.301	0.039	0.004	0.000	0.000	0.000	25.49	87.98
	1.5 - 2	0.000	0.002	2.102	2.813	1.473	1.997	0.120	0.022	0.000	0.000	0.000	8.53	96.51
	2 - 2.5	0.000	0.000	0.017	1.417	0.320	0.544	0.113	0.007	0.000	0.000	0.000	2.42	98.93
	2.5 - 3	0.000	0.000	0.000	0.366	0.124	0.183	0.063	0.004	0.000	0.000	0.000	0.74	99.67
	3 - 3.5	0.000	0.000	0.000	0.072	0.111	0.048	0.011	0.004	0.000	0.000	0.000	0.25	99.92
	3.5 - 4	0.000	0.000	0.000	0.000	0.039	0.019	0.015	0.000	0.000	0.000	0.000	0.07	99.99
	4 - 4.5	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.01	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	1.35	11.15	16.52	11.21	19.57	39.79	0.36	0.04	0.00	0.00	0.00		
	Cum H_s	1.35	12.51	29.03	40.24	59.80	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-3 Annual frequency of occurrence tableat P03. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual	Peak Wave Period, T_P (s)												
Mean Wave Direction, MWD (oN)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
N	0.081	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	0.14
NNE	0.033	0.329	0.266	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.63	0.77
NE	0.030	0.094	0.931	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.09	1.86
ENE	0.013	0.394	0.659	0.581	0.004	0.000	0.000	0.000	0.000	0.000	0.000	1.65	3.51
E	0.007	1.179	6.212	2.213	0.096	0.002	0.000	0.000	0.000	0.000	0.000	9.71	13.22
ESE	0.004	1.279	6.188	6.808	9.053	0.770	0.120	0.015	0.000	0.000	0.000	24.24	37.46
SE	0.004	0.383	1.393	1.497	10.638	39.412	0.242	0.026	0.000	0.000	0.000	53.60	91.05
SSE	0.004	0.318	0.735	0.531	0.142	0.002	0.000	0.000	0.000	0.000	0.000	1.73	92.78
S	0.028	0.527	0.598	0.167	0.022	0.002	0.000	0.000	0.000	0.000	0.000	1.34	94.13
SSW	0.126	1.256	0.089	0.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.52	95.65
SW	0.226	1.249	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.53	97.18
WSW	0.402	1.238	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.64	98.82
W	0.266	0.579	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.85	99.67
WNW	0.124	0.139	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.26	99.93
NW	0.035	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.05	99.99
NNW	0.013	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.01	100.00
All PWD	1.40	9.05	17.13	11.88	19.96	40.19	0.36	0.04	0.00	0.00	0.00		
Cum PWD	1.40	10.44	27.57	39.45	59.41	99.60	99.96	100.00	100.00	100.00	100.00		

Annual	Significant Wave Height, H_s (m)												
Mean Wave Direction, MWD (oN)	0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
N	0.131	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	0.14
NNE	0.411	0.191	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.63	0.77
NE	0.537	0.513	0.039	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.09	1.86
ENE	0.413	1.044	0.179	0.011	0.004	0.000	0.000	0.000	0.000	0.000	0.000	1.65	3.51
E	0.516	3.925	4.041	1.147	0.072	0.007	0.000	0.000	0.000	0.000	0.000	9.71	13.22
ESE	0.981	9.080	8.155	4.030	1.399	0.426	0.146	0.039	0.000	0.000	0.000	24.24	37.46
SE	5.561	31.782	12.117	2.996	0.786	0.252	0.072	0.020	0.009	0.000	0.000	53.60	91.05
SSE	0.105	0.872	0.575	0.148	0.030	0.002	0.000	0.000	0.000	0.000	0.000	1.73	92.78
S	0.207	0.703	0.342	0.085	0.006	0.000	0.000	0.000	0.000	0.000	0.000	1.34	94.13
SSW	0.328	0.936	0.235	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.52	95.65
SW	0.476	0.946	0.109	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.53	97.18
WSW	0.794	0.816	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.64	98.82
W	0.427	0.411	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.85	99.67
WNW	0.178	0.085	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.26	99.93
NW	0.041	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.05	99.99
NNW	0.013	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.01	100.00
All PWD	11.12	51.31	25.86	8.45	2.30	0.69	0.22	0.06	0.01	0.00	0.00		
Cum PWD	11.12	62.42	88.28	96.73	99.03	99.71	99.93	99.99	100.00	100.00	100.00		

Annual	Peak Wave Period, T_P (s)												
Significant Waved Height, H_s (m)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
0 - 0.5	1.380	2.117	0.831	1.086	3.138	2.565	0.000	0.000	0.000	0.000	0.000	11.12	11.12
0.5 - 1	0.015	6.654	5.422	4.036	9.872	25.307	0.000	0.000	0.000	0.000	0.000	51.31	62.42
1 - 1.5	0.000	0.272	9.238	2.063	4.780	9.463	0.039	0.004	0.000	0.000	0.000	25.86	88.28
1.5 - 2	0.000	0.002	1.638	3.075	1.540	2.054	0.117	0.020	0.000	0.000	0.000	8.45	96.73
2 - 2.5	0.000	0.000	0.002	1.282	0.335	0.555	0.115	0.009	0.000	0.000	0.000	2.30	99.03
2.5 - 3	0.000	0.000	0.000	0.298	0.144	0.176	0.065	0.004	0.000	0.000	0.000	0.69	99.71
3 - 3.5	0.000	0.000	0.000	0.043	0.111	0.050	0.011	0.004	0.000	0.000	0.000	0.22	99.93
3.5 - 4	0.000	0.000	0.000	0.000	0.026	0.017	0.017	0.000	0.000	0.000	0.000	0.06	99.99
4 - 4.5	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.01	100.00
4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
All H_s	1.40	9.05	17.13	11.88	19.96	40.19	0.36	0.04	0.00	0.00	0.00		
Cum H_s	1.40	10.44	27.57	39.45	59.41	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-4 Annual frequency of occurrence tableat P04. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual	Peak Wave Period, T_p (s) 0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_p	Cum T_p
Mean Wave Direction, MWD (oN) N	0.074	0.052	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
NNE	0.039	0.333	0.254	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.63	0.75
NE	0.024	0.102	0.988	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.16	1.91
ENE	0.013	0.439	0.740	0.679	0.006	0.000	0.000	0.000	0.000	0.000	0.000	1.88	3.78
E	0.007	1.207	7.034	3.311	0.176	0.004	0.000	0.000	0.000	0.000	0.000	11.74	15.52
ESE	0.002	1.554	4.665	5.618	10.951	1.234	0.161	0.015	0.000	0.000	0.000	24.20	39.72
SE	0.004	0.426	1.247	1.375	8.797	39.373	0.204	0.026	0.000	0.000	0.000	51.45	91.17
SSE	0.004	0.281	0.709	0.496	0.139	0.002	0.000	0.000	0.000	0.000	0.000	1.63	92.80
S	0.026	0.470	0.575	0.159	0.019	0.002	0.000	0.000	0.000	0.000	0.000	1.25	94.05
SSW	0.126	1.208	0.087	0.050	0.004	0.000	0.000	0.000	0.000	0.000	0.000	1.47	95.53
SW	0.198	1.279	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.54	97.07
WSW	0.396	1.229	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.62	98.69
W	0.279	0.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.88	99.57
WNW	0.163	0.157	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.32	99.89
NW	0.059	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.08	99.97
NNW	0.028	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.03	100.00
All PWD	1.44	9.36	16.36	11.73	20.09	40.61	0.36	0.04	0.00	0.00	0.00		
Cum PWD	1.44	10.80	27.16	38.89	58.96	99.59	99.96	100.00	100.00	100.00	100.00		

Annual	Significant Wave Height, H_s (m) 0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN) N	0.117	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
NNE	0.407	0.202	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.63	0.75
NE	0.553	0.566	0.035	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.16	1.91
ENE	0.413	1.207	0.242	0.013	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.88	3.78
E	0.600	4.650	4.793	1.562	0.128	0.006	0.000	0.000	0.000	0.000	0.000	11.74	15.52
ESE	0.979	9.437	7.896	3.777	1.406	0.464	0.179	0.052	0.009	0.000	0.000	24.20	39.72
SE	5.450	30.503	11.695	2.789	0.718	0.218	0.057	0.013	0.007	0.000	0.000	51.45	91.17
SSE	0.113	0.840	0.529	0.122	0.024	0.002	0.000	0.000	0.000	0.000	0.000	1.63	92.80
S	0.211	0.666	0.300	0.068	0.006	0.000	0.000	0.000	0.000	0.000	0.000	1.25	94.05
SSW	0.328	0.907	0.218	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.47	95.53
SW	0.498	0.933	0.102	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.54	97.07
WSW	0.799	0.799	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.62	98.69
W	0.442	0.427	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.88	99.57
WNW	0.220	0.100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.32	99.89
NW	0.065	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.08	99.97
NNW	0.026	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.03	100.00
All PWD	11.22	51.27	25.86	8.36	2.28	0.69	0.24	0.06	0.02	0.00	0.00		
Cum PWD	11.22	62.49	88.35	96.71	98.99	99.68	99.92	99.98	100.00	100.00	100.00		

Annual	Peak Wave Period, T_p (s) 0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_p	Cum T_p
Significant Waved Height, H_s (m) 0 - 0.5	1.425	2.219	0.818	1.064	3.164	2.528	0.000	0.000	0.000	0.000	0.000	11.22	11.22
0.5 - 1	0.015	6.908	5.281	4.045	9.645	25.374	0.000	0.000	0.000	0.000	0.000	51.27	62.49
1 - 1.5	0.000	0.233	8.897	2.167	4.854	9.674	0.033	0.004	0.000	0.000	0.000	25.86	88.35
1.5 - 2	0.000	0.002	1.362	3.001	1.721	2.135	0.117	0.022	0.000	0.000	0.000	8.36	96.71
2 - 2.5	0.000	0.000	0.000	1.147	0.402	0.616	0.111	0.007	0.000	0.000	0.000	2.28	98.99
2.5 - 3	0.000	0.000	0.000	0.263	0.152	0.198	0.074	0.004	0.000	0.000	0.000	0.69	99.68
3 - 3.5	0.000	0.000	0.000	0.043	0.117	0.061	0.013	0.004	0.000	0.000	0.000	0.24	99.92
3.5 - 4	0.000	0.000	0.000	0.000	0.028	0.028	0.009	0.000	0.000	0.000	0.000	0.06	99.98
4 - 4.5	0.000	0.000	0.000	0.000	0.009	0.000	0.007	0.000	0.000	0.000	0.000	0.02	100.00
4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
All H_s	1.44	9.36	16.36	11.73	20.09	40.61	0.36	0.04	0.00	0.00	0.00		
Cum H_s	1.44	10.80	27.16	38.89	58.96	99.59	99.96	100.00	100.00	100.00	100.00		

Table B-5 Annual frequency of occurrence tableat P05. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.083	0.052	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	0.14
	NNE	0.039	0.335	0.257	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.63	0.77
	NE	0.022	0.105	0.994	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.16	1.93
	ENE	0.006	0.446	0.849	0.681	0.006	0.000	0.000	0.000	0.000	0.000	0.000	1.99	3.92
	E	0.009	1.140	7.578	4.565	0.394	0.002	0.000	0.000	0.000	0.000	0.000	13.69	17.61
	ESE	0.000	1.340	3.964	4.552	11.077	1.369	0.165	0.015	0.000	0.000	0.000	22.48	40.09
	SE	0.004	0.340	1.132	1.323	8.755	39.647	0.198	0.026	0.000	0.000	0.000	51.42	91.51
	SSE	0.002	0.259	0.657	0.476	0.133	0.002	0.000	0.000	0.000	0.000	0.000	1.53	93.04
	S	0.046	0.366	0.568	0.159	0.022	0.002	0.000	0.000	0.000	0.000	0.000	1.16	94.20
	SSW	0.102	1.107	0.091	0.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.35	95.55
	SW	0.187	1.234	0.063	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.48	97.04
	WSW	0.390	1.238	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.63	98.67
	W	0.266	0.618	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.88	99.55
	WNW	0.172	0.176	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.35	99.90
	NW	0.056	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.08	99.98
	NNW	0.020	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.02	100.00
	All PWD	1.40	8.78	16.15	11.85	20.39	41.02	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	1.40	10.19	26.34	38.19	58.58	99.60	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.128	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	0.14
	NNE	0.403	0.213	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.63	0.77
	NE	0.540	0.587	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.16	1.93
	ENE	0.392	1.284	0.298	0.011	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.99	3.92
	E	0.557	5.350	5.185	2.195	0.370	0.026	0.006	0.000	0.000	0.000	0.000	13.69	17.61
	ESE	0.881	8.455	7.600	3.516	1.316	0.494	0.167	0.050	0.004	0.000	0.000	22.48	40.09
	SE	4.937	30.875	12.165	2.618	0.605	0.163	0.048	0.009	0.004	0.000	0.000	51.42	91.51
	SSE	0.093	0.775	0.520	0.117	0.024	0.000	0.000	0.000	0.000	0.000	0.000	1.53	93.04
	S	0.178	0.613	0.296	0.070	0.007	0.000	0.000	0.000	0.000	0.000	0.000	1.16	94.20
	SSW	0.263	0.836	0.228	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.35	95.55
	SW	0.442	0.934	0.098	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.48	97.04
	WSW	0.762	0.827	0.039	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.63	98.67
	W	0.420	0.452	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.88	99.55
	WNW	0.218	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.35	99.90
	NW	0.061	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.08	99.98
	NNW	0.020	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.02	100.00
	All PWD	10.30	51.38	26.49	8.56	2.32	0.68	0.22	0.06	0.01	0.00	0.00		
	Cum PWD	10.30	61.65	88.15	96.71	99.03	99.71	99.93	99.99	100.00	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	1.384	1.965	0.799	1.036	2.931	2.180	0.000	0.000	0.000	0.000	0.000	10.30	10.30
	0.5 - 1	0.020	6.554	5.139	4.097	10.013	25.535	0.000	0.000	0.000	0.000	0.000	51.36	61.65
	1 - 1.5	0.000	0.259	8.642	2.232	5.059	10.259	0.039	0.004	0.000	0.000	0.000	26.49	88.15
	1.5 - 2	0.000	0.004	1.573	2.959	1.696	2.193	0.113	0.022	0.000	0.000	0.000	8.56	96.71
	2 - 2.5	0.000	0.000	0.000	1.210	0.390	0.594	0.122	0.007	0.000	0.000	0.000	2.32	99.03
	2.5 - 3	0.000	0.000	0.000	0.270	0.155	0.189	0.065	0.004	0.000	0.000	0.000	0.68	99.71
	3 - 3.5	0.000	0.000	0.000	0.044	0.109	0.054	0.009	0.004	0.000	0.000	0.000	0.22	99.93
	3.5 - 4	0.000	0.000	0.000	0.000	0.026	0.019	0.015	0.000	0.000	0.000	0.000	0.06	99.99
	4 - 4.5	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.01	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	1.40	8.78	16.15	11.85	20.39	41.02	0.36	0.04	0.00	0.00	0.00		
	Cum H_s	1.40	10.19	26.34	38.19	58.58	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-6 Annual frequency of occurrence tableat P06. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.068	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.017	0.355	0.268	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.64	0.77
	NE	0.019	0.096	1.044	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.20	1.97
	ENE	0.006	0.424	0.946	0.677	0.006	0.000	0.000	0.000	0.000	0.000	0.000	2.06	4.03
	E	0.009	0.990	7.454	4.495	0.318	0.004	0.000	0.000	0.000	0.000	0.000	13.27	17.30
	ESE	0.000	1.134	3.660	4.634	10.574	1.120	0.146	0.015	0.000	0.000	0.000	21.28	38.58
	SE	0.004	0.285	1.064	1.421	9.691	40.901	0.217	0.026	0.000	0.000	0.000	53.61	92.19
	SSE	0.002	0.198	0.588	0.452	0.155	0.000	0.000	0.000	0.000	0.000	0.000	1.40	93.58
	S	0.041	0.274	0.331	0.228	0.109	0.000	0.000	0.000	0.000	0.000	0.000	0.98	94.57
	SSW	0.135	0.603	0.231	0.222	0.017	0.000	0.000	0.000	0.000	0.000	0.000	1.21	95.77
	SW	0.224	0.753	0.322	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.30	97.07
	WSW	0.322	1.216	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.54	98.61
	W	0.268	0.650	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.92	99.53
	WNW	0.163	0.174	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.34	99.86
	NW	0.072	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.10	99.97
	NNW	0.031	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.03	100.00
	All PWD	1.36	7.24	15.91	12.17	20.87	42.02	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	1.36	8.62	24.53	36.70	57.57	99.60	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.118	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.379	0.226	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.64	0.77
	NE	0.496	0.642	0.057	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.20	1.97
	ENE	0.328	1.306	0.398	0.024	0.002	0.000	0.000	0.000	0.000	0.000	0.000	2.06	4.03
	E	0.426	4.778	5.224	2.454	0.357	0.030	0.002	0.000	0.000	0.000	0.000	13.27	17.30
	ESE	0.666	8.436	7.496	3.101	1.055	0.376	0.135	0.017	0.000	0.000	0.000	21.28	38.58
	SE	3.845	30.563	14.556	3.457	0.853	0.239	0.072	0.022	0.002	0.000	0.000	53.61	92.19
	SSE	0.070	0.655	0.513	0.124	0.030	0.004	0.000	0.000	0.000	0.000	0.000	1.40	93.58
	S	0.131	0.529	0.254	0.061	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.98	94.57
	SSW	0.229	0.749	0.209	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.21	95.77
	SW	0.374	0.818	0.100	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.30	97.07
	WSW	0.707	0.785	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.54	98.61
	W	0.413	0.483	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.92	99.53
	WNW	0.194	0.141	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.34	99.86
	NW	0.085	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.10	99.97
	NNW	0.031	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.03	100.00
	All PWD	8.49	50.14	28.91	9.25	2.30	0.65	0.21	0.04	0.00	0.00	0.00		
	Cum PWD	8.49	58.63	87.54	96.80	99.10	99.75	99.96	100.00	100.00	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	1.355	1.667	0.735	0.890	2.446	1.401	0.000	0.000	0.000	0.000	0.000	8.49	8.49
	0.5 - 1	0.024	5.489	5.059	4.354	10.692	24.523	0.000	0.000	0.000	0.000	0.000	50.14	58.63
	1 - 1.5	0.000	0.089	8.483	2.396	5.474	12.435	0.030	0.004	0.000	0.000	0.000	28.91	87.54
	1.5 - 2	0.000	0.000	1.630	3.038	1.717	2.717	0.130	0.022	0.000	0.000	0.000	9.25	96.80
	2 - 2.5	0.000	0.000	0.002	1.182	0.331	0.672	0.109	0.007	0.000	0.000	0.000	2.30	99.10
	2.5 - 3	0.000	0.000	0.000	0.265	0.115	0.202	0.065	0.002	0.000	0.000	0.000	0.65	99.75
	3 - 3.5	0.000	0.000	0.000	0.044	0.072	0.057	0.030	0.006	0.000	0.000	0.000	0.21	99.96
	3.5 - 4	0.000	0.000	0.000	0.000	0.020	0.019	0.000	0.000	0.000	0.000	0.000	0.04	100.00
	4 - 4.5	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	1.38	7.24	15.91	12.17	20.87	42.02	0.36	0.04	0.00	0.00	0.00		
	Cum H_s	1.36	8.62	24.53	36.70	57.57	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-7 Annual frequency of occurrence tableat P07. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Main Wave Direction, MWD (oN)	N	0.078	0.063	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	0.14
	NNE	0.017	0.407	0.279	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.70	0.84
	NE	0.013	0.102	1.149	0.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.31	2.16
	ENE	0.004	0.363	1.055	0.790	0.011	0.000	0.000	0.000	0.000	0.000	0.000	2.22	4.38
	E	0.009	0.872	6.915	4.865	0.518	0.004	0.000	0.000	0.000	0.000	0.000	13.18	17.56
	ESE	0.002	0.640	3.579	4.434	11.932	1.954	0.202	0.022	0.000	0.000	0.000	22.76	40.33
	SE	0.002	0.218	0.934	1.330	8.744	41.160	0.165	0.019	0.000	0.000	0.000	52.57	92.90
	SSE	0.002	0.148	0.470	0.383	0.144	0.002	0.000	0.000	0.000	0.000	0.000	1.15	94.05
	S	0.035	0.229	0.289	0.194	0.083	0.002	0.000	0.000	0.000	0.000	0.000	0.83	94.88
	SSW	0.113	0.494	0.198	0.204	0.026	0.000	0.000	0.000	0.000	0.000	0.000	1.03	95.92
	SW	0.204	0.655	0.326	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.19	97.11
	WSW	0.294	1.181	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.47	98.58
	W	0.252	0.672	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.92	99.51
	WNW	0.170	0.187	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.36	99.86
	NW	0.067	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.10	99.97
	NNW	0.030	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.03	100.00
	All PWD	1.29	6.27	15.19	12.26	21.46	43.12	0.37	0.04	0.00	0.00	0.00		
	Cum PWD	1.29	7.56	22.75	35.01	56.47	99.59	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.120	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	0.14
	NNE	0.387	0.263	0.054	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.70	0.84
	NE	0.437	0.751	0.117	0.006	0.004	0.000	0.000	0.000	0.000	0.000	0.000	1.31	2.16
	ENE	0.274	1.319	0.568	0.056	0.006	0.000	0.000	0.000	0.000	0.000	0.000	2.22	4.38
	E	0.324	4.663	4.896	2.626	0.616	0.046	0.007	0.002	0.000	0.000	0.000	13.18	17.56
	ESE	0.513	7.282	7.868	4.158	1.754	0.716	0.313	0.117	0.043	0.002	0.000	22.76	40.33
	SE	3.164	28.312	15.768	3.949	0.946	0.298	0.089	0.031	0.015	0.000	0.000	52.57	92.90
	SSE	0.065	0.520	0.422	0.115	0.022	0.006	0.000	0.000	0.000	0.000	0.000	1.15	94.05
	S	0.122	0.457	0.202	0.046	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.83	94.88
	SSW	0.194	0.638	0.183	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.03	95.92
	SW	0.337	0.753	0.094	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.19	97.11
	WSW	0.637	0.785	0.054	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.47	98.58
	W	0.398	0.503	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.92	99.51
	WNW	0.198	0.155	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.36	99.86
	NW	0.078	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.10	99.97
	NNW	0.030	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.03	100.00
	All PWD	7.28	46.45	30.25	10.98	3.35	1.07	0.41	0.15	0.06	0.00	0.00		
	Cum PWD	7.28	53.73	83.98	94.96	98.32	99.38	99.79	99.94	100.00	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	1.268	1.541	0.657	0.740	2.087	0.984	0.000	0.000	0.000	0.000	0.000	7.28	7.28
	0.5 - 1	0.024	4.643	4.850	4.104	10.067	22.763	0.000	0.000	0.000	0.000	0.000	46.45	53.73
	1 - 1.5	0.000	0.085	7.585	2.694	5.598	14.269	0.020	0.000	0.000	0.000	0.000	30.25	83.98
	1.5 - 2	0.000	0.000	2.093	2.720	2.600	3.499	0.065	0.007	0.000	0.000	0.000	10.98	94.96
	2 - 2.5	0.000	0.000	0.009	1.527	0.685	1.005	0.109	0.019	0.000	0.000	0.000	3.35	98.32
	2.5 - 3	0.000	0.000	0.000	0.387	0.209	0.377	0.085	0.007	0.000	0.000	0.000	1.07	99.38
	3 - 3.5	0.000	0.000	0.000	0.074	0.126	0.148	0.057	0.004	0.000	0.000	0.000	0.41	99.79
	3.5 - 4	0.000	0.000	0.000	0.013	0.067	0.052	0.015	0.004	0.000	0.000	0.000	0.15	99.94
	4 - 4.5	0.000	0.000	0.000	0.000	0.019	0.024	0.015	0.000	0.000	0.000	0.000	0.06	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	1.29	6.27	15.19	12.26	21.46	43.12	0.37	0.04	0.00	0.00	0.00		
	Cum H_s	1.29	7.56	22.75	35.01	56.47	99.59	99.96	100.00	100.00	100.00	100.00		

Table B-8 Annual frequency of occurrence tableat P08. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.070	0.068	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	0.14
	NNE	0.024	0.352	0.278	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.65	0.79
	NE	0.013	0.135	0.960	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.15	1.94
	ENE	0.006	0.524	1.125	0.611	0.006	0.000	0.000	0.000	0.000	0.000	0.000	2.27	4.21
	E	0.009	1.101	7.319	3.594	0.155	0.002	0.000	0.000	0.000	0.000	0.000	12.18	16.39
	ESE	0.004	0.816	3.940	5.768	9.920	1.060	0.161	0.015	0.000	0.000	0.000	21.68	38.08
	SE	0.000	0.265	1.060	1.366	10.479	40.361	0.205	0.026	0.000	0.000	0.000	53.76	91.84
	SSE	0.002	0.185	0.559	0.457	0.130	0.002	0.000	0.000	0.000	0.000	0.000	1.33	93.17
	S	0.037	0.278	0.437	0.155	0.019	0.002	0.000	0.000	0.000	0.000	0.000	0.93	94.10
	SSW	0.115	0.851	0.152	0.041	0.009	0.000	0.000	0.000	0.000	0.000	0.000	1.17	95.27
	SW	0.231	1.049	0.081	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.38	96.65
	WSW	0.339	1.347	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.69	98.33
	W	0.285	0.799	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.08	99.42
	WNW	0.200	0.222	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.42	99.84
	NW	0.065	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.11	99.95
	NNW	0.048	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.05	100.00
	All PWD	1.45	8.04	15.91	12.05	20.72	41.43	0.37	0.04	0.00	0.00	0.00		
	Cum PWD	1.45	9.49	25.40	37.45	58.17	99.59	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.126	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	0.14
	NNE	0.390	0.215	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.65	0.79
	NE	0.481	0.601	0.063	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.15	1.94
	ENE	0.344	1.382	0.505	0.035	0.004	0.000	0.000	0.000	0.000	0.000	0.000	2.27	4.21
	E	0.400	4.097	4.632	2.387	0.601	0.054	0.007	0.002	0.000	0.000	0.000	12.18	16.39
	ESE	0.718	7.150	7.163	3.843	1.686	0.687	0.261	0.126	0.043	0.007	0.000	21.68	38.08
	SE	4.515	31.273	13.533	3.170	0.842	0.296	0.098	0.028	0.007	0.000	0.000	53.76	91.84
	SSE	0.096	0.662	0.448	0.102	0.022	0.004	0.000	0.000	0.000	0.000	0.000	1.33	93.17
	S	0.148	0.509	0.205	0.057	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.93	94.10
	SSW	0.200	0.716	0.224	0.026	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.17	95.27
	SW	0.374	0.879	0.109	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.38	96.65
	WSW	0.699	0.920	0.065	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.69	98.33
	W	0.461	0.594	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.08	99.42
	WNW	0.231	0.185	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.42	99.84
	NW	0.078	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.11	99.95
	NNW	0.048	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.05	100.00
	All PWD	9.31	49.23	27.03	9.64	3.17	1.04	0.37	0.16	0.05	0.01	0.00		
	Cum PWD	9.31	58.54	85.57	95.21	98.38	99.42	99.79	99.94	99.99	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	1.414	1.739	0.736	0.951	2.683	1.788	0.000	0.000	0.000	0.000	0.000	9.31	9.31
	0.5 - 1	0.033	6.034	4.974	3.827	9.595	24.767	0.000	0.000	0.000	0.000	0.000	49.23	58.54
	1 - 1.5	0.000	0.261	7.987	2.528	5.076	11.151	0.024	0.004	0.000	0.000	0.000	27.03	85.57
	1.5 - 2	0.000	0.004	2.195	2.563	2.337	2.457	0.085	0.004	0.000	0.000	0.000	9.64	95.21
	2 - 2.5	0.000	0.000	0.022	1.604	0.633	0.799	0.089	0.019	0.000	0.000	0.000	3.17	98.38
	2.5 - 3	0.000	0.000	0.000	0.457	0.196	0.276	0.102	0.009	0.000	0.000	0.000	1.04	99.42
	3 - 3.5	0.000	0.000	0.000	0.091	0.100	0.130	0.043	0.004	0.000	0.000	0.000	0.37	99.79
	3.5 - 4	0.000	0.000	0.000	0.028	0.070	0.048	0.007	0.002	0.000	0.000	0.000	0.16	99.94
	4 - 4.5	0.000	0.000	0.000	0.000	0.028	0.013	0.009	0.000	0.000	0.000	0.000	0.05	99.99
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.000	0.000	0.01	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	1.45	8.04	15.91	12.05	20.72	41.43	0.37	0.04	0.00	0.00	0.00		
	Cum H_s	1.45	9.49	25.40	37.45	58.17	99.59	99.96	100.00	100.00	100.00	100.00		

Table B-9 Annual frequency of occurrence tableat P09. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.063	0.065	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.028	0.328	0.255	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.61	0.74
	NE	0.013	0.207	0.873	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.14	1.87
	ENE	0.006	0.683	1.345	0.587	0.006	0.000	0.000	0.000	0.000	0.000	0.000	2.63	4.50
	E	0.015	1.351	7.677	4.288	0.313	0.002	0.000	0.000	0.000	0.000	0.000	13.85	18.35
	ESE	0.004	1.077	3.917	5.007	9.737	1.157	0.163	0.015	0.000	0.000	0.000	21.08	39.42
	SE	0.000	0.346	1.173	1.297	9.724	38.692	0.202	0.026	0.000	0.000	0.000	51.46	90.88
	SSE	0.002	0.228	0.687	0.500	0.020	0.000	0.000	0.000	0.000	0.000	0.000	1.44	92.32
	S	0.037	0.353	0.529	0.076	0.009	0.000	0.000	0.000	0.000	0.000	0.000	1.00	93.32
	SSW	0.113	0.999	0.111	0.046	0.013	0.000	0.000	0.000	0.000	0.000	0.000	1.28	94.61
	SW	0.263	1.170	0.105	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.55	96.16
	WSW	0.376	1.516	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.90	98.06
	W	0.316	0.923	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.24	99.30
	WNW	0.222	0.276	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.50	99.80
	NW	0.093	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	99.94
	NNW	0.061	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	100.00
	All PWD	1.61	9.57	16.88	11.86	19.82	39.85	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	1.61	11.18	28.06	39.92	59.74	99.59	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.124	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.398	0.194	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.61	0.74
	NE	0.537	0.559	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.14	1.87
	ENE	0.439	1.610	0.537	0.039	0.002	0.000	0.000	0.000	0.000	0.000	0.000	2.63	4.50
	E	0.533	4.943	5.128	2.481	0.668	0.081	0.009	0.002	0.000	0.000	0.000	13.85	18.35
	ESE	1.027	7.132	6.971	3.623	1.417	0.574	0.226	0.087	0.020	0.000	0.000	21.08	39.42
	SE	6.116	31.928	10.579	2.128	0.514	0.130	0.054	0.009	0.002	0.000	0.000	51.46	90.88
	SSE	0.117	0.768	0.439	0.091	0.020	0.002	0.000	0.000	0.000	0.000	0.000	1.44	92.32
	S	0.170	0.557	0.218	0.057	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.00	93.32
	SSW	0.202	0.807	0.250	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.28	94.61
	SW	0.413	0.975	0.161	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.55	96.16
	WSW	0.757	1.062	0.076	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.90	98.06
	W	0.501	0.698	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.24	99.30
	WNW	0.246	0.248	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.50	99.80
	NW	0.102	0.035	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	99.94
	NNW	0.061	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	100.00
	All PWD	11.74	51.52	24.46	8.45	2.62	0.79	0.29	0.10	0.02	0.00	0.00		
	Cum PWD	11.74	63.26	87.73	96.18	98.80	99.59	99.88	99.98	100.00	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	1.566	1.934	0.818	1.153	3.351	2.920	0.000	0.000	0.000	0.000	0.000	11.74	11.74
	0.5 - 1	0.044	7.333	5.538	3.629	9.147	25.831	0.000	0.000	0.000	0.000	0.000	51.52	63.26
	1 - 1.5	0.000	0.302	8.618	2.380	4.687	8.425	0.048	0.004	0.000	0.000	0.000	24.46	87.73
	1.5 - 2	0.000	0.002	1.895	2.768	1.858	1.826	0.091	0.013	0.000	0.000	0.000	8.45	96.18
	2 - 2.5	0.000	0.000	0.013	1.482	0.433	0.561	0.118	0.017	0.000	0.000	0.000	2.62	98.80
	2.5 - 3	0.000	0.000	0.000	0.359	0.165	0.183	0.076	0.004	0.000	0.000	0.000	0.79	99.59
	3 - 3.5	0.000	0.000	0.000	0.080	0.118	0.076	0.011	0.004	0.000	0.000	0.000	0.29	99.88
	3.5 - 4	0.000	0.000	0.000	0.009	0.054	0.028	0.007	0.000	0.000	0.000	0.000	0.10	99.98
	4 - 4.5	0.000	0.000	0.000	0.000	0.009	0.000	0.013	0.000	0.000	0.000	0.000	0.02	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	1.61	9.57	16.88	11.86	19.82	39.85	0.36	0.04	0.00	0.00	0.00		
	Cum H_s	1.61	11.18	28.06	39.92	59.74	99.59	99.96	100.00	100.00	100.00	100.00		

Table B-10 Annual frequency of occurrence tableat P10. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, Tp (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All Tp	Cum Tp
Mean Wave Direction, MWD (oN)	N	0.070	0.056	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.031	0.337	0.226	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.59	0.72
	NE	0.017	0.233	0.942	0.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.24	1.96
	ENE	0.006	0.799	1.545	0.909	0.009	0.000	0.000	0.000	0.000	0.000	0.000	3.27	5.23
	E	0.009	1.388	8.174	5.701	1.427	0.015	0.000	0.000	0.000	0.000	0.000	16.71	21.94
	ESE	0.004	1.519	3.760	3.227	10.816	4.543	0.255	0.035	0.000	0.000	0.000	24.16	46.10
	SE	0.000	0.409	1.153	1.134	7.156	34.876	0.104	0.006	0.000	0.000	0.000	44.84	90.94
	SSE	0.002	0.244	0.655	0.450	0.017	0.000	0.000	0.000	0.000	0.000	0.000	1.37	92.31
	S	0.037	0.357	0.520	0.039	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.96	93.27
	SSW	0.105	0.992	0.104	0.048	0.009	0.000	0.000	0.000	0.000	0.000	0.000	1.26	94.53
	SW	0.252	1.136	0.100	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.50	96.03
	WSW	0.381	1.486	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.88	97.91
	W	0.326	1.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.33	99.25
	WNW	0.231	0.313	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.54	99.79
	NW	0.102	0.052	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.15	99.94
	NNW	0.054	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	100.00
	All PWD	1.63	10.33	17.19	11.57	19.44	39.43	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	1.63	11.96	29.15	40.72	60.17	99.60	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, Hs (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All Hs	Cum Hs
Mean Wave Direction, MWD (oN)	N	0.120	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.398	0.183	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.59	0.72
	NE	0.607	0.600	0.033	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.24	1.96
	ENE	0.507	1.974	0.729	0.056	0.002	0.000	0.000	0.000	0.000	0.000	0.000	3.27	5.23
	E	0.740	6.684	5.814	2.761	0.609	0.089	0.017	0.000	0.000	0.000	0.000	16.71	21.94
	ESE	1.384	9.417	7.922	3.484	1.297	0.468	0.155	0.050	0.002	0.000	0.000	24.16	46.10
	SE	5.757	28.670	8.632	1.388	0.313	0.052	0.020	0.006	0.000	0.000	0.000	44.84	90.94
	SSE	0.118	0.761	0.396	0.081	0.011	0.000	0.000	0.000	0.000	0.000	0.000	1.37	92.31
	S	0.179	0.527	0.215	0.041	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.96	93.27
	SSW	0.194	0.781	0.265	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.26	94.53
	SW	0.398	0.946	0.154	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.50	96.03
	WSW	0.755	1.046	0.076	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.88	97.91
	W	0.529	0.759	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.33	99.25
	WNW	0.255	0.283	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.54	99.79
	NW	0.102	0.050	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.15	99.94
	NNW	0.054	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	100.00
	All PWD	12.10	52.69	24.30	7.82	2.23	0.61	0.19	0.06	0.00	0.00	0.00		
	Cum PWD	12.10	64.79	89.09	96.91	99.14	99.75	99.94	100.00	100.00	100.00	100.00		

Annual		Peak Wave Period, Tp (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All Tp	Cum Tp
Significant Waved Height, H s (m)	0 - 0.5	1.578	1.954	0.838	1.179	3.436	3.113	0.000	0.000	0.000	0.000	0.000	12.10	12.10
	0.5 - 1	0.048	8.059	5.289	3.858	9.536	25.899	0.000	0.000	0.000	0.000	0.000	52.69	64.79
	1 - 1.5	0.000	0.316	9.202	2.026	4.561	8.122	0.068	0.004	0.000	0.000	0.000	24.30	89.09
	1.5 - 2	0.000	0.002	1.858	2.887	1.338	1.615	0.098	0.022	0.000	0.000	0.000	7.82	96.91
	2 - 2.5	0.000	0.000	0.004	1.301	0.311	0.487	0.122	0.009	0.000	0.000	0.000	2.23	99.14
	2.5 - 3	0.000	0.000	0.000	0.278	0.137	0.141	0.048	0.006	0.000	0.000	0.000	0.61	99.75
	3 - 3.5	0.000	0.000	0.000	0.044	0.093	0.048	0.007	0.000	0.000	0.000	0.000	0.19	99.94
	3.5 - 4	0.000	0.000	0.000	0.000	0.031	0.009	0.015	0.000	0.000	0.000	0.000	0.06	100.00
	4 - 4.5	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All Hs	1.63	10.33	17.19	11.57	19.44	39.43	0.36	0.04	0.00	0.00	0.00		
	Cum Hs	1.63	11.96	29.15	40.72	60.17	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-11 Annual frequency of occurrence tableat P11. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual	Peak Wave Period, T_P (s)												
Mean Wave Direction, MWD (oN)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
N	0.070	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
NNE	0.039	0.305	0.204	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.55	0.68
NE	0.017	0.339	0.823	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.23	1.91
ENE	0.009	0.981	1.606	0.762	0.009	0.000	0.000	0.000	0.000	0.000	0.000	3.37	5.27
E	0.015	1.769	8.671	5.873	1.120	0.015	0.000	0.000	0.000	0.000	0.000	17.46	22.74
ESE	0.004	1.974	3.729	3.057	10.818	2.985	0.266	0.041	0.000	0.000	0.000	22.87	45.61
SE	0.000	0.489	1.225	1.083	6.684	34.358	0.087	0.000	0.000	0.000	0.000	43.92	89.54
SSE	0.002	0.313	0.731	0.501	0.015	0.000	0.000	0.000	0.000	0.000	0.000	1.56	91.10
S	0.039	0.415	0.577	0.052	0.009	0.000	0.000	0.000	0.000	0.000	0.000	1.09	92.19
SSW	0.122	1.118	0.118	0.046	0.013	0.000	0.000	0.000	0.000	0.000	0.000	1.42	93.61
SW	0.292	1.268	0.117	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.70	95.31
WSW	0.427	1.723	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.17	97.47
W	0.420	1.223	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.64	99.12
WNW	0.263	0.368	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.65	99.77
NW	0.117	0.057	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.17	99.94
NNW	0.048	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	100.00
All PWD	1.90	12.41	17.82	11.45	18.67	37.36	0.35	0.04	0.00	0.00	0.00		
Cum PWD	1.90	14.32	32.13	43.58	62.25	99.61	99.96	100.00	100.00	100.00	100.00		

Annual	Significant Wave Height, H_s (m)												
Mean Wave Direction, MWD (oN)	0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
N	0.124	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
NNE	0.392	0.154	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.55	0.68
NE	0.679	0.533	0.013	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.23	1.91
ENE	0.557	2.015	0.735	0.059	0.002	0.000	0.000	0.000	0.000	0.000	0.000	3.37	5.27
E	0.838	6.541	6.046	2.950	0.879	0.172	0.031	0.006	0.000	0.000	0.000	17.46	22.74
ESE	1.721	8.775	7.276	3.320	1.136	0.437	0.148	0.059	0.002	0.000	0.000	22.87	45.61
SE	7.911	28.570	6.432	0.823	0.168	0.015	0.006	0.000	0.000	0.000	0.000	43.92	89.54
SSE	0.152	0.903	0.426	0.072	0.009	0.000	0.000	0.000	0.000	0.000	0.000	1.56	91.10
S	0.204	0.614	0.231	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.09	92.19
SSW	0.237	0.875	0.292	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.42	93.61
SW	0.461	1.066	0.172	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.70	95.31
WSW	0.859	1.199	0.105	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.17	97.47
W	0.640	0.947	0.056	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.64	99.12
WNW	0.322	0.324	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.65	99.77
NW	0.113	0.057	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.17	99.94
NNW	0.048	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	100.00
All PWD	15.26	52.59	21.79	7.29	2.19	0.62	0.19	0.06	0.00	0.00	0.00		
Cum PWD	15.26	67.85	89.64	96.93	99.12	99.75	99.93	100.00	100.00	100.00	100.00		

Annual	Peak Wave Period, T_P (s)												
Significant Waved Height, H_s (m)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
0 - 0.5	1.849	2.289	0.886	1.355	4.164	4.715	0.000	0.000	0.000	0.000	0.000	15.26	15.26
0.5 - 1	0.056	9.763	5.585	3.392	8.447	25.342	0.006	0.000	0.000	0.000	0.000	52.59	67.85
1 - 1.5	0.000	0.357	9.323	2.224	4.201	5.601	0.083	0.006	0.000	0.000	0.000	21.79	89.64
1.5 - 2	0.000	0.002	2.011	2.646	1.286	1.219	0.094	0.028	0.000	0.000	0.000	7.29	96.93
2 - 2.5	0.000	0.000	0.013	1.419	0.320	0.326	0.113	0.004	0.000	0.000	0.000	2.19	99.12
2.5 - 3	0.000	0.000	0.000	0.340	0.130	0.115	0.035	0.004	0.000	0.000	0.000	0.62	99.75
3 - 3.5	0.000	0.000	0.000	0.068	0.074	0.037	0.006	0.000	0.000	0.000	0.000	0.19	99.93
3.5 - 4	0.000	0.000	0.000	0.002	0.046	0.002	0.015	0.000	0.000	0.000	0.000	0.06	100.00
4 - 4.5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.00	100.00
4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
All H_s	1.90	12.41	17.82	11.45	18.67	37.36	0.35	0.04	0.00	0.00	0.00		
Cum H_s	1.90	14.32	32.13	43.58	62.25	99.61	99.96	100.00	100.00	100.00	100.00		

Table B-12 Annual frequency of occurrence tableat P12. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_p (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_p	Cum T_p
Mean Wave Direction, MWD (oN)	N	0.074	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.12	0.12
	NNE	0.028	0.357	0.220	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.61	0.72
	NE	0.013	0.242	1.194	0.089	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.54	2.26
	ENE	0.006	0.620	1.734	1.530	0.028	0.000	0.000	0.000	0.000	0.000	0.000	3.92	6.18
	E	0.015	1.286	8.375	6.593	6.580	0.300	0.028	0.015	0.000	0.000	0.000	23.19	29.37
	ESE	0.004	1.014	3.769	2.246	9.865	40.144	0.329	0.026	0.000	0.000	0.000	57.40	86.77
	SE	0.000	0.252	0.977	0.936	3.581	0.202	0.000	0.000	0.000	0.000	0.000	5.95	92.72
	SSE	0.002	0.202	0.494	0.292	0.039	0.000	0.000	0.000	0.000	0.000	0.000	1.03	93.75
	S	0.024	0.229	0.278	0.126	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.73	94.47
	SSW	0.076	0.479	0.163	0.215	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.95	95.42
	SW	0.194	0.581	0.340	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.13	96.55
	WSW	0.291	1.140	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.47	98.02
	W	0.329	0.897	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.23	99.25
	WNW	0.226	0.340	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.57	99.81
	NW	0.085	0.063	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.15	99.96
	NNW	0.031	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.04	100.00
	All PWD	1.40	7.76	17.59	12.04	20.18	40.65	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	1.40	9.15	26.74	38.78	58.96	99.60	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.111	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.12	0.12
	NNE	0.394	0.205	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.61	0.72
	NE	0.616	0.864	0.052	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.54	2.26
	ENE	0.446	2.184	1.157	0.130	0.002	0.000	0.000	0.000	0.000	0.000	0.000	3.92	6.18
	E	0.757	8.999	8.368	3.842	0.979	0.172	0.070	0.006	0.000	0.000	0.000	23.19	29.37
	ESE	2.650	32.759	16.251	4.147	1.112	0.352	0.104	0.024	0.000	0.000	0.000	57.40	86.77
	SE	1.817	3.088	0.764	0.213	0.048	0.013	0.006	0.000	0.000	0.000	0.000	5.95	92.72
	SSE	0.089	0.607	0.276	0.046	0.011	0.000	0.000	0.000	0.000	0.000	0.000	1.03	93.75
	S	0.111	0.381	0.183	0.050	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.73	94.47
	SSW	0.144	0.609	0.183	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.95	95.42
	SW	0.300	0.727	0.089	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.13	96.55
	WSW	0.601	0.794	0.068	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.47	98.02
	W	0.505	0.685	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.23	99.25
	WNW	0.257	0.302	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.57	99.81
	NW	0.087	0.059	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.15	99.96
	NNW	0.031	0.007	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.04	100.00
	All PWD	8.92	52.28	27.44	8.46	2.16	0.54	0.18	0.03	0.00	0.00	0.00		
	Cum PWD	8.92	61.19	88.64	97.10	99.25	99.79	99.97	100.00	100.00	100.00	100.00		

Annual		Peak Wave Period, T_p (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_p	Cum T_p
Significant Waved Height, H_s (m)	0 - 0.5	1.358	1.558	0.777	1.027	2.587	1.610	0.000	0.000	0.000	0.000	0.000	8.92	8.92
	0.5 - 1	0.039	6.070	5.089	4.249	10.983	25.848	0.000	0.000	0.000	0.000	0.000	52.28	61.19
	1 - 1.5	0.000	0.124	9.524	2.121	4.983	10.618	0.070	0.004	0.000	0.000	0.000	27.44	88.64
	1.5 - 2	0.000	0.004	2.185	2.987	1.158	1.980	0.122	0.024	0.000	0.000	0.000	8.46	97.10
	2 - 2.5	0.000	0.000	0.009	1.355	0.246	0.424	0.115	0.007	0.000	0.000	0.000	2.16	99.25
	2.5 - 3	0.000	0.000	0.000	0.268	0.109	0.122	0.031	0.006	0.000	0.000	0.000	0.54	99.79
	3 - 3.5	0.000	0.000	0.000	0.033	0.091	0.044	0.011	0.000	0.000	0.000	0.000	0.18	99.97
	3.5 - 4	0.000	0.000	0.000	0.000	0.022	0.000	0.007	0.000	0.000	0.000	0.000	0.03	100.00
	4 - 4.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	1.40	7.76	17.59	12.04	20.18	40.65	0.36	0.04	0.00	0.00	0.00		
	Cum H_s	1.40	9.15	26.74	38.78	58.96	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-13 Annual frequency of occurrence tableat P13. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, Tp (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All Tp	Cum Tp
Mean Wave Direction, MWD (oN)	N	0.074	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.12	0.12
	NNE	0.028	0.372	0.222	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.62	0.74
	NE	0.013	0.237	1.218	0.093	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.56	2.30
	ENE	0.006	0.583	1.793	1.499	0.026	0.000	0.000	0.000	0.000	0.000	0.000	3.91	6.20
	E	0.015	1.194	8.227	6.963	6.747	0.374	0.074	0.015	0.000	0.000	0.000	23.61	29.81
	ESE	0.004	0.933	3.603	2.011	8.984	38.917	0.283	0.026	0.000	0.000	0.000	54.74	84.55
	SE	0.000	0.235	0.910	0.959	4.708	1.786	0.000	0.000	0.000	0.000	0.000	8.60	93.15
	SSE	0.002	0.183	0.452	0.272	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.95	94.10
	S	0.022	0.220	0.242	0.115	0.067	0.000	0.000	0.000	0.000	0.000	0.000	0.67	94.76
	SSW	0.087	0.439	0.141	0.191	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.86	95.63
	SW	0.333	0.392	0.302	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.04	96.68
	WSW	0.357	0.953	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.35	98.01
	W	0.324	0.890	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.21	99.23
	WNW	0.228	0.348	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.58	99.80
	NW	0.085	0.065	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.15	99.95
	NNW	0.035	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.05	100.00
	All PWD	1.61	7.10	17.15	12.11	20.55	41.08	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	1.61	8.71	25.86	37.97	58.53	99.60	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, Hs (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All Hs	Cum Hs
Mean Wave Direction, MWD (oN)	N	0.111	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.12	0.12
	NNE	0.392	0.217	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.62	0.74
	NE	0.588	0.905	0.061	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.56	2.30
	ENE	0.418	2.117	1.205	0.165	0.002	0.000	0.000	0.000	0.000	0.000	0.000	3.91	6.20
	E	0.648	8.235	8.756	4.295	1.262	0.270	0.102	0.041	0.000	0.000	0.000	23.61	29.81
	ESE	1.949	30.403	16.632	4.182	1.099	0.357	0.094	0.024	0.000	0.000	0.000	54.74	84.55
	SE	2.158	5.422	0.764	0.196	0.041	0.011	0.006	0.000	0.000	0.000	0.000	8.60	93.15
	SSE	0.085	0.555	0.252	0.044	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.95	94.10
	S	0.105	0.340	0.179	0.037	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.67	94.76
	SSW	0.131	0.568	0.154	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.86	95.63
	SW	0.279	0.670	0.078	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.04	96.68
	WSW	0.564	0.725	0.059	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.35	98.01
	W	0.522	0.651	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.21	99.23
	WNW	0.259	0.309	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.58	99.80
	NW	0.091	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.15	99.95
	NNW	0.031	0.013	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.05	100.00
	All PWD	8.33	51.20	28.20	8.95	2.42	0.64	0.20	0.06	0.00	0.00	0.00		
	Cum PWD	8.33	59.53	87.73	96.68	99.10	99.73	99.94	100.00	100.00	100.00	100.00		

Annual		Peak Wave Period, Tp (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All Tp	Cum Tp
Significant Waved Height, H s (m)	0 - 0.5	1.488	1.358	0.753	0.979	2.382	1.375	0.000	0.000	0.000	0.000	0.000	8.33	8.33
	0.5 - 1	0.126	5.625	4.835	4.191	10.894	25.524	0.000	0.000	0.000	0.000	0.000	51.20	59.53
	1 - 1.5	0.000	0.113	9.056	2.300	5.337	11.327	0.067	0.004	0.000	0.000	0.000	28.20	87.73
	1.5 - 2	0.000	0.000	2.493	2.741	1.390	2.195	0.107	0.022	0.000	0.000	0.000	8.95	96.68
	2 - 2.5	0.000	0.000	0.015	1.506	0.298	0.470	0.118	0.009	0.000	0.000	0.000	2.42	99.10
	2.5 - 3	0.000	0.000	0.000	0.331	0.120	0.139	0.043	0.006	0.000	0.000	0.000	0.64	99.73
	3 - 3.5	0.000	0.000	0.000	0.063	0.085	0.044	0.009	0.000	0.000	0.000	0.000	0.20	99.94
	3.5 - 4	0.000	0.000	0.000	0.000	0.046	0.004	0.013	0.000	0.000	0.000	0.000	0.06	100.00
	4 - 4.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All Hs	1.61	7.10	17.15	12.11	20.55	41.08	0.36	0.04	0.00	0.00	0.00		
	Cum Hs	1.61	8.71	25.86	37.97	58.53	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-14 Annual frequency of occurrence tableat P14. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.085	0.039	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.12	0.12
	NNE	0.020	0.435	0.261	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.72	0.84
	NE	0.013	0.196	1.417	0.135	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.76	2.60
	ENE	0.004	0.437	2.071	1.963	0.083	0.002	0.000	0.000	0.000	0.000	0.000	4.56	7.16
	E	0.015	0.933	7.483	6.943	9.051	0.624	0.098	0.015	0.000	0.000	0.000	25.16	32.32
	ESE	0.004	0.651	2.902	1.919	12.071	42.472	0.263	0.026	0.000	0.000	0.000	60.31	92.63
	SE	0.000	0.170	0.679	0.777	0.104	0.000	0.000	0.000	0.000	0.000	0.000	1.73	94.36
	SSE	0.002	0.150	0.324	0.168	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.67	95.03
	S	0.048	0.157	0.183	0.094	0.054	0.000	0.000	0.000	0.000	0.000	0.000	0.54	95.57
	SSW	0.070	0.350	0.126	0.142	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.69	96.26
	SW	0.252	0.318	0.207	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.78	97.04
	WSW	0.283	0.777	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.07	98.11
	W	0.255	0.883	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.14	99.25
	WNW	0.139	0.422	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.56	99.81
	NW	0.043	0.107	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.15	99.96
	NNW	0.020	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.04	100.00
	All PWD	1.25	6.04	15.67	12.15	21.39	43.10	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	1.25	7.29	22.96	35.11	56.50	99.60	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.117	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.12	0.12
	NNE	0.413	0.278	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.72	0.84
	NE	0.489	1.127	0.139	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.76	2.60
	ENE	0.281	2.206	1.704	0.357	0.011	0.000	0.000	0.000	0.000	0.000	0.000	4.56	7.16
	E	0.479	8.716	9.260	4.730	1.462	0.340	0.130	0.044	0.000	0.000	0.000	25.16	32.32
	ESE	2.383	31.464	19.511	5.181	1.207	0.416	0.105	0.033	0.006	0.000	0.000	60.31	92.63
	SE	0.281	0.577	0.644	0.174	0.048	0.006	0.000	0.000	0.000	0.000	0.000	1.73	94.36
	SSE	0.070	0.418	0.150	0.030	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.67	95.03
	S	0.085	0.279	0.150	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.54	95.57
	SSW	0.109	0.470	0.102	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.69	96.26
	SW	0.229	0.490	0.057	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.78	97.04
	WSW	0.448	0.598	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.07	98.11
	W	0.503	0.614	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.14	99.25
	WNW	0.246	0.302	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.56	99.81
	NW	0.081	0.065	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.15	99.96
	NNW	0.028	0.007	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.04	100.00
	All PWD	6.24	47.62	31.81	10.51	2.74	0.76	0.24	0.08	0.01	0.00	0.00		
	Cum PWD	6.24	53.86	85.67	96.18	98.92	99.68	99.92	99.99	100.00	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	1.195	1.334	0.638	0.759	1.701	0.616	0.000	0.000	0.000	0.000	0.000	6.24	6.24
	0.5 - 1	0.057	4.632	4.271	4.315	11.301	23.042	0.000	0.000	0.000	0.000	0.000	47.62	53.86
	1 - 1.5	0.000	0.076	8.311	2.406	5.947	15.035	0.031	0.004	0.000	0.000	0.000	31.81	85.67
	1.5 - 2	0.000	0.000	2.437	2.781	1.789	3.364	0.118	0.022	0.000	0.000	0.000	10.51	96.18
	2 - 2.5	0.000	0.000	0.009	1.504	0.361	0.746	0.107	0.007	0.000	0.000	0.000	2.74	98.92
	2.5 - 3	0.000	0.000	0.000	0.328	0.148	0.209	0.074	0.004	0.000	0.000	0.000	0.76	99.68
	3 - 3.5	0.000	0.000	0.000	0.056	0.098	0.063	0.015	0.004	0.000	0.000	0.000	0.24	99.92
	3.5 - 4	0.000	0.000	0.000	0.000	0.041	0.022	0.015	0.000	0.000	0.000	0.000	0.08	99.99
	4 - 4.5	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.01	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	1.25	6.04	15.67	12.15	21.39	43.10	0.36	0.04	0.00	0.00	0.00		
	Cum H_s	1.25	7.29	22.96	35.11	56.50	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-15 Annual frequency of occurrence tableat P15. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.081	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.028	0.422	0.237	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.69	0.81
	NE	0.013	0.213	1.321	0.093	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.64	2.45
	ENE	0.004	0.574	2.330	1.591	0.046	0.000	0.000	0.000	0.000	0.000	0.000	4.54	7.00
	E	0.015	1.036	7.637	7.881	7.481	0.631	0.104	0.015	0.000	0.000	0.000	24.80	31.80
	ESE	0.004	0.509	2.263	1.523	8.742	36.510	0.261	0.026	0.000	0.000	0.000	49.84	81.64
	SE	0.000	0.178	0.644	0.872	5.159	5.600	0.000	0.000	0.000	0.000	0.000	12.45	94.09
	SSE	0.004	0.154	0.311	0.207	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.70	94.79
	S	0.054	0.144	0.185	0.080	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.51	95.29
	SSW	0.067	0.344	0.130	0.144	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.70	95.99
	SW	0.320	0.244	0.194	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.79	96.78
	WSW	0.435	0.538	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.02	97.80
	W	0.738	0.564	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.30	99.10
	WNW	0.254	0.424	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.68	99.78
	NW	0.054	0.122	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.18	99.95
	NNW	0.024	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.05	100.00
	All PWD	2.09	5.54	15.29	12.42	21.51	42.74	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	2.09	7.63	22.92	35.34	56.85	99.59	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.111	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.398	0.254	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.69	0.81
	NE	0.529	1.001	0.102	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.64	2.45
	ENE	0.329	2.241	1.523	0.400	0.050	0.002	0.000	0.000	0.000	0.000	0.000	4.54	7.00
	E	0.494	6.571	8.808	5.368	2.317	0.779	0.265	0.137	0.046	0.013	0.000	24.80	31.80
	ESE	1.258	25.381	16.930	4.458	1.186	0.416	0.148	0.037	0.022	0.000	0.000	49.84	81.64
	SE	2.246	9.206	0.835	0.130	0.028	0.007	0.000	0.000	0.000	0.000	0.000	12.45	94.09
	SSE	0.089	0.426	0.154	0.028	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.70	94.79
	S	0.100	0.283	0.102	0.020	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.51	95.29
	SSW	0.113	0.476	0.105	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.70	95.99
	SW	0.250	0.470	0.061	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.79	96.78
	WSW	0.431	0.557	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.02	97.80
	W	0.614	0.670	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.30	99.10
	WNW	0.292	0.366	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.68	99.78
	NW	0.096	0.076	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.18	99.95
	NNW	0.031	0.015	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.05	100.00
	All PWD	7.38	48.01	28.73	10.42	3.59	1.20	0.41	0.17	0.07	0.01	0.00		
	Cum PWD	7.38	55.39	84.12	94.54	98.13	99.33	99.74	99.92	99.99	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	1.791	0.973	0.699	0.833	2.111	0.975	0.000	0.000	0.000	0.000	0.000	7.38	7.38
	0.5 - 1	0.302	4.489	4.543	3.788	10.294	24.593	0.000	0.000	0.000	0.000	0.000	48.01	55.39
	1 - 1.5	0.000	0.074	7.084	2.981	5.396	13.159	0.028	0.004	0.000	0.000	0.000	28.73	84.12
	1.5 - 2	0.000	0.000	2.837	2.160	2.574	2.757	0.085	0.007	0.000	0.000	0.000	10.42	94.54
	2 - 2.5	0.000	0.000	0.131	1.823	0.703	0.818	0.091	0.022	0.000	0.000	0.000	3.59	98.13
	2.5 - 3	0.000	0.000	0.000	0.622	0.215	0.268	0.096	0.004	0.000	0.000	0.000	1.20	99.33
	3 - 3.5	0.000	0.000	0.000	0.159	0.104	0.107	0.039	0.004	0.000	0.000	0.000	0.41	99.74
	3.5 - 4	0.000	0.000	0.000	0.048	0.067	0.052	0.007	0.000	0.000	0.000	0.000	0.17	99.92
	4 - 4.5	0.000	0.000	0.000	0.006	0.044	0.011	0.009	0.000	0.000	0.000	0.000	0.07	99.99
	4.5 - 5	0.000	0.000	0.000	0.000	0.004	0.000	0.009	0.000	0.000	0.000	0.000	0.01	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	2.09	5.54	15.29	12.42	21.51	42.74	0.36	0.04	0.00	0.00	0.00		
	Cum H_s	2.09	7.63	22.92	35.34	56.85	99.59	99.96	100.00	100.00	100.00	100.00		

Table B-16 Annual frequency of occurrence tableat P16. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual	Peak Wave Period, T_P (s)											
Mean Wave Direction, MWD (oN)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
N	0.080	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
NNE	0.028	0.433	0.246	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.71	0.83
NE	0.011	0.226	1.371	0.096	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.70	2.54
ENE	0.004	0.551	2.444	1.730	0.041	0.000	0.000	0.000	0.000	0.000	0.000	4.77	7.31
E	0.015	1.029	7.641	7.522	7.939	0.513	0.087	0.015	0.000	0.000	0.000	24.76	32.07
ESE	0.004	0.505	2.258	1.751	12.994	42.535	0.278	0.026	0.000	0.000	0.000	60.35	92.42
SE	0.000	0.157	0.590	0.822	0.468	0.000	0.000	0.000	0.000	0.000	0.000	2.04	94.46
SSE	0.004	0.139	0.239	0.192	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.60	95.06
S	0.052	0.111	0.167	0.072	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.44	95.50
SSW	0.054	0.272	0.126	0.141	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.60	96.09
SW	0.274	0.231	0.170	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.70	96.79
WSW	0.381	0.450	0.054	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.88	97.67
W	0.711	0.559	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.27	98.94
WNW	0.326	0.479	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.80	99.75
NW	0.056	0.141	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.20	99.94
NNW	0.030	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	100.00
All PWD	2.03	5.36	15.31	12.35	21.51	43.05	0.36	0.04	0.00	0.00	0.00		
Cum PWD	2.03	7.39	22.69	35.04	56.55	99.59	99.96	100.00	100.00	100.00	100.00		

Annual	Significant Wave Height, H_s (m)											
Mean Wave Direction, MWD (oN)	0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
N	0.115	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
NNE	0.403	0.279	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.71	0.83
NE	0.514	1.075	0.109	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.70	2.54
ENE	0.320	2.289	1.693	0.442	0.024	0.002	0.000	0.000	0.000	0.000	0.000	4.77	7.31
E	0.511	7.709	9.376	4.772	1.726	0.424	0.163	0.063	0.015	0.000	0.000	24.76	32.07
ESE	2.733	33.236	18.061	4.641	1.136	0.389	0.117	0.035	0.002	0.000	0.000	60.35	92.42
SE	0.620	0.683	0.585	0.113	0.030	0.007	0.000	0.000	0.000	0.000	0.000	2.04	94.46
SSE	0.093	0.392	0.089	0.022	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.60	95.06
S	0.105	0.237	0.087	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.44	95.50
SSW	0.115	0.398	0.081	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.60	96.09
SW	0.224	0.424	0.044	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.70	96.79
WSW	0.396	0.468	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.88	97.67
W	0.637	0.620	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.27	98.94
WNW	0.359	0.427	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.80	99.75
NW	0.111	0.081	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.20	99.94
NNW	0.039	0.017	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	100.00
All PWD	7.29	48.35	30.21	10.01	2.92	0.82	0.28	0.10	0.02	0.00	0.00		
Cum PWD	7.29	55.64	85.85	95.86	98.78	99.61	99.89	99.98	100.00	100.00	100.00		

Annual	Peak Wave Period, T_P (s)											
Significant Waved Height, H_s (m)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
0 - 0.5	1.778	1.064	0.685	0.803	2.106	0.859	0.000	0.000	0.000	0.000	0.000	7.29	7.29
0.5 - 1	0.248	4.243	4.600	4.188	10.698	24.373	0.000	0.000	0.000	0.000	0.000	48.35	55.64
1 - 1.5	0.000	0.052	7.506	2.776	5.999	13.840	0.031	0.004	0.000	0.000	0.000	30.21	85.85
1.5 - 2	0.000	0.000	2.480	2.463	1.965	2.983	0.105	0.013	0.000	0.000	0.000	10.01	95.86
2 - 2.5	0.000	0.000	0.035	1.634	0.435	0.687	0.117	0.017	0.000	0.000	0.000	2.92	98.78
2.5 - 3	0.000	0.000	0.000	0.383	0.146	0.211	0.078	0.004	0.000	0.000	0.000	0.82	99.61
3 - 3.5	0.000	0.000	0.000	0.087	0.100	0.074	0.015	0.004	0.000	0.000	0.000	0.28	99.89
3.5 - 4	0.000	0.000	0.000	0.013	0.054	0.022	0.009	0.000	0.000	0.000	0.000	0.10	99.98
4 - 4.5	0.000	0.000	0.000	0.000	0.007	0.000	0.009	0.000	0.000	0.000	0.000	0.02	100.00
4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
All H_s	2.03	5.36	15.31	12.35	21.51	43.05	0.36	0.04	0.00	0.00	0.00		
Cum H_s	2.03	7.39	22.69	35.04	56.55	99.59	99.96	100.00	100.00	100.00	100.00		

Table B-17 Annual frequency of occurrence tableat P17. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.067	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.026	0.440	0.263	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.73	0.85
	NE	0.013	0.211	1.416	0.102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.74	2.60
	ENE	0.004	0.538	1.995	1.849	0.054	0.000	0.000	0.000	0.000	0.000	0.000	4.44	7.04
	E	0.015	1.134	7.803	7.023	8.483	0.474	0.081	0.015	0.000	0.000	0.000	25.03	32.06
	ESE	0.004	1.001	2.879	2.091	12.108	42.633	0.279	0.026	0.000	0.000	0.000	61.02	93.08
	SE	0.000	0.141	0.577	0.537	0.126	0.000	0.000	0.000	0.000	0.000	0.000	1.38	94.47
	SSE	0.004	0.144	0.213	0.144	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.55	95.02
	S	0.059	0.105	0.146	0.063	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.42	95.43
	SSW	0.072	0.229	0.109	0.128	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.55	95.98
	SW	0.255	0.239	0.167	0.033	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.69	96.67
	WSW	0.315	0.365	0.078	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.76	97.43
	W	0.627	0.627	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.25	98.68
	WNW	0.377	0.642	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.02	99.70
	NW	0.059	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.23	99.94
	NNW	0.031	0.033	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	100.00
	All PWD	1.93	6.08	15.65	11.97	20.87	43.11	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	1.93	8.01	23.66	35.63	56.49	99.60	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.115	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.426	0.276	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.73	0.85
	NE	0.537	1.081	0.117	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.74	2.60
	ENE	0.318	2.272	1.512	0.324	0.011	0.002	0.000	0.000	0.000	0.000	0.000	4.44	7.04
	E	0.555	8.416	9.080	4.730	1.636	0.407	0.122	0.076	0.006	0.000	0.000	25.03	32.06
	ESE	3.370	32.361	18.279	4.987	1.330	0.487	0.161	0.039	0.007	0.000	0.000	61.02	93.08
	SE	0.137	0.579	0.538	0.096	0.026	0.004	0.000	0.000	0.000	0.000	0.000	1.38	94.47
	SSE	0.100	0.365	0.065	0.019	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.55	95.02
	S	0.117	0.226	0.068	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.42	95.43
	SSW	0.135	0.344	0.065	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.55	95.98
	SW	0.228	0.420	0.043	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.69	96.67
	WSW	0.316	0.420	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.76	97.43
	W	0.598	0.635	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.25	98.68
	WNW	0.442	0.553	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.02	99.70
	NW	0.115	0.113	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.23	99.94
	NNW	0.044	0.019	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	100.00
	All PWD	7.55	48.09	29.87	10.17	3.01	0.90	0.28	0.11	0.01	0.00	0.00		
	Cum PWD	7.55	55.64	85.51	95.68	98.69	99.59	99.87	99.99	100.00	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	1.714	1.162	0.703	0.786	2.202	0.984	0.000	0.000	0.000	0.000	0.000	7.55	7.55
	0.5 - 1	0.215	4.813	4.041	4.321	10.270	24.430	0.000	0.000	0.000	0.000	0.000	48.09	55.64
	1 - 1.5	0.000	0.107	7.681	2.383	5.933	13.727	0.031	0.004	0.000	0.000	0.000	29.87	85.51
	1.5 - 2	0.000	0.000	3.168	2.102	1.799	2.972	0.109	0.022	0.000	0.000	0.000	10.17	95.68
	2 - 2.5	0.000	0.000	0.052	1.778	0.359	0.699	0.113	0.007	0.000	0.000	0.000	3.01	98.69
	2.5 - 3	0.000	0.000	0.000	0.485	0.135	0.200	0.076	0.004	0.000	0.000	0.000	0.90	99.59
	3 - 3.5	0.000	0.000	0.000	0.096	0.094	0.074	0.015	0.004	0.000	0.000	0.000	0.28	99.87
	3.5 - 4	0.000	0.000	0.000	0.017	0.061	0.020	0.017	0.000	0.000	0.000	0.000	0.11	99.99
	4 - 4.5	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.01	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	1.93	6.08	15.65	11.97	20.87	43.11	0.36	0.04	0.00	0.00	0.00		
	Cum H_s	1.93	8.01	23.66	35.63	56.49	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-18 Annual frequency of occurrence tableat P18. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual	Peak Wave Period, T_P (s)												
Mean Wave Direction, MWD (oN)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
N	0.072	0.070	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	0.14
NNE	0.026	0.448	0.265	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.74	0.88
NE	0.013	0.263	1.406	0.100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.78	2.66
ENE	0.004	0.579	2.171	1.826	0.054	0.000	0.000	0.000	0.000	0.000	0.000	4.63	7.30
E	0.015	1.219	7.881	6.965	8.312	0.435	0.076	0.015	0.000	0.000	0.000	24.92	32.22
ESE	0.004	0.664	2.894	2.239	12.115	42.489	0.285	0.026	0.000	0.000	0.000	60.72	92.93
SE	0.000	0.142	0.557	0.546	0.148	0.002	0.000	0.000	0.000	0.000	0.000	1.40	94.33
SSE	0.004	0.141	0.207	0.139	0.043	0.002	0.000	0.000	0.000	0.000	0.000	0.53	94.86
S	0.063	0.096	0.126	0.061	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.39	95.25
SSW	0.091	0.218	0.111	0.105	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.54	95.79
SW	0.268	0.217	0.154	0.057	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.70	96.48
WSW	0.307	0.320	0.104	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.73	97.22
W	0.590	0.609	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.20	98.42
WNW	0.470	0.751	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.22	99.64
NW	0.083	0.205	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.29	99.93
NNW	0.035	0.039	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.07	100.00
All PWD	2.04	5.98	15.88	12.04	20.73	42.93	0.36	0.04	0.00	0.00	0.00		
Cum PWD	2.04	8.03	23.90	35.94	56.67	99.60	99.96	100.00	100.00	100.00	100.00		

Annual	Significant Wave Height, H_s (m)												
Mean Wave Direction, MWD (oN)	0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
N	0.124	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	0.14
NNE	0.424	0.274	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.74	0.88
NE	0.555	1.099	0.120	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.78	2.66
ENE	0.331	2.283	1.612	0.385	0.020	0.002	0.000	0.000	0.000	0.000	0.000	4.63	7.30
E	0.618	8.199	9.012	4.661	1.751	0.444	0.126	0.085	0.022	0.000	0.000	24.92	32.22
ESE	3.621	32.480	17.428	4.957	1.414	0.548	0.192	0.061	0.015	0.000	0.000	60.72	92.93
SE	0.209	0.596	0.501	0.065	0.020	0.004	0.000	0.000	0.000	0.000	0.000	1.40	94.33
SSE	0.102	0.359	0.056	0.015	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.53	94.86
S	0.117	0.204	0.067	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.39	95.25
SSW	0.152	0.326	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.54	95.79
SW	0.239	0.416	0.039	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.70	96.48
WSW	0.318	0.394	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.73	97.22
W	0.575	0.609	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.20	98.42
WNW	0.513	0.675	0.033	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.22	99.64
NW	0.142	0.142	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.29	99.93
NNW	0.048	0.022	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.07	100.00
All PWD	8.09	48.10	29.01	10.09	3.21	1.00	0.32	0.15	0.04	0.00	0.00		
Cum PWD	8.09	56.19	85.20	95.29	98.50	99.50	99.82	99.96	100.00	100.00	100.00		

Annual	Peak Wave Period, T_P (s)												
Significant Waved Height, H_s (m)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
0 - 0.5	1.821	1.199	0.725	0.818	2.363	1.162	0.000	0.000	0.000	0.000	0.000	8.09	8.09
0.5 - 1	0.224	4.704	4.363	4.204	9.904	24.698	0.000	0.000	0.000	0.000	0.000	48.10	56.19
1 - 1.5	0.000	0.080	7.530	2.411	5.807	13.153	0.026	0.004	0.000	0.000	0.000	29.01	85.20
1.5 - 2	0.000	0.000	3.177	2.013	1.928	2.866	0.094	0.015	0.000	0.000	0.000	10.09	95.29
2 - 2.5	0.000	0.000	0.081	1.884	0.409	0.698	0.124	0.015	0.000	0.000	0.000	3.21	98.50
2.5 - 3	0.000	0.000	0.000	0.548	0.137	0.231	0.078	0.004	0.000	0.000	0.000	1.00	99.50
3 - 3.5	0.000	0.000	0.000	0.130	0.080	0.085	0.020	0.004	0.000	0.000	0.000	0.32	99.82
3.5 - 4	0.000	0.000	0.000	0.031	0.072	0.033	0.009	0.000	0.000	0.000	0.000	0.15	99.96
4 - 4.5	0.000	0.000	0.000	0.000	0.026	0.000	0.009	0.000	0.000	0.000	0.000	0.04	100.00
4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
All H_s	2.04	5.98	15.88	12.04	20.73	42.93	0.36	0.04	0.00	0.00	0.00		
Cum H_s	2.04	8.03	23.90	35.94	56.67	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-19 Annual frequency of occurrence tableat P19. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.072	0.076	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.15	0.15
	NNE	0.024	0.444	0.272	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.74	0.89
	NE	0.013	0.383	1.416	0.170	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.98	2.87
	ENE	0.007	0.905	2.287	2.345	0.105	0.002	0.000	0.000	0.000	0.000	0.000	5.65	8.52
	E	0.013	1.493	8.281	6.449	10.596	0.809	0.093	0.015	0.000	0.000	0.000	27.75	36.27
	ESE	0.004	1.081	2.535	1.947	9.648	40.742	0.268	0.026	0.000	0.000	0.000	56.25	92.52
	SE	0.002	0.146	0.557	0.374	0.137	0.002	0.000	0.000	0.000	0.000	0.000	1.22	93.74
	SSE	0.004	0.157	0.211	0.144	0.037	0.002	0.000	0.000	0.000	0.000	0.000	0.56	94.29
	S	0.072	0.098	0.135	0.057	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.40	94.69
	SSW	0.096	0.246	0.104	0.117	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.58	95.27
	SW	0.291	0.237	0.165	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.76	96.03
	WSW	0.326	0.344	0.142	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.81	96.85
	W	0.648	0.659	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.31	98.16
	WNW	0.540	0.840	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.38	99.54
	NW	0.113	0.255	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.37	99.90
	NNW	0.050	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.10	100.00
	All PWD	2.27	7.41	16.11	11.67	20.58	41.56	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	2.27	9.69	25.79	37.47	58.04	99.60	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.122	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.15	0.15
	NNE	0.446	0.270	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.74	0.89
	NE	0.651	1.207	0.118	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.98	2.87
	ENE	0.487	2.839	1.871	0.427	0.026	0.002	0.000	0.000	0.000	0.000	0.000	5.65	8.52
	E	0.903	9.954	9.732	4.695	1.749	0.477	0.146	0.080	0.013	0.000	0.000	27.75	36.27
	ESE	4.974	32.100	13.812	3.679	1.083	0.420	0.135	0.033	0.015	0.000	0.000	56.25	92.52
	SE	0.107	0.662	0.398	0.043	0.006	0.002	0.000	0.000	0.000	0.000	0.000	1.22	93.74
	SSE	0.124	0.370	0.054	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.56	94.29
	S	0.137	0.215	0.044	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.40	94.69
	SSW	0.179	0.348	0.052	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.58	95.27
	SW	0.272	0.463	0.026	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.76	96.03
	WSW	0.346	0.448	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.81	96.85
	W	0.618	0.672	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.31	98.16
	WNW	0.574	0.770	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.38	99.54
	NW	0.174	0.183	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.37	99.90
	NNW	0.067	0.026	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.10	100.00
	All PWD	10.18	50.55	26.22	8.86	2.87	0.90	0.28	0.11	0.03	0.00	0.00		
	Cum PWD	10.18	60.73	86.95	95.81	98.68	99.58	99.86	99.97	100.00	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	2.006	1.405	0.794	0.996	3.053	1.928	0.000	0.000	0.000	0.000	0.000	10.18	10.18
	0.5 - 1	0.268	5.840	4.404	4.280	9.841	25.918	0.000	0.000	0.000	0.000	0.000	50.55	60.73
	1 - 1.5	0.000	0.167	7.829	2.110	5.411	10.666	0.033	0.004	0.000	0.000	0.000	26.22	86.95
	1.5 - 2	0.000	0.000	3.016	1.960	1.627	2.139	0.100	0.017	0.000	0.000	0.000	8.86	95.81
	2 - 2.5	0.000	0.000	0.063	1.706	0.355	0.611	0.118	0.013	0.000	0.000	0.000	2.87	98.68
	2.5 - 3	0.000	0.000	0.000	0.496	0.120	0.202	0.080	0.004	0.000	0.000	0.000	0.90	99.58
	3 - 3.5	0.000	0.000	0.000	0.105	0.085	0.074	0.013	0.004	0.000	0.000	0.000	0.28	99.86
	3.5 - 4	0.000	0.000	0.000	0.022	0.059	0.019	0.013	0.000	0.000	0.000	0.000	0.11	99.97
	4 - 4.5	0.000	0.000	0.000	0.000	0.024	0.000	0.004	0.000	0.000	0.000	0.000	0.03	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	2.27	7.41	16.11	11.67	20.58	41.56	0.36	0.04	0.00	0.00	0.00		
	Cum H_s	2.27	9.69	25.79	37.47	58.04	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-20 Annual frequency of occurrence tableat P20. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.074	0.078	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.15	0.15
	NNE	0.028	0.416	0.287	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.73	0.88
	NE	0.013	0.426	1.343	0.328	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.11	2.99
	ENE	0.007	1.108	2.637	2.916	0.237	0.004	0.000	0.000	0.000	0.000	0.000	6.91	9.90
	E	0.013	1.821	8.665	6.175	11.447	2.959	0.168	0.015	0.000	0.000	0.000	31.25	41.15
	ESE	0.004	1.077	2.106	1.487	8.159	37.665	0.194	0.026	0.000	0.000	0.000	50.70	91.85
	SE	0.000	0.139	0.546	0.355	0.130	0.002	0.000	0.000	0.000	0.000	0.000	1.17	93.02
	SSE	0.006	0.159	0.231	0.139	0.033	0.002	0.000	0.000	0.000	0.000	0.000	0.57	93.59
	S	0.072	0.137	0.163	0.067	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.48	94.07
	SSW	0.128	0.279	0.107	0.111	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.65	94.72
	SW	0.355	0.250	0.172	0.089	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.87	95.58
	WSW	0.392	0.405	0.165	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.96	96.55
	W	0.699	0.751	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.46	98.00
	WNW	0.542	0.896	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.44	99.44
	NW	0.146	0.292	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.44	99.88
	NNW	0.056	0.067	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.12	100.00
	All PWD	2.54	8.30	16.42	11.65	20.06	40.63	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	2.54	10.84	27.25	38.90	58.97	99.60	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.131	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.15	0.15
	NNE	0.435	0.281	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.73	0.88
	NE	0.818	1.171	0.115	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	2.11	2.99
	ENE	0.687	3.623	2.004	0.526	0.067	0.004	0.000	0.000	0.000	0.000	0.000	6.91	9.90
	E	1.355	11.416	10.398	5.113	1.967	0.657	0.220	0.105	0.022	0.000	0.000	31.25	41.15
	ESE	6.323	30.540	10.455	2.430	0.699	0.187	0.056	0.008	0.002	0.000	0.000	50.70	91.85
	SE	0.111	0.733	0.305	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.17	93.02
	SSE	0.135	0.389	0.039	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.57	93.59
	S	0.161	0.266	0.046	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.48	94.07
	SSW	0.250	0.357	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.65	94.72
	SW	0.331	0.509	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.87	95.58
	WSW	0.424	0.520	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.96	96.55
	W	0.675	0.768	0.011	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.46	98.00
	WNW	0.572	0.818	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.44	99.44
	NW	0.207	0.220	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.44	99.88
	NNW	0.087	0.031	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.12	100.00
	All PWD	12.70	51.66	23.54	8.11	2.74	0.85	0.28	0.11	0.02	0.00	0.00		
	Cum PWD	12.70	64.37	87.90	96.01	98.74	99.59	99.86	99.98	100.00	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	2.256	1.612	0.875	1.177	3.707	3.075	0.000	0.000	0.000	0.000	0.000	12.70	12.70
	0.5 - 1	0.279	6.558	4.907	4.208	9.197	26.514	0.000	0.000	0.000	0.000	0.000	51.66	64.37
	1 - 1.5	0.000	0.131	7.902	2.021	4.933	8.505	0.041	0.004	0.000	0.000	0.000	23.54	87.90
	1.5 - 2	0.000	0.000	2.678	2.023	1.599	1.702	0.091	0.013	0.000	0.000	0.000	8.11	96.01
	2 - 2.5	0.000	0.000	0.056	1.630	0.342	0.563	0.128	0.017	0.000	0.000	0.000	2.74	98.74
	2.5 - 3	0.000	0.000	0.000	0.463	0.124	0.181	0.076	0.004	0.000	0.000	0.000	0.85	99.59
	3 - 3.5	0.000	0.000	0.000	0.104	0.085	0.074	0.009	0.004	0.000	0.000	0.000	0.28	99.86
	3.5 - 4	0.000	0.000	0.000	0.022	0.063	0.017	0.009	0.000	0.000	0.000	0.000	0.11	99.98
	4 - 4.5	0.000	0.000	0.000	0.000	0.015	0.000	0.009	0.000	0.000	0.000	0.000	0.02	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	2.54	8.30	16.42	11.65	20.06	40.63	0.36	0.04	0.00	0.00	0.00		
	Cum H_s	2.54	10.84	27.25	38.90	58.97	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-21 Annual frequency of occurrence tableat P21 Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.111	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.013	0.490	0.274	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.78	0.91
	NE	0.020	0.002	1.649	0.148	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.82	2.73
	ENE	0.039	0.019	0.120	2.361	0.100	0.002	0.000	0.000	0.000	0.000	0.000	2.64	5.37
	E	0.017	0.296	1.408	2.024	7.481	0.213	0.004	0.000	0.000	0.000	0.000	11.44	16.81
	ESE	0.013	0.318	1.915	8.710	19.589	50.798	0.365	0.041	0.000	0.000	0.000	81.75	98.56
	SE	0.024	0.142	0.248	0.446	0.117	0.000	0.000	0.000	0.000	0.000	0.000	0.98	99.54
	SSE	0.000	0.013	0.144	0.298	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.46	100.00
	S	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	SSW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	SW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	WSW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	W	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	WNW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	NW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	NNW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All PWD	0.24	1.30	5.76	13.99	27.29	51.01	0.37	0.04	0.00	0.00	0.00		
	Cum PWD	0.24	1.54	7.30	21.29	48.58	99.59	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.131	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.13	0.13
	NNE	0.777	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.78	0.91
	NE	1.776	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.82	2.73
	ENE	1.712	0.929	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.64	5.37
	E	2.733	8.710	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	11.44	16.81
	ESE	9.121	72.350	0.278	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	81.75	98.56
	SE	0.929	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.98	99.54
	SSE	0.459	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.46	100.00
	S	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	SSW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	SW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	WSW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	W	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	WNW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	NW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	NNW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All PWD	17.64	82.08	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	Cum PWD	17.64	99.72	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	0.237	1.277	3.014	5.144	5.885	2.085	0.000	0.000	0.000	0.000	0.000	17.64	17.64
	0.5 - 1	0.000	0.024	2.744	8.818	21.251	48.840	0.363	0.041	0.000	0.000	0.000	82.08	99.72
	1 - 1.5	0.000	0.000	0.000	0.030	0.155	0.087	0.006	0.000	0.000	0.000	0.000	0.28	100.00
	1.5 - 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	2 - 2.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	2.5 - 3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	3 - 3.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	3.5 - 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	4 - 4.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	0.24	1.30	5.76	13.99	27.29	51.01	0.37	0.04	0.00	0.00	0.00		
	Cum H_s	0.24	1.54	7.30	21.29	48.58	99.59	99.96	100.00	100.00	100.00	100.00		

Table B-22 Annual frequency of occurrence tableat P22. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_p (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_p	Cum T_p
Mean Wave Direction, MWD (oN)	N	0.120	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	0.14
	NNE	0.011	0.500	0.266	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.78	0.92
	NE	0.019	0.000	1.612	0.148	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.78	2.70
	ENE	0.039	0.026	0.113	2.383	0.107	0.000	0.000	0.000	0.000	0.000	0.000	2.67	5.36
	E	0.020	0.303	0.757	1.813	7.770	0.172	0.004	0.000	0.000	0.000	0.000	10.84	16.20
	ESE	0.013	0.363	2.187	9.169	19.758	51.086	0.365	0.041	0.000	0.000	0.000	82.98	99.19
	SE	0.020	0.122	0.239	0.396	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.79	99.98
	SSE	0.000	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.02	100.00
	S	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	SSW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	SW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	WSW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	W	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	WNW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	NW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	NNW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All PWD	0.24	1.33	5.20	13.91	27.65	51.26	0.37	0.04	0.00	0.00	0.00		
	Cum PWD	0.24	1.58	6.77	20.68	48.33	99.59	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.141	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	0.14
	NNE	0.777	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.78	0.92
	NE	1.769	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.78	2.70
	ENE	2.287	0.381	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.67	5.36
	E	6.536	4.304	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.84	16.20
	ESE	23.170	59.811	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	82.98	99.19
	SE	0.790	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.79	99.98
	SSE	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.02	100.00
	S	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	SSW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	SW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	WSW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	W	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	WNW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	NW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	NNW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All PWD	35.49	64.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	Cum PWD	35.49	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		

Annual		Peak Wave Period, T_p (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_p	Cum T_p
Significant Waved Height, H_s (m)	0 - 0.5	0.242	1.334	3.803	7.807	13.035	9.273	0.000	0.000	0.000	0.000	0.000	35.49	35.49
	0.5 - 1	0.000	0.000	1.395	6.103	14.613	41.986	0.368	0.041	0.000	0.000	0.000	64.51	100.00
	1 - 1.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	1.5 - 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	2 - 2.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	2.5 - 3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	3 - 3.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	3.5 - 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	4 - 4.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	0.24	1.33	5.20	13.91	27.65	51.26	0.37	0.04	0.00	0.00	0.00		
	Cum H_s	0.24	1.58	6.77	20.68	48.33	99.59	99.96	100.00	100.00	100.00	100.00		

Table B-23 Annual frequency of occurrence tableat P23. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.105	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.12	0.12
	NNE	0.011	0.477	0.283	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.77	0.89
	NE	0.022	0.000	1.693	0.167	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.88	2.78
	ENE	0.039	0.022	0.065	2.763	0.117	0.002	0.000	0.000	0.000	0.000	0.000	3.01	5.78
	E	0.013	0.257	0.624	1.586	8.906	0.348	0.004	0.000	0.000	0.000	0.000	11.74	17.52
	ESE	0.015	0.298	1.956	8.964	18.731	50.949	0.365	0.041	0.000	0.000	0.000	81.32	98.84
	SE	0.019	0.118	0.174	0.326	0.113	0.000	0.000	0.000	0.000	0.000	0.000	0.75	99.59
	SSE	0.000	0.002	0.117	0.222	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.34	99.93
	S	0.000	0.000	0.002	0.070	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.07	100.00
	SSW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	SW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	WSW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	W	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	WNW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	NW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	NNW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All PWD	0.22	1.19	4.91	14.10	27.87	51.30	0.37	0.04	0.00	0.00	0.00		
	Cum PWD	0.22	1.42	6.33	20.43	48.29	99.59	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.122	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.12	0.12
	NNE	0.772	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.77	0.89
	NE	1.843	0.039	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.88	2.78
	ENE	2.021	0.986	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.01	5.78
	E	3.433	8.305	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	11.74	17.52
	ESE	8.995	72.321	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	81.32	98.84
	SE	0.746	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.75	99.59
	SSE	0.340	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.34	99.93
	S	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.07	100.00
	SSW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	SW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	WSW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	W	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	WNW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	NW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	NNW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All PWD	18.34	81.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	Cum PWD	18.34	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	0.224	1.188	3.285	6.027	6.005	1.615	0.000	0.000	0.000	0.000	0.000	18.34	18.34
	0.5 - 1	0.000	0.004	1.628	8.070	21.862	49.682	0.368	0.041	0.000	0.000	0.000	81.65	100.00
	1 - 1.5	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	1.5 - 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	2 - 2.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	2.5 - 3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	3 - 3.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	3.5 - 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	4 - 4.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	0.22	1.19	4.91	14.10	27.87	51.30	0.37	0.04	0.00	0.00	0.00		
	Cum H_s	0.22	1.42	6.33	20.43	48.29	99.59	99.96	100.00	100.00	100.00	100.00		

Table B-24 Annual frequency of occurrence tableat P24. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (oN)	N	0.074	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.11	0.11
	NNE	0.031	0.377	0.246	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.66	0.77
	NE	0.015	0.185	1.290	0.102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.59	2.36
	ENE	0.006	0.624	1.886	1.726	0.046	0.000	0.000	0.000	0.000	0.000	0.000	4.29	6.65
	E	0.009	1.125	8.068	6.595	7.585	0.281	0.011	0.002	0.000	0.000	0.000	23.68	30.33
	ESE	0.004	1.088	3.042	2.095	12.766	41.355	0.348	0.039	0.000	0.000	0.000	60.74	91.06
	SE	0.000	0.244	0.875	0.842	0.244	0.000	0.000	0.000	0.000	0.000	0.000	2.21	93.27
	SSE	0.002	0.204	0.424	0.265	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.93	94.20
	S	0.070	0.183	0.242	0.109	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.66	94.86
	SSW	0.104	0.422	0.131	0.191	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.86	95.72
	SW	0.422	0.340	0.259	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.03	96.75
	WSW	0.627	0.705	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.35	98.10
	W	0.685	0.503	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.19	99.29
	WNW	0.305	0.248	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.55	99.84
	NW	0.072	0.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.12	99.96
	NNW	0.026	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.04	100.00
	All PWD	2.45	6.35	16.49	11.93	20.75	41.64	0.36	0.04	0.00	0.00	0.00		
	Cum PWD	2.45	8.80	25.29	37.22	57.96	99.60	99.96	100.00	100.00	100.00	100.00		

Annual		Significant Wave Height, H_s (m)												
		0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
Mean Wave Direction, MWD (oN)	N	0.111	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.11	0.11
	NNE	0.418	0.222	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.66	0.77
	NE	0.629	0.894	0.063	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.59	2.36
	ENE	0.448	2.413	1.271	0.154	0.002	0.000	0.000	0.000	0.000	0.000	0.000	4.29	6.65
	E	0.779	9.660	8.546	3.649	0.814	0.159	0.068	0.002	0.000	0.000	0.000	23.68	30.33
	ESE	3.856	34.669	16.430	4.225	1.108	0.331	0.093	0.024	0.000	0.000	0.000	60.74	91.06
	SE	0.413	0.857	0.705	0.178	0.043	0.009	0.002	0.000	0.000	0.000	0.000	2.21	93.27
	SSE	0.091	0.555	0.235	0.041	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.93	94.20
	S	0.115	0.352	0.161	0.035	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.66	94.86
	SSW	0.144	0.559	0.144	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.86	95.72
	SW	0.305	0.648	0.070	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.03	96.75
	WSW	0.603	0.703	0.044	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.35	98.10
	W	0.518	0.640	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.19	99.29
	WNW	0.274	0.272	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.55	99.84
	NW	0.076	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.12	99.96
	NNW	0.026	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.04	100.00
	All PWD	8.81	52.50	27.72	8.30	1.98	0.50	0.16	0.03	0.00	0.00	0.00		
	Cum PWD	8.81	61.31	89.03	97.34	99.31	99.81	99.97	100.00	100.00	100.00	100.00		

Annual		Peak Wave Period, T_P (s)												
		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
Significant Waved Height, H_s (m)	0 - 0.5	2.000	0.966	0.796	1.016	2.554	1.475	0.000	0.000	0.000	0.000	0.000	8.81	8.81
	0.5 - 1	0.452	5.307	5.057	4.352	11.249	26.084	0.000	0.000	0.000	0.000	0.000	52.50	61.31
	1 - 1.5	0.000	0.076	8.934	2.189	5.157	11.293	0.068	0.004	0.000	0.000	0.000	27.72	89.03
	1.5 - 2	0.000	0.000	1.697	3.055	1.281	2.137	0.111	0.024	0.000	0.000	0.000	8.30	97.34
	2 - 2.5	0.000	0.000	0.002	1.107	0.285	0.455	0.120	0.007	0.000	0.000	0.000	1.98	99.31
	2.5 - 3	0.000	0.000	0.000	0.189	0.122	0.144	0.039	0.006	0.000	0.000	0.000	0.50	99.81
	3 - 3.5	0.000	0.000	0.000	0.024	0.083	0.044	0.011	0.000	0.000	0.000	0.000	0.16	99.97
	3.5 - 4	0.000	0.000	0.000	0.000	0.015	0.002	0.009	0.000	0.000	0.000	0.000	0.03	100.00
	4 - 4.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
	All H_s	2.45	6.35	16.49	11.93	20.75	41.64	0.36	0.04	0.00	0.00	0.00		
	Cum H_s	2.45	8.80	25.29	37.22	57.96	99.60	99.96	100.00	100.00	100.00	100.00		

Table B-25 Annual frequency of occurrence tableat P25. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual	Peak Wave Period, T_P (s)												
Mean Wave Direction, MWD (oN)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
N	0.094	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.16	0.16
NNE	0.039	0.374	0.283	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.70	0.85
NE	0.022	0.089	1.012	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.16	2.02
ENE	0.009	0.387	0.922	0.631	0.006	0.000	0.000	0.000	0.000	0.000	0.000	1.95	3.97
E	0.009	1.021	7.259	4.149	0.242	0.002	0.000	0.000	0.000	0.000	0.000	12.68	16.65
ESE	0.000	1.186	3.727	5.072	10.224	1.033	0.154	0.015	0.000	0.000	0.000	21.41	38.06
SE	0.004	0.303	1.084	1.386	10.348	40.897	0.211	0.026	0.000	0.000	0.000	54.26	92.32
SSE	0.002	0.229	0.607	0.476	0.133	0.002	0.000	0.000	0.000	0.000	0.000	1.45	93.77
S	0.056	0.324	0.485	0.146	0.022	0.002	0.000	0.000	0.000	0.000	0.000	1.03	94.80
SSW	0.168	0.959	0.074	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.24	96.05
SW	0.254	0.992	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.29	97.34
WSW	0.352	1.092	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.44	98.78
W	0.281	0.527	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.81	99.59
WNW	0.176	0.144	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.32	99.91
NW	0.041	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	99.97
NNW	0.024	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.03	100.00
All PWD	1.53	7.71	15.50	11.94	20.97	41.94	0.36	0.04	0.00	0.00	0.00		
Cum PWD	1.53	9.25	24.74	36.69	57.66	99.59	99.96	100.00	100.00	100.00	100.00		

Annual	Significant Wave Height, H_s (m)												
Mean Wave Direction, MWD (oN)	0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
N	0.146	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.16	0.16
NNE	0.433	0.229	0.033	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.70	0.85
NE	0.507	0.592	0.059	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.16	2.02
ENE	0.359	1.249	0.324	0.020	0.002	0.000	0.000	0.000	0.000	0.000	0.000	1.95	3.97
E	0.420	4.652	4.944	2.237	0.398	0.028	0.004	0.000	0.000	0.000	0.000	12.68	16.65
ESE	0.711	7.708	7.465	3.523	1.295	0.472	0.183	0.052	0.009	0.000	0.000	21.41	38.06
SE	4.441	31.436	14.077	3.225	0.757	0.229	0.068	0.017	0.007	0.000	0.000	54.26	92.32
SSE	0.089	0.727	0.492	0.111	0.026	0.004	0.000	0.000	0.000	0.000	0.000	1.45	93.77
S	0.165	0.555	0.248	0.059	0.007	0.000	0.000	0.000	0.000	0.000	0.000	1.03	94.80
SSW	0.265	0.775	0.185	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.24	96.05
SW	0.415	0.803	0.068	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.29	97.34
WSW	0.724	0.696	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.44	98.78
W	0.396	0.400	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.81	99.59
WNW	0.198	0.122	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.32	99.91
NW	0.046	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.06	99.97
NNW	0.024	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.03	100.00
All PWD	9.34	49.97	27.93	9.20	2.49	0.73	0.26	0.07	0.02	0.00	0.00		
Cum PWD	9.34	59.30	87.24	96.44	98.93	99.66	99.91	99.98	100.00	100.00	100.00		

Annual	Peak Wave Period, T_P (s)												
Significant Waved Height, H_s (m)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
0 - 0.5	1.495	1.708	0.783	0.942	2.715	1.695	0.000	0.000	0.000	0.000	0.000	9.34	9.34
0.5 - 1	0.035	5.814	4.841	4.117	10.141	25.019	0.000	0.000	0.000	0.000	0.000	49.97	59.30
1 - 1.5	0.000	0.192	8.266	2.385	5.426	11.630	0.030	0.004	0.000	0.000	0.000	27.93	87.24
1.5 - 2	0.000	0.000	1.608	2.926	1.936	2.596	0.117	0.020	0.000	0.000	0.000	9.20	96.44
2 - 2.5	0.000	0.000	0.002	1.251	0.437	0.677	0.111	0.009	0.000	0.000	0.000	2.49	98.93
2.5 - 3	0.000	0.000	0.000	0.272	0.167	0.220	0.072	0.002	0.000	0.000	0.000	0.73	99.66
3 - 3.5	0.000	0.000	0.000	0.048	0.117	0.067	0.019	0.006	0.000	0.000	0.000	0.26	99.91
3.5 - 4	0.000	0.000	0.000	0.000	0.028	0.031	0.009	0.000	0.000	0.000	0.000	0.07	99.98
4 - 4.5	0.000	0.000	0.000	0.000	0.009	0.000	0.007	0.000	0.000	0.000	0.000	0.02	100.00
4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
All H_s	1.53	7.71	15.50	11.94	20.97	41.94	0.36	0.04	0.00	0.00	0.00		
Cum H_s	1.53	9.25	24.74	36.69	57.66	99.59	99.96	100.00	100.00	100.00	100.00		

Table B-26 Annual frequency of occurrence tableat P26. Peak wave period and mean wave direction (top), significant wave height and mean wave direction (middle) and significant wave height and peak wave period (bottom)

Annual	Peak Wave Period, T_P (s)												
Mean Wave Direction, MWD (oN)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
N	0.146	0.054	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.20	0.20
NNE	0.044	0.437	0.287	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.77	0.97
NE	0.015	0.265	1.475	0.202	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.96	2.92
ENE	0.009	0.922	2.163	2.631	0.135	0.002	0.000	0.000	0.000	0.000	0.000	5.86	8.79
E	0.013	1.895	9.269	6.479	11.173	1.299	0.105	0.015	0.000	0.000	0.000	30.25	39.03
ESE	0.004	0.983	2.165	1.769	9.162	39.957	0.254	0.026	0.000	0.000	0.000	54.32	93.35
SE	0.002	0.131	0.490	0.468	0.128	0.002	0.000	0.000	0.000	0.000	0.000	1.22	94.57
SSE	0.006	0.057	0.239	0.178	0.037	0.002	0.000	0.000	0.000	0.000	0.000	0.52	95.09
S	0.033	0.111	0.200	0.061	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.45	95.54
SSW	0.104	0.250	0.091	0.105	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.55	96.09
SW	0.218	0.142	0.137	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.53	96.62
WSW	0.220	0.211	0.094	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.53	97.14
W	0.390	0.513	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.90	98.04
WNW	0.755	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.35	99.39
NW	0.276	0.194	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.47	99.86
NNW	0.118	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	100.00
All PWD	2.35	6.78	16.61	11.92	20.68	41.26	0.36	0.04	0.00	0.00	0.00		
Cum PWD	2.35	9.13	25.74	37.66	58.34	99.60	99.96	100.00	100.00	100.00	100.00		

Annual	Significant Wave Height, H_s (m)												
Mean Wave Direction, MWD (oN)	0 - 0.5	0.5 - 1	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5	> 5	All H_s	Cum H_s
N	0.183	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.20	0.20
NNE	0.509	0.248	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.77	0.97
NE	0.855	1.031	0.065	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.96	2.92
ENE	0.696	3.323	1.547	0.289	0.006	0.002	0.000	0.000	0.000	0.000	0.000	5.86	8.79
E	1.327	11.440	10.278	4.791	1.688	0.468	0.185	0.070	0.002	0.000	0.000	30.25	39.03
ESE	6.617	32.968	10.946	2.615	0.814	0.270	0.070	0.017	0.002	0.000	0.000	54.32	93.35
SE	0.155	0.770	0.278	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.22	94.57
SSE	0.170	0.305	0.039	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.52	95.09
S	0.187	0.222	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.45	95.54
SSW	0.266	0.274	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.55	96.09
SW	0.263	0.255	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.53	96.62
WSW	0.294	0.229	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.53	97.14
W	0.561	0.339	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.90	98.04
WNW	0.768	0.566	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.35	99.39
NW	0.298	0.167	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.47	99.86
NNW	0.115	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.14	100.00
All PWD	13.26	52.18	23.24	7.72	2.51	0.74	0.26	0.09	0.00	0.00	0.00		
Cum PWD	13.26	65.44	88.68	96.41	98.91	99.65	99.91	100.00	100.00	100.00	100.00		

Annual	Peak Wave Period, T_P (s)												
Significant Waved Height, H_s (m)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20	> 20	All T_P	Cum T_P
0 - 0.5	2.211	1.695	1.157	1.293	3.964	2.944	0.000	0.000	0.000	0.000	0.000	13.26	13.26
0.5 - 1	0.142	5.052	4.937	4.539	9.883	27.626	0.000	0.000	0.000	0.000	0.000	52.18	65.44
1 - 1.5	0.000	0.030	8.029	1.826	4.943	8.353	0.056	0.004	0.000	0.000	0.000	23.24	88.68
1.5 - 2	0.000	0.000	2.465	2.191	1.349	1.606	0.093	0.019	0.000	0.000	0.000	7.72	96.41
2 - 2.5	0.000	0.000	0.022	1.556	0.278	0.514	0.126	0.011	0.000	0.000	0.000	2.51	98.91
2.5 - 3	0.000	0.000	0.000	0.413	0.109	0.150	0.061	0.007	0.000	0.000	0.000	0.74	99.65
3 - 3.5	0.000	0.000	0.000	0.094	0.093	0.061	0.007	0.000	0.000	0.000	0.000	0.26	99.91
3.5 - 4	0.000	0.000	0.000	0.009	0.054	0.007	0.017	0.000	0.000	0.000	0.000	0.09	100.00
4 - 4.5	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
4.5 - 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
> 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	100.00
All H_s	2.35	6.78	16.61	11.92	20.68	41.26	0.36	0.04	0.00	0.00	0.00		
Cum H_s	2.35	9.13	25.74	37.66	58.34	99.60	99.96	100.00	100.00	100.00	100.00		

B.3 Non-Exceedance Plots

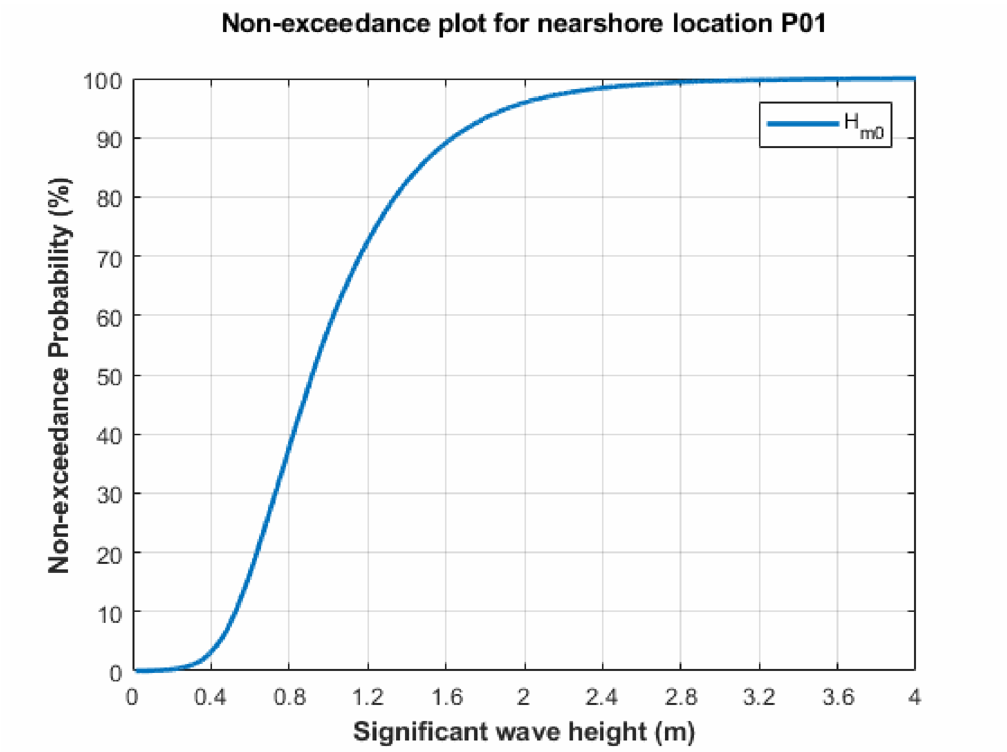

Figure B-27 Non-exceedance plots of Significant wave height at P01

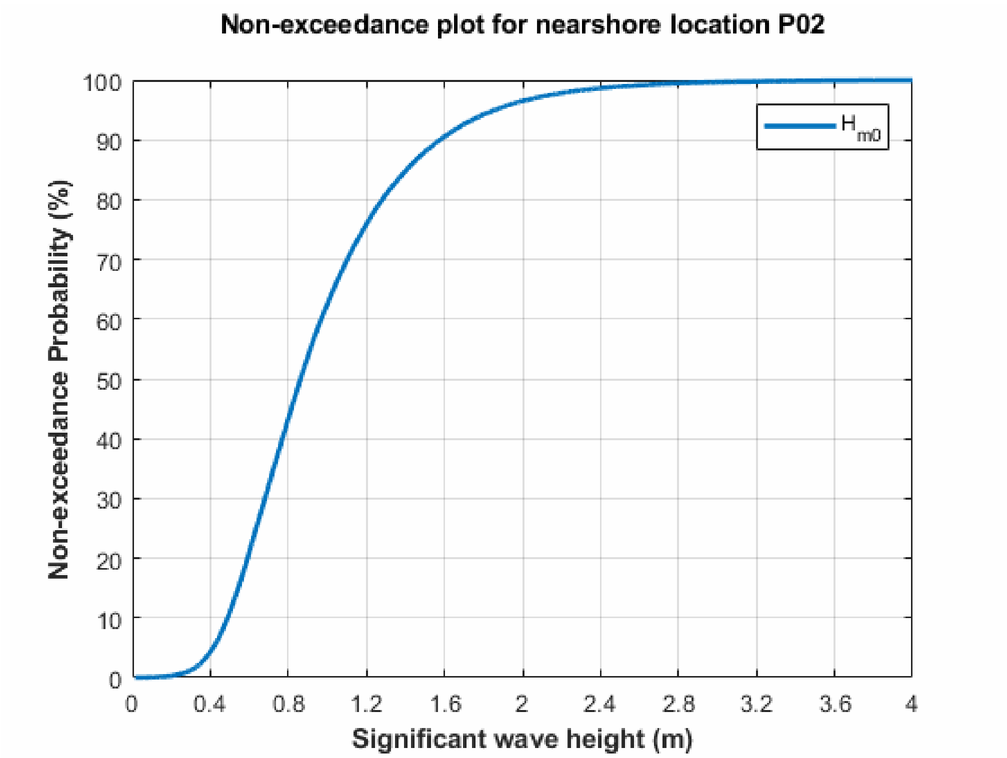

Figure B-28 Non-exceedance plots of Significant wave height at P02

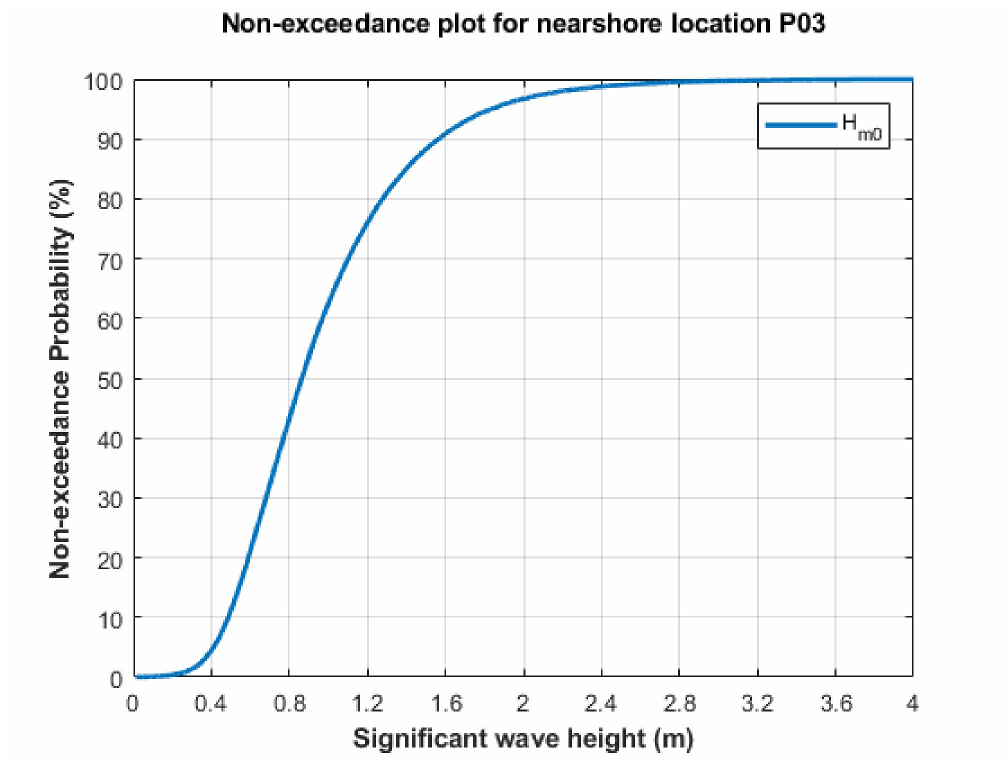

Figure B-29 Non-exceedance plots of Significant wave height at P03

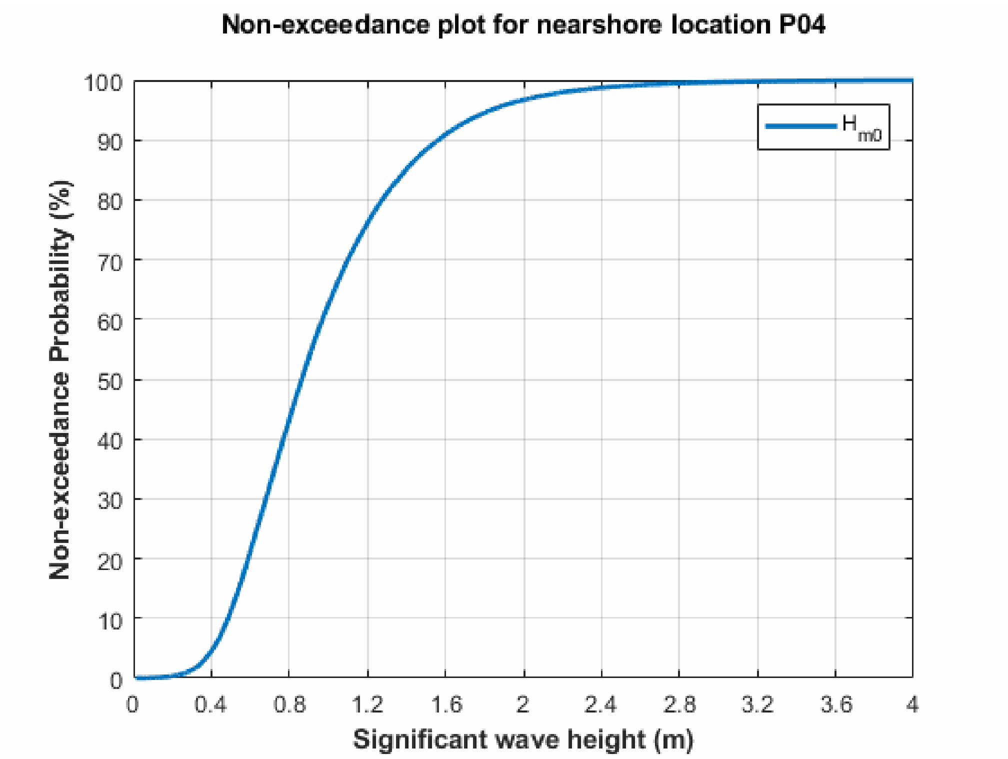

Figure B-30 Non-exceedance plots of Significant wave height at P04

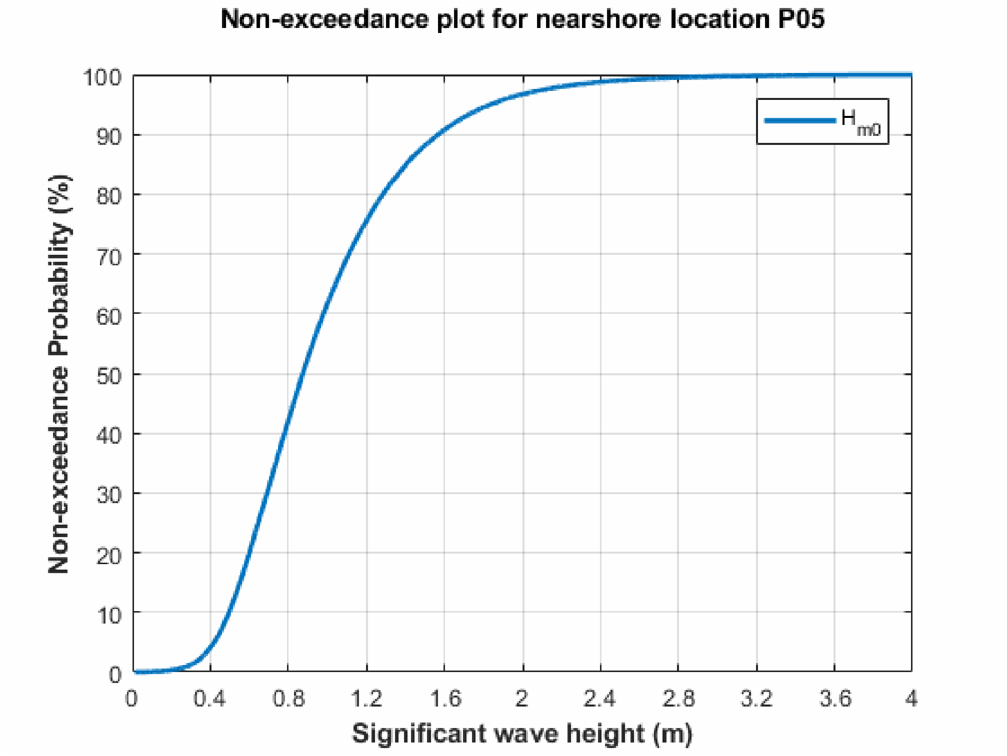

Figure B-31 Non-exceedance plots of Significant wave height at P05

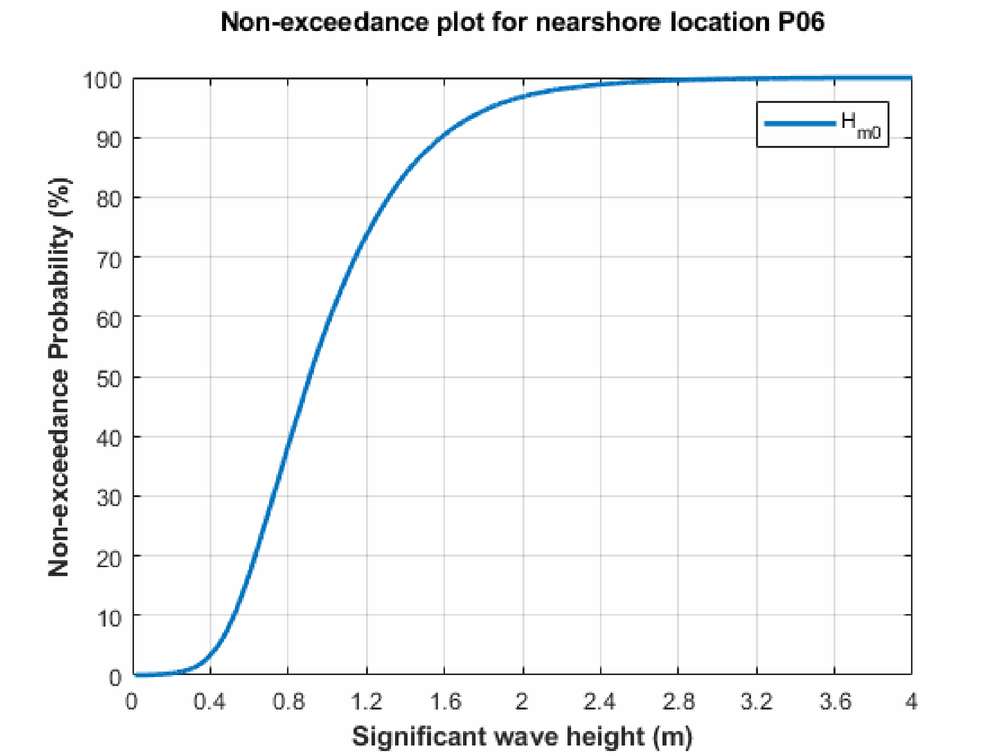

Figure B-32 Non-exceedance plots of Significant wave height at P06

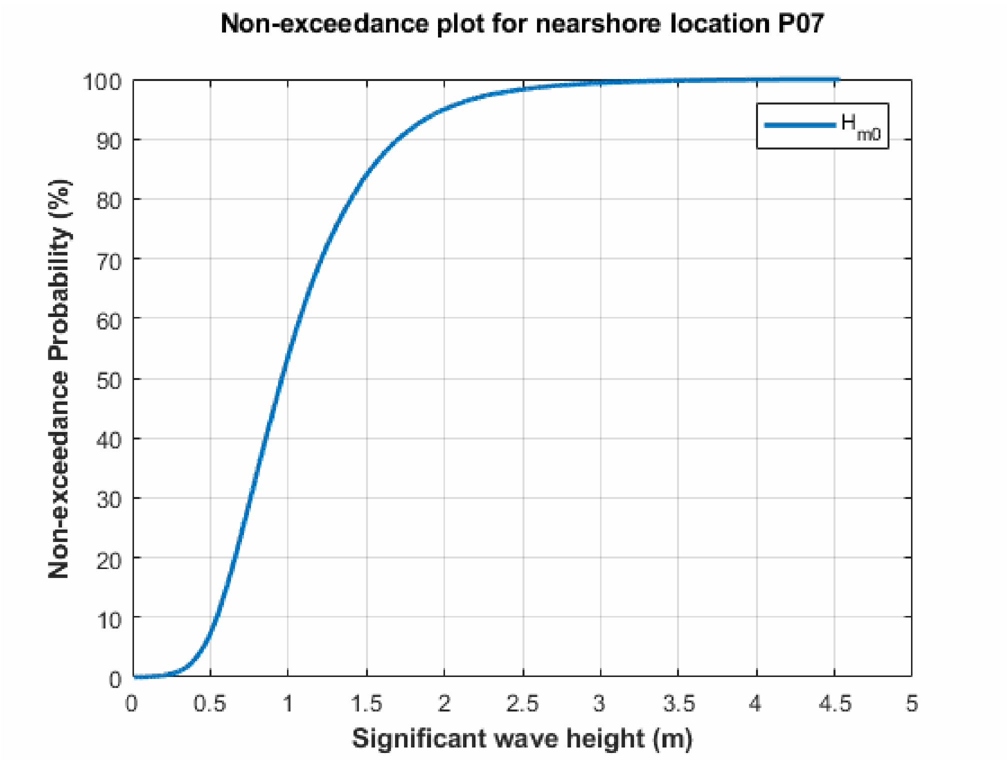

Figure B-33 Non-exceedance plots of Significant wave height at P07

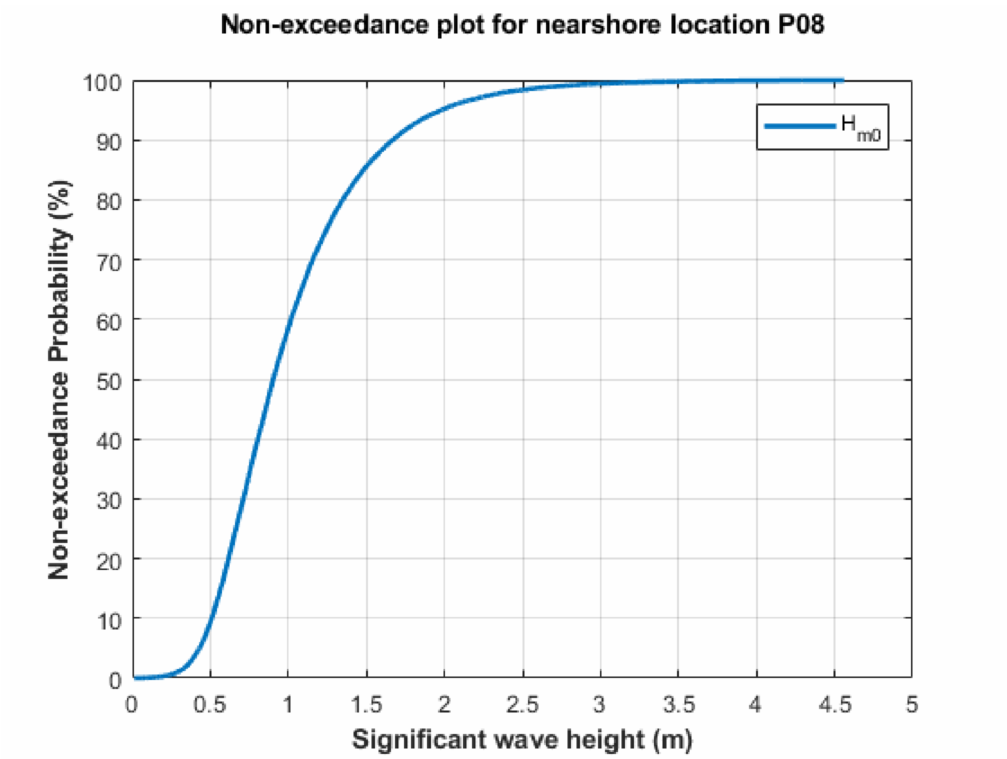

Figure B-34 Non-exceedance plots of Significant wave height at P08

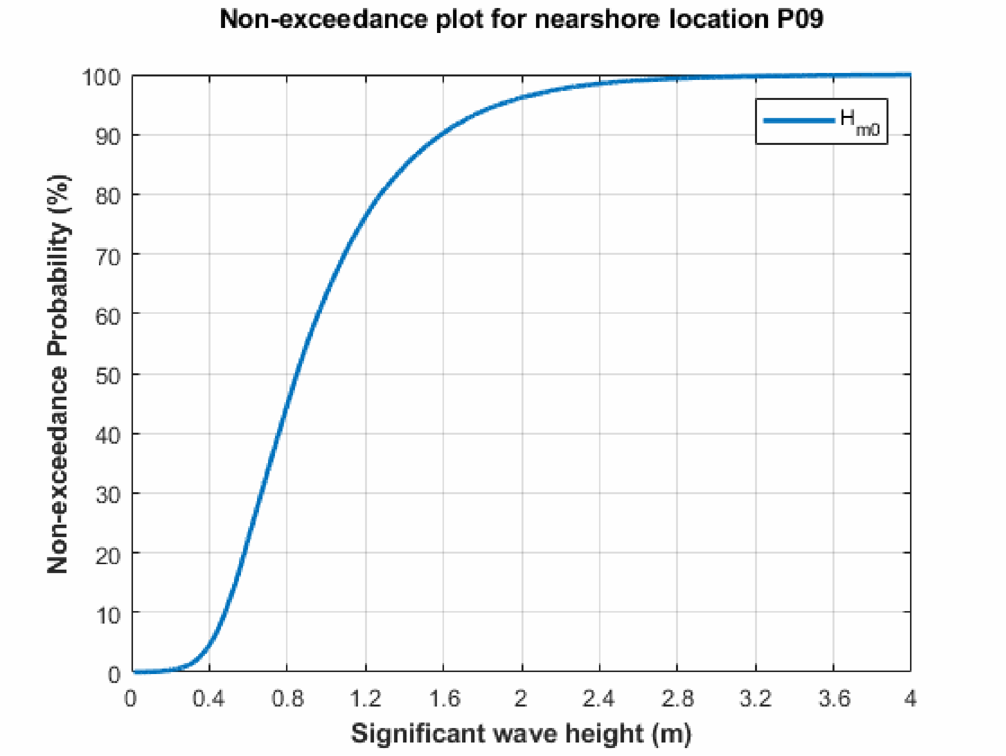

Figure B-35 Non-exceedance plots of Significant wave height at P09

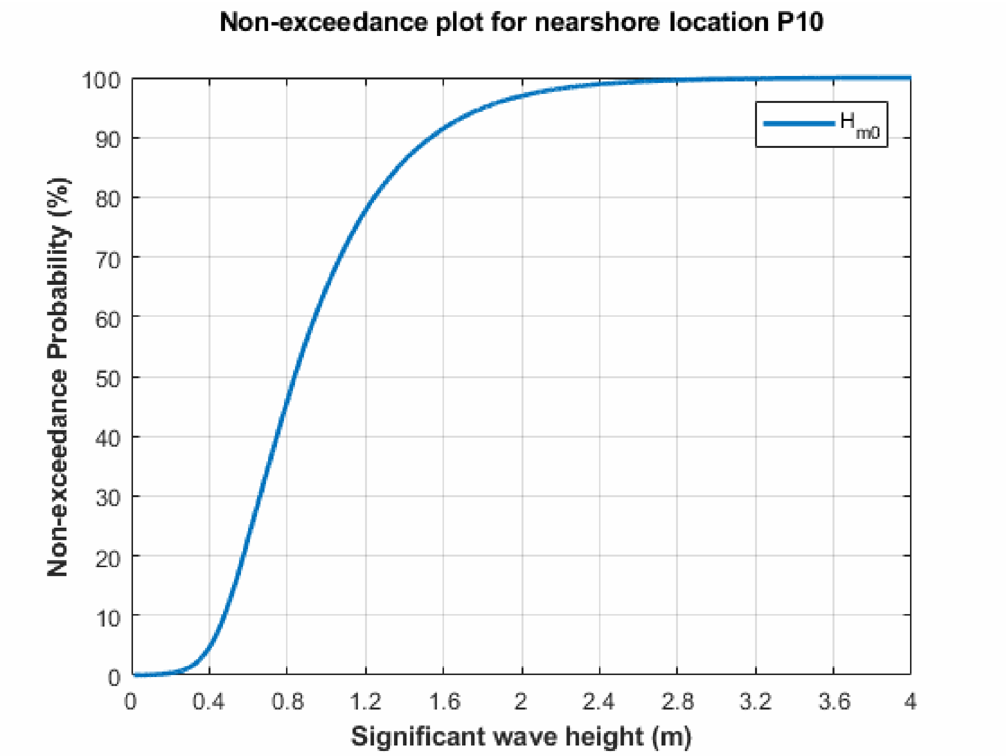

Figure B-36 Non-exceedance plots of Significant wave height at P10

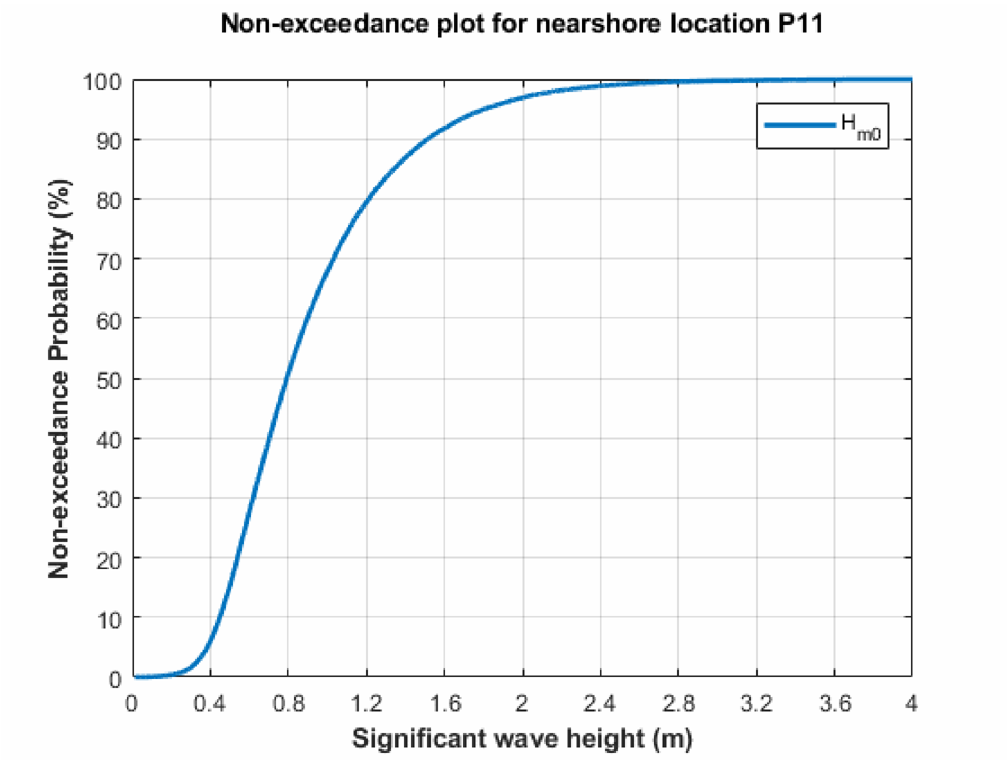

Figure B-37 Non-exceedance plots of Significant wave height at P11

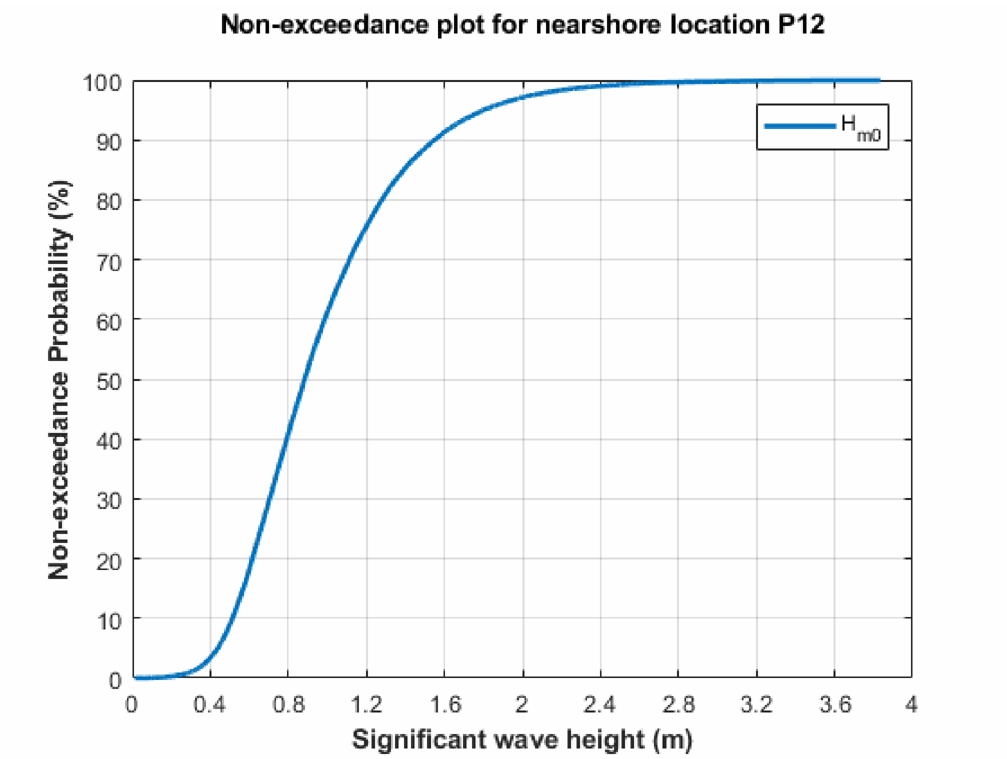

Figure B-38 Non-exceedance plots of Significant wave height at P12

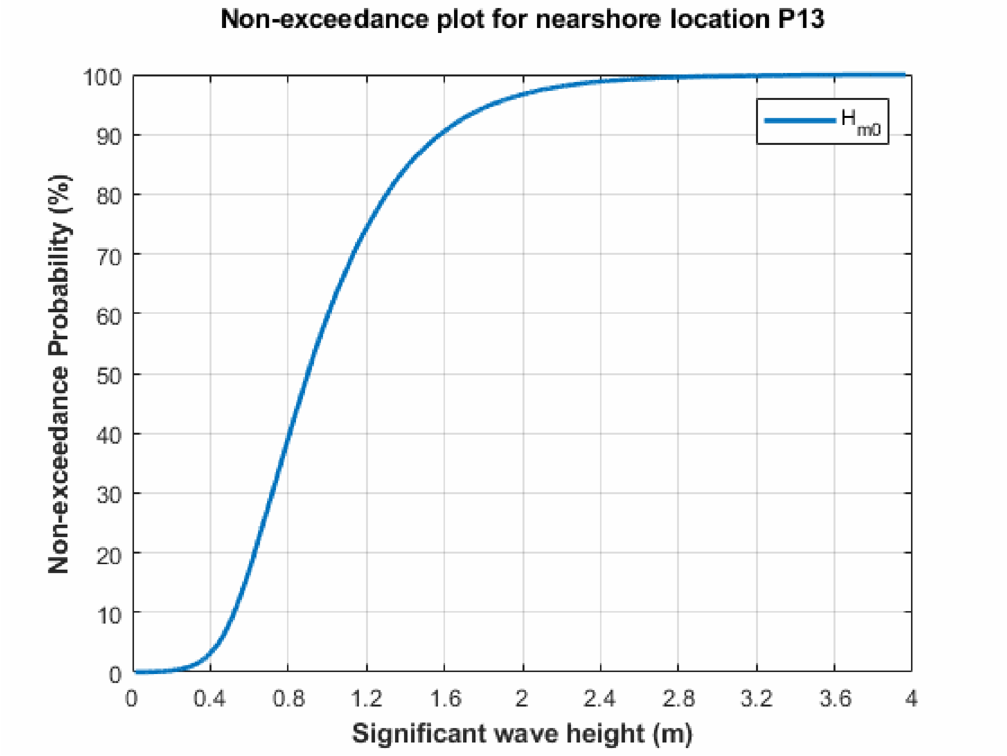

Figure B-39 Non-exceedance plots of Significant wave height at P13

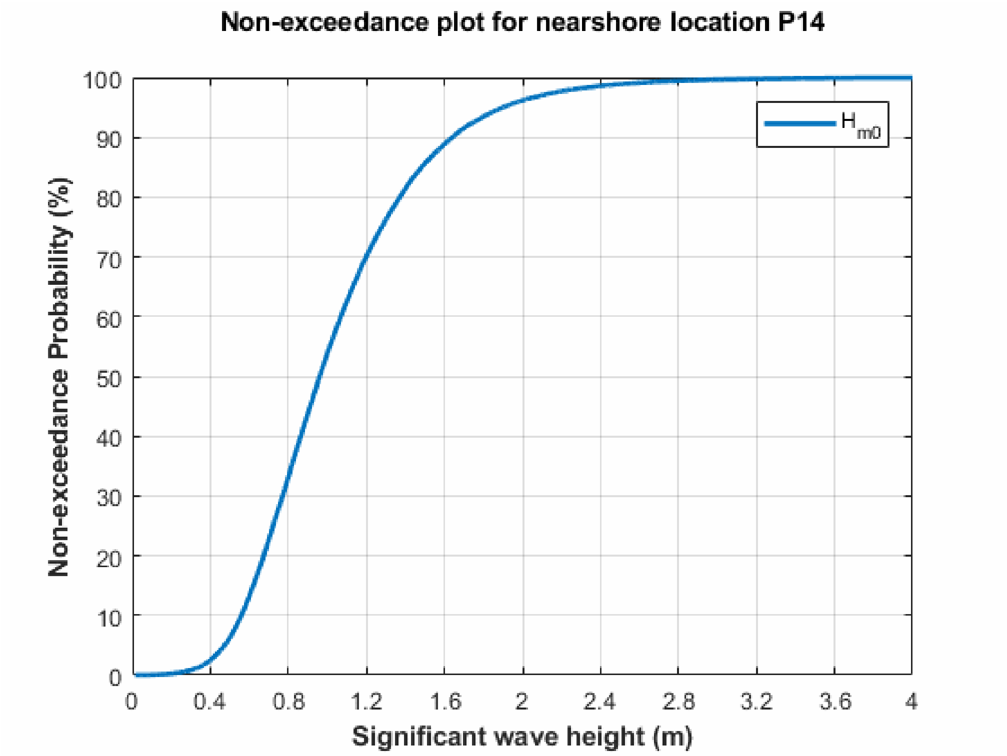

Figure B-40 Non-exceedance plots of Significant wave height at P14

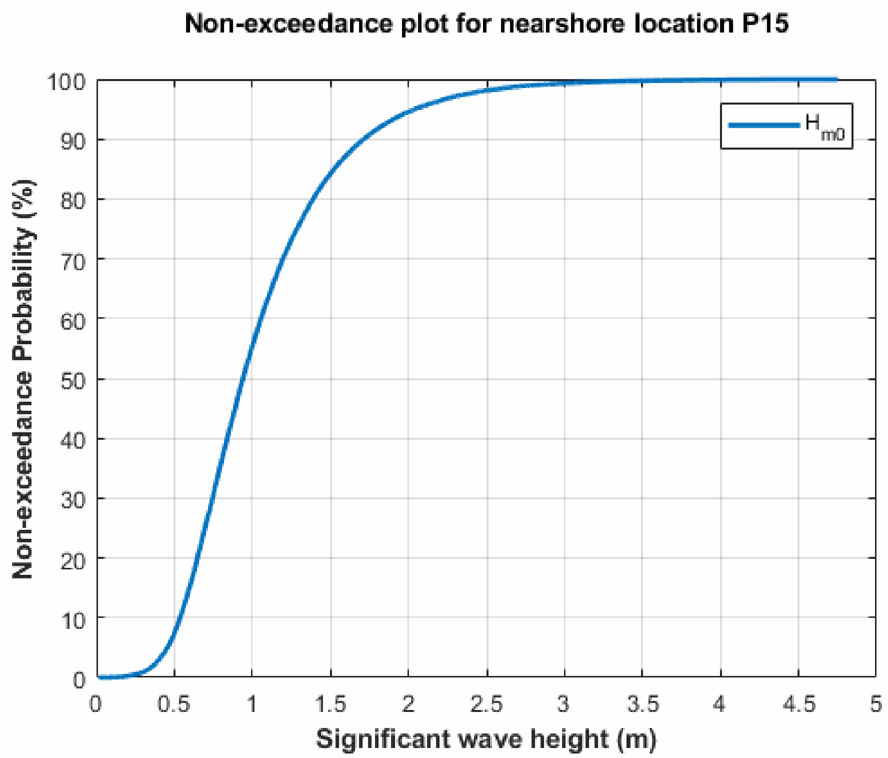

Figure B-41 Non-exceedance plots of Significant wave height at P15

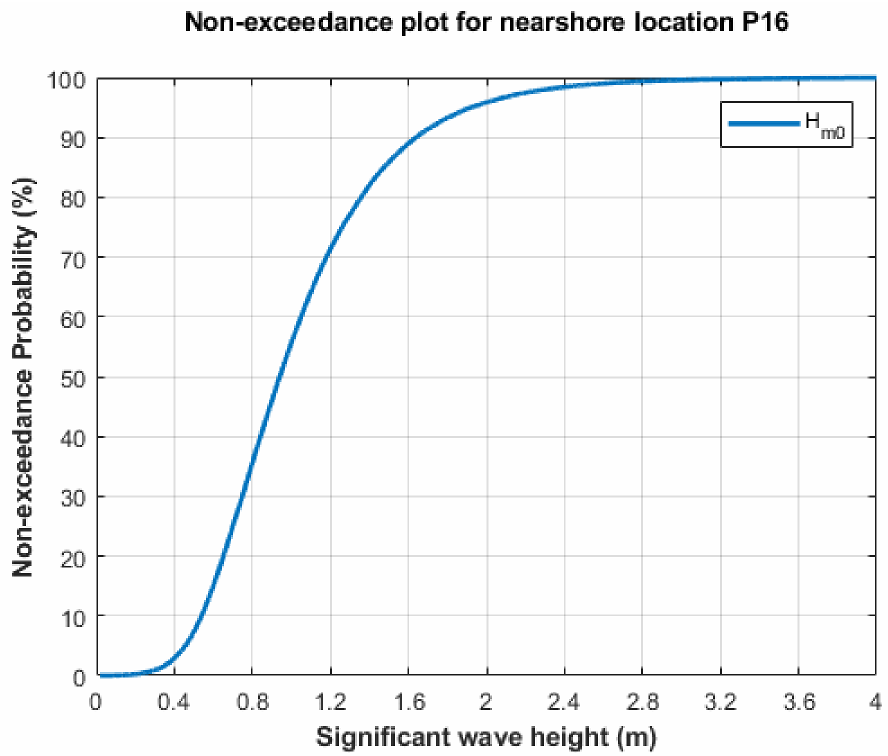

Figure B-42 Non-exceedance plots of Significant wave height at P16

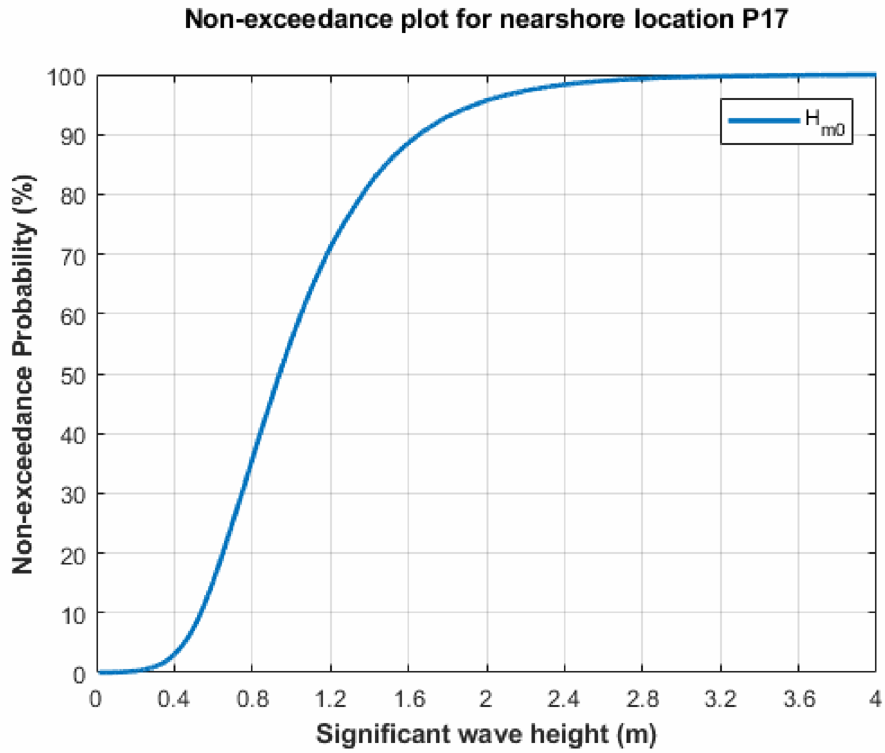

Figure B-43 Non-exceedance plots of Significant wave height at P17

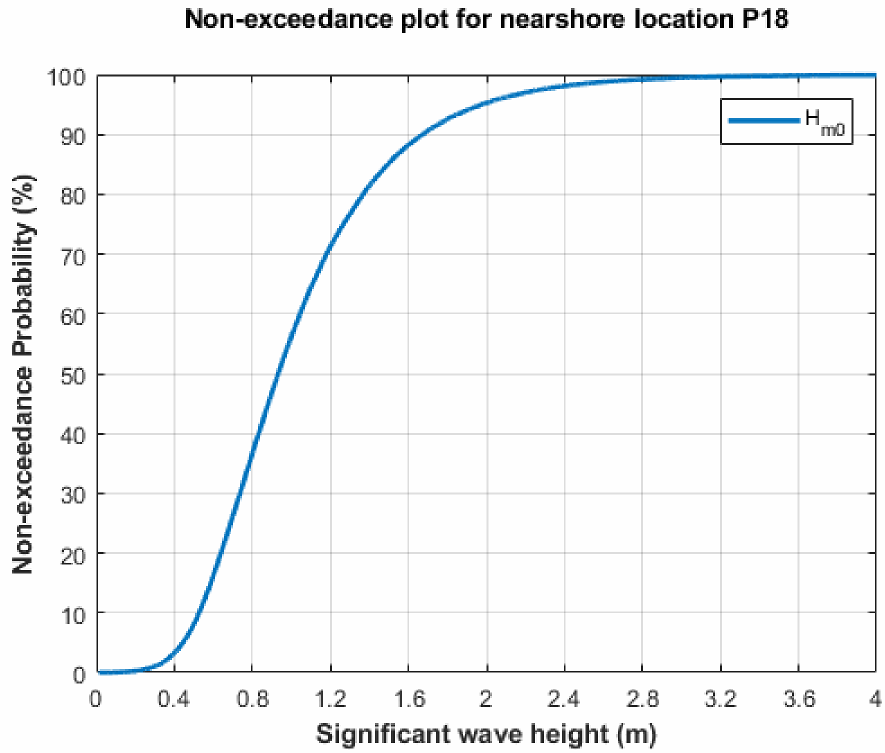

Figure B-44 Non-exceedance plots of Significant wave height at P18

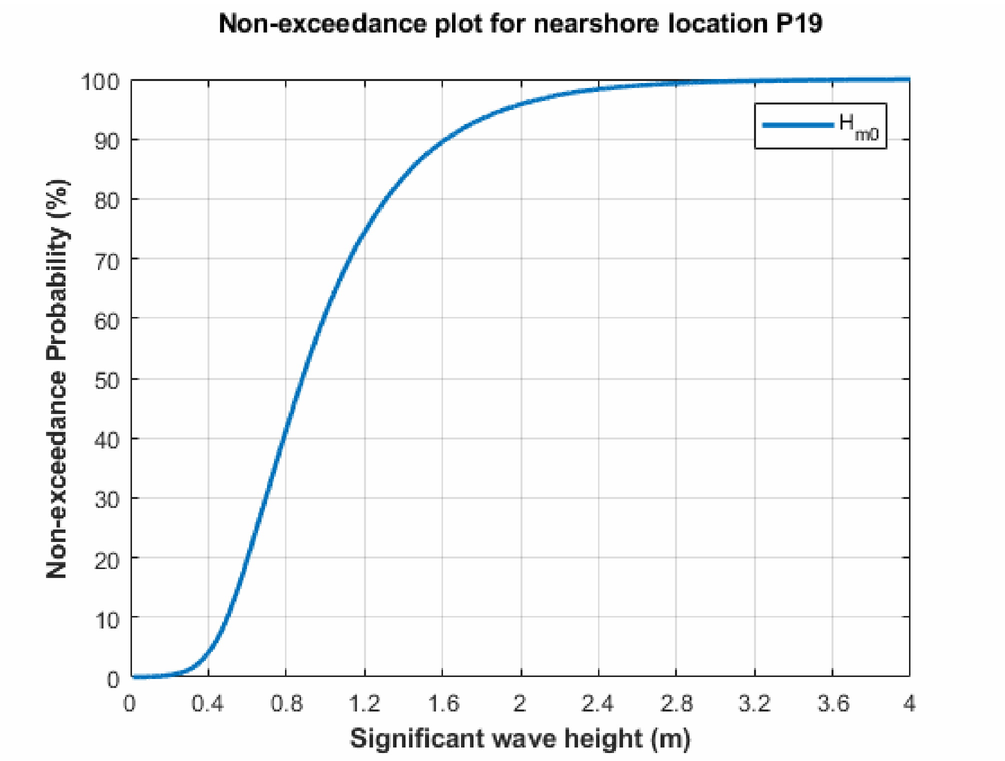

Figure B-45 Non-exceedance plots of Significant wave height at P19

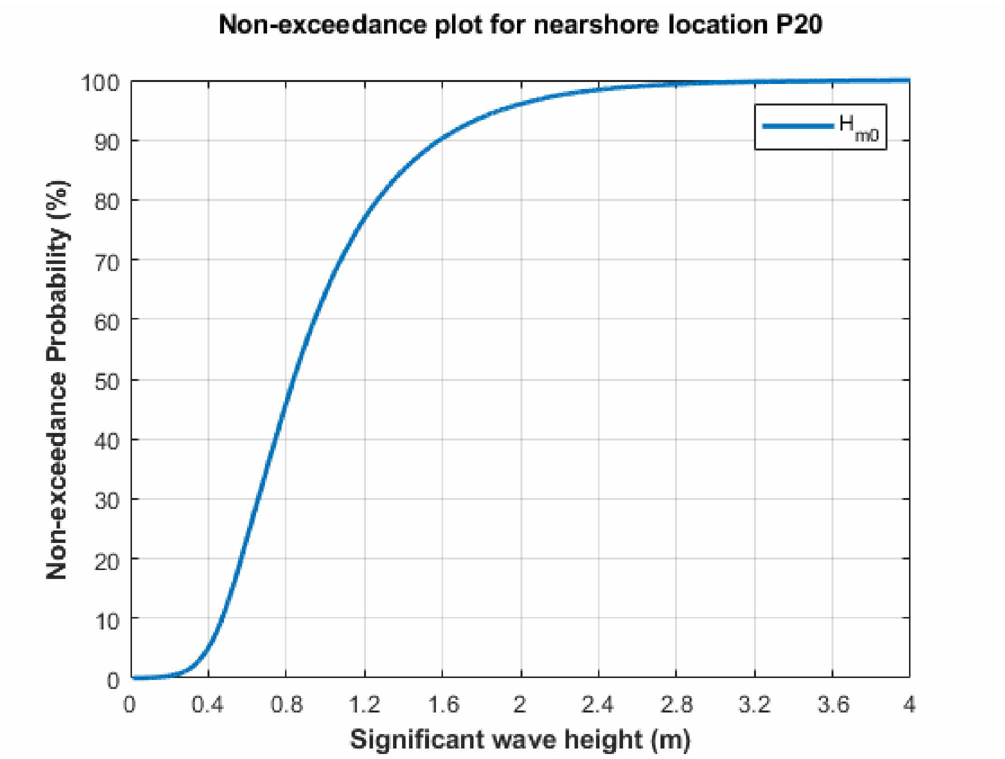

Figure B-46 Non-exceedance plots of Significant wave height at P20

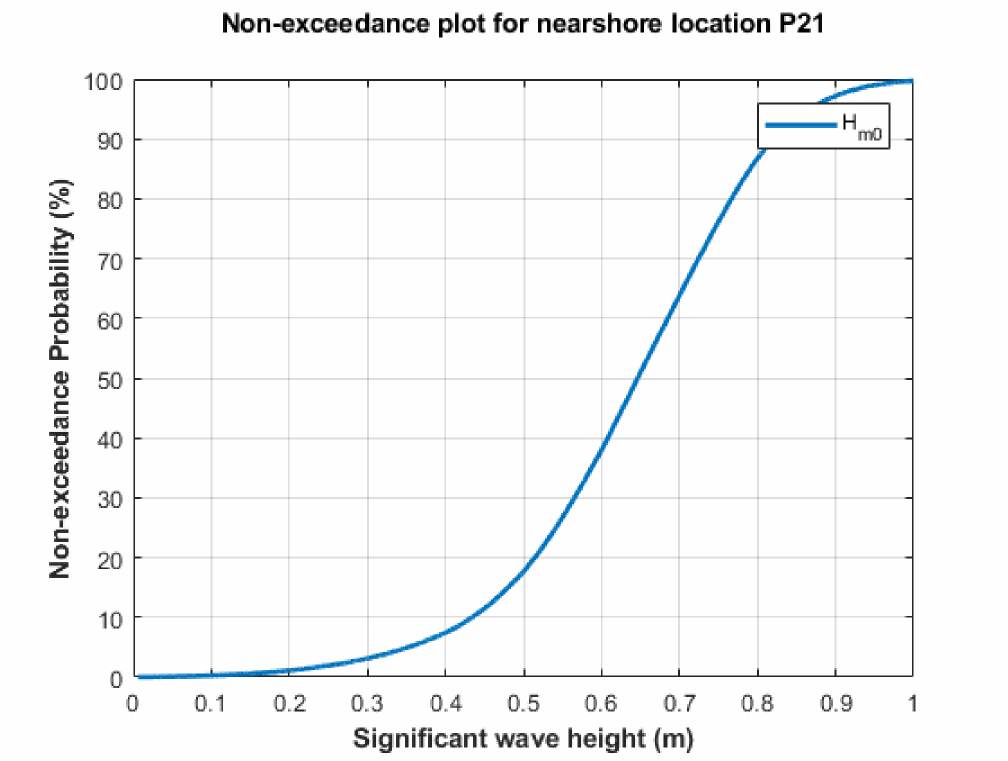

Figure B-47 Non-exceedance plots of Significant wave height at P21

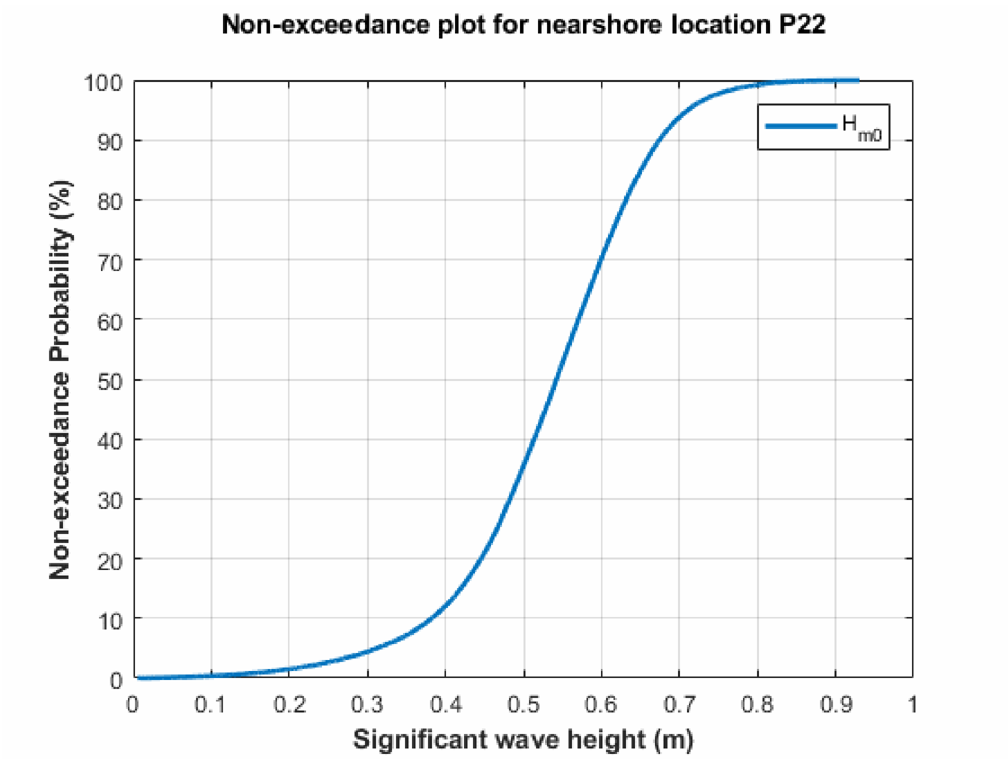

Figure B-48 Non-exceedance plots of Significant wave height at P22

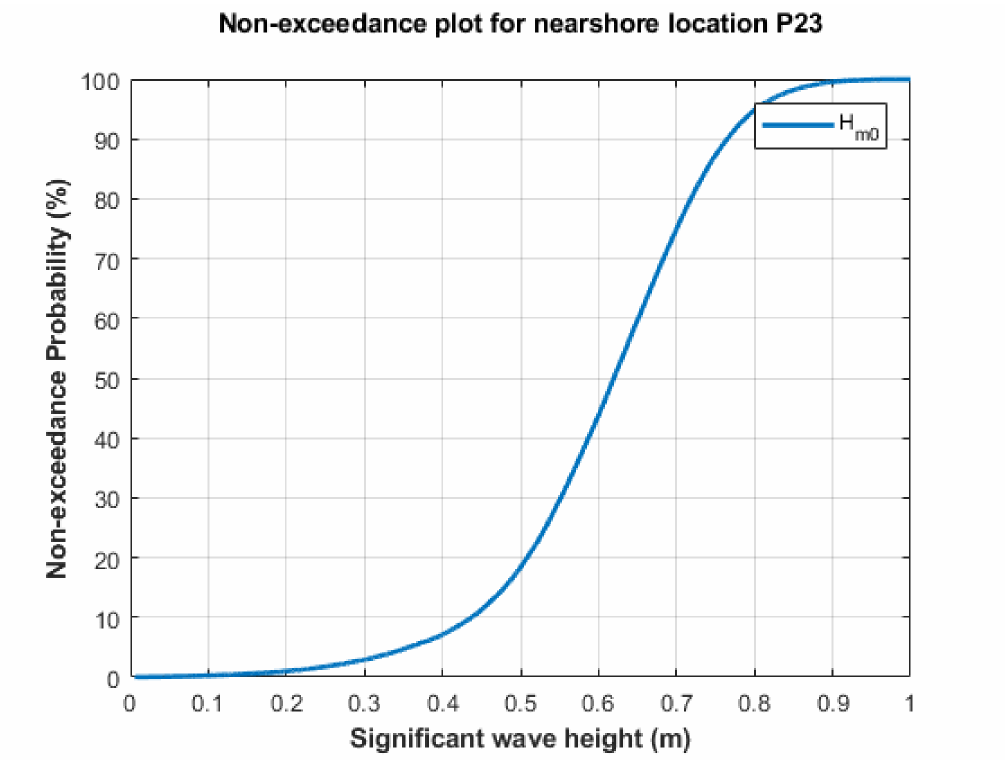

Figure B-49 Non-exceedance plots of Significant wave height at P23

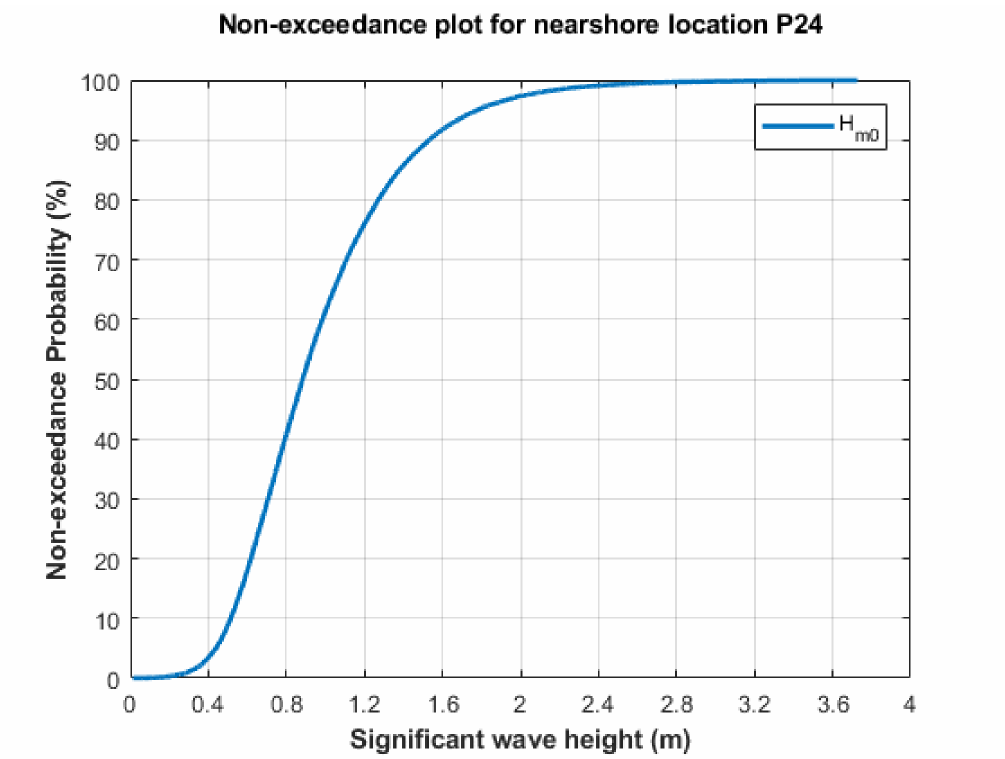

Figure B-50 Non-exceedance plots of Significant wave height at P24

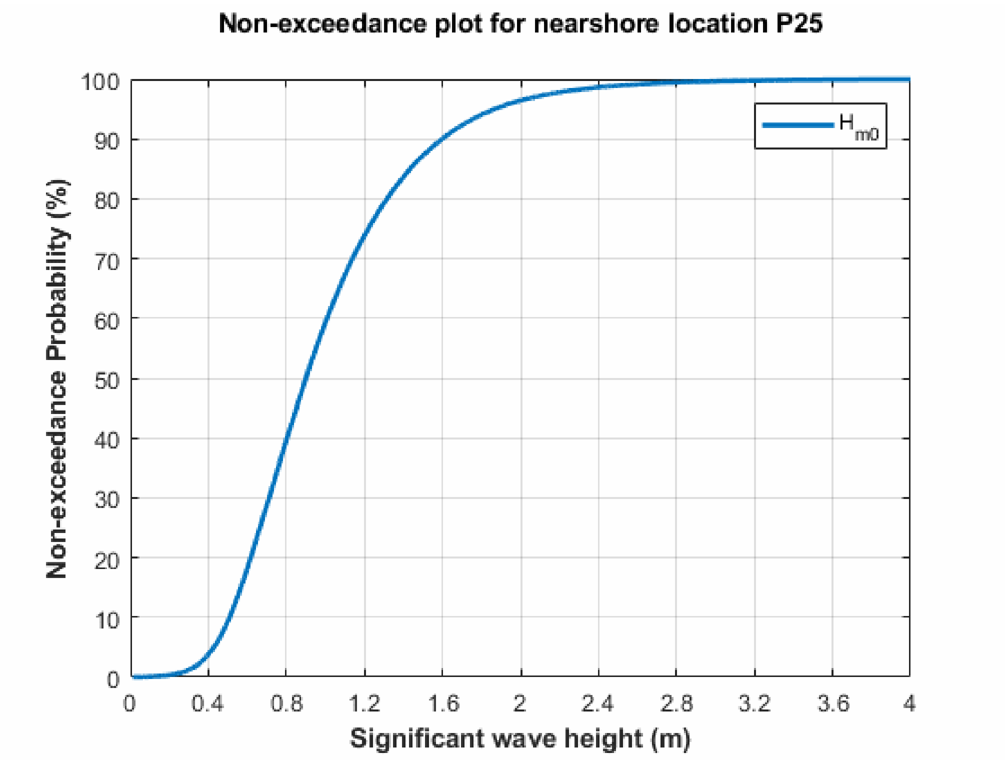

Figure B-51 Non-exceedance plots of Significant wave height at P25

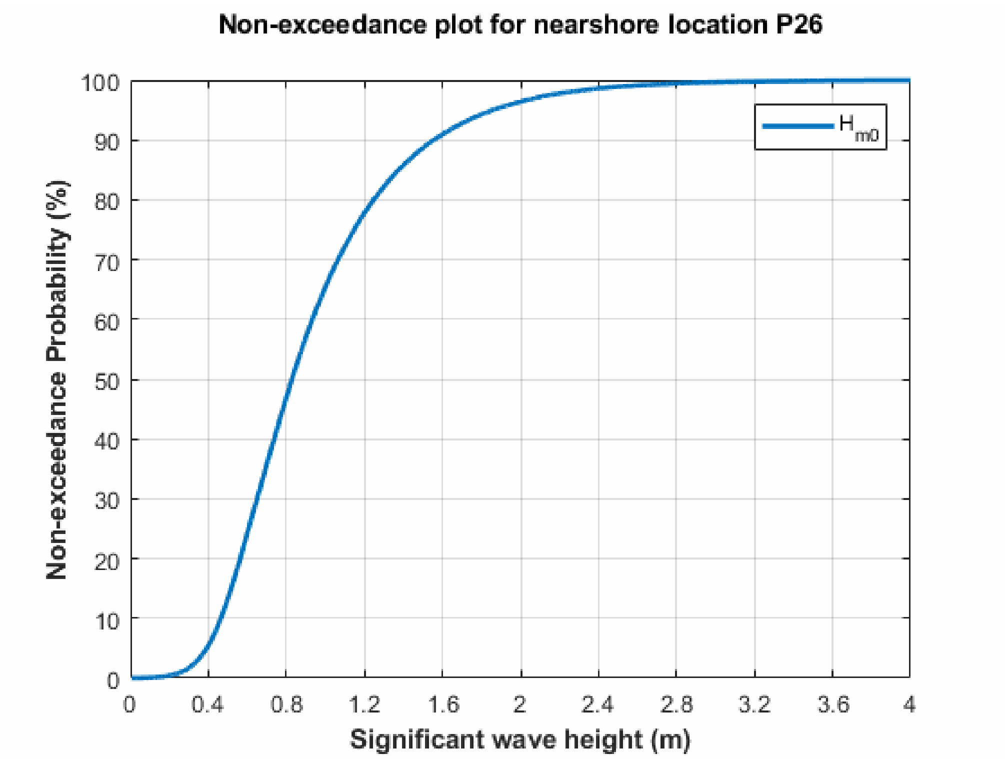

Figure B-52 Non-exceedance plots of Significant wave height at P26

B.4 Histograms

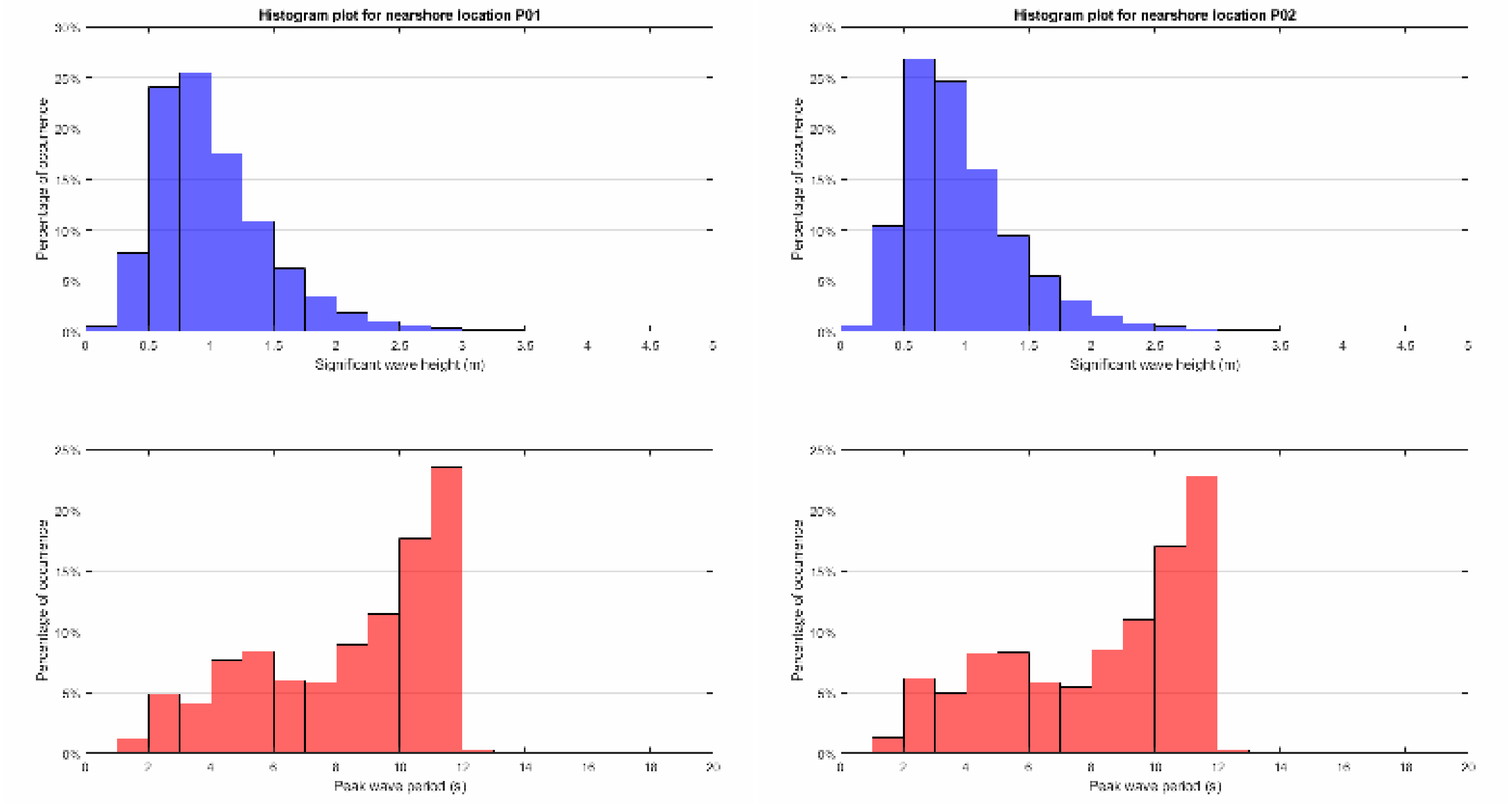

Figure B-53 Histograms of significant wave height (top) and peak wave period (bottom). P01 histograms (left) and P02 histograms (right)

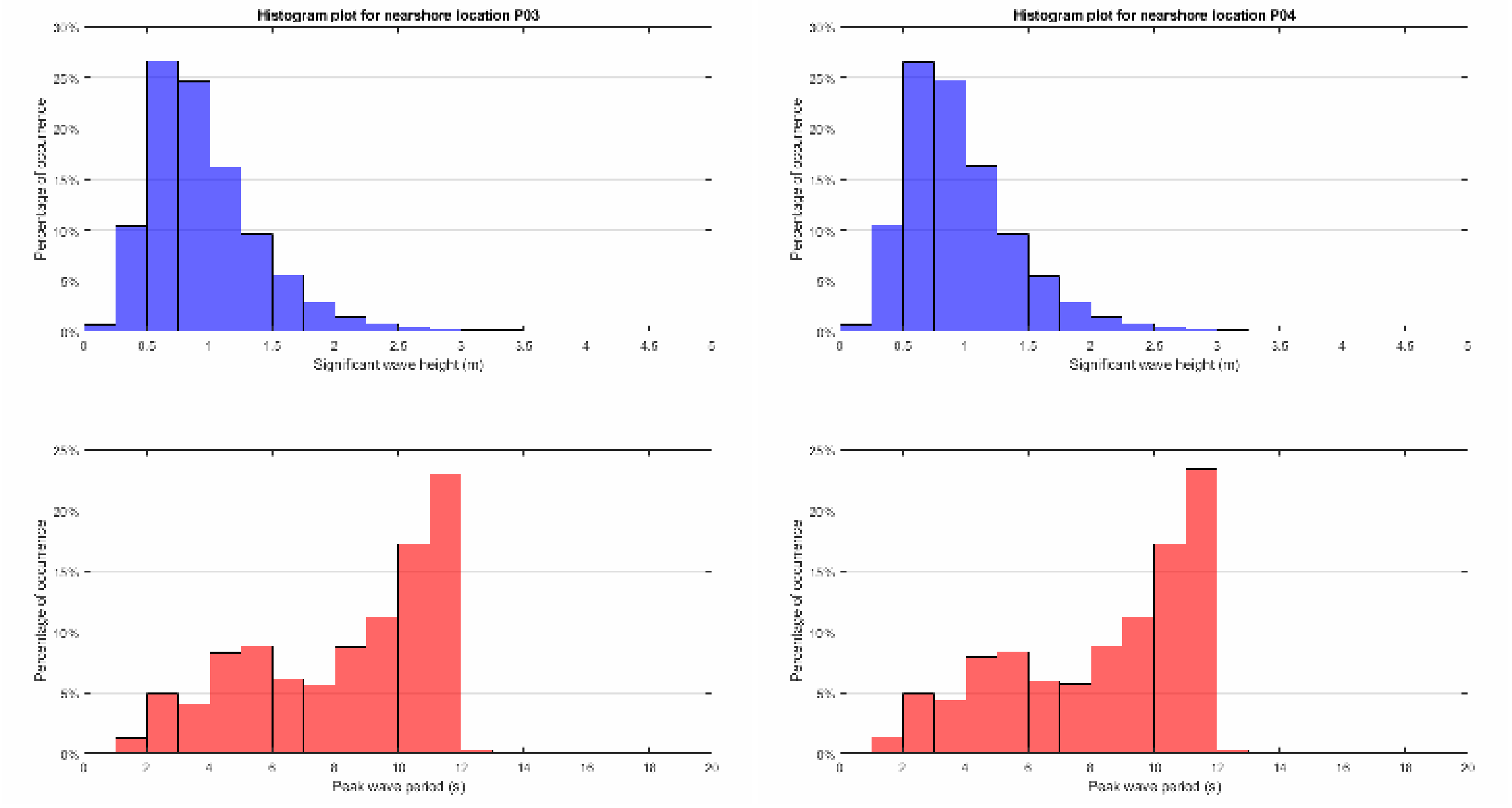

Figure B-54 Histograms of significant wave height (top) and peak wave period (bottom). P03 histograms (left) and P04 histograms (right)

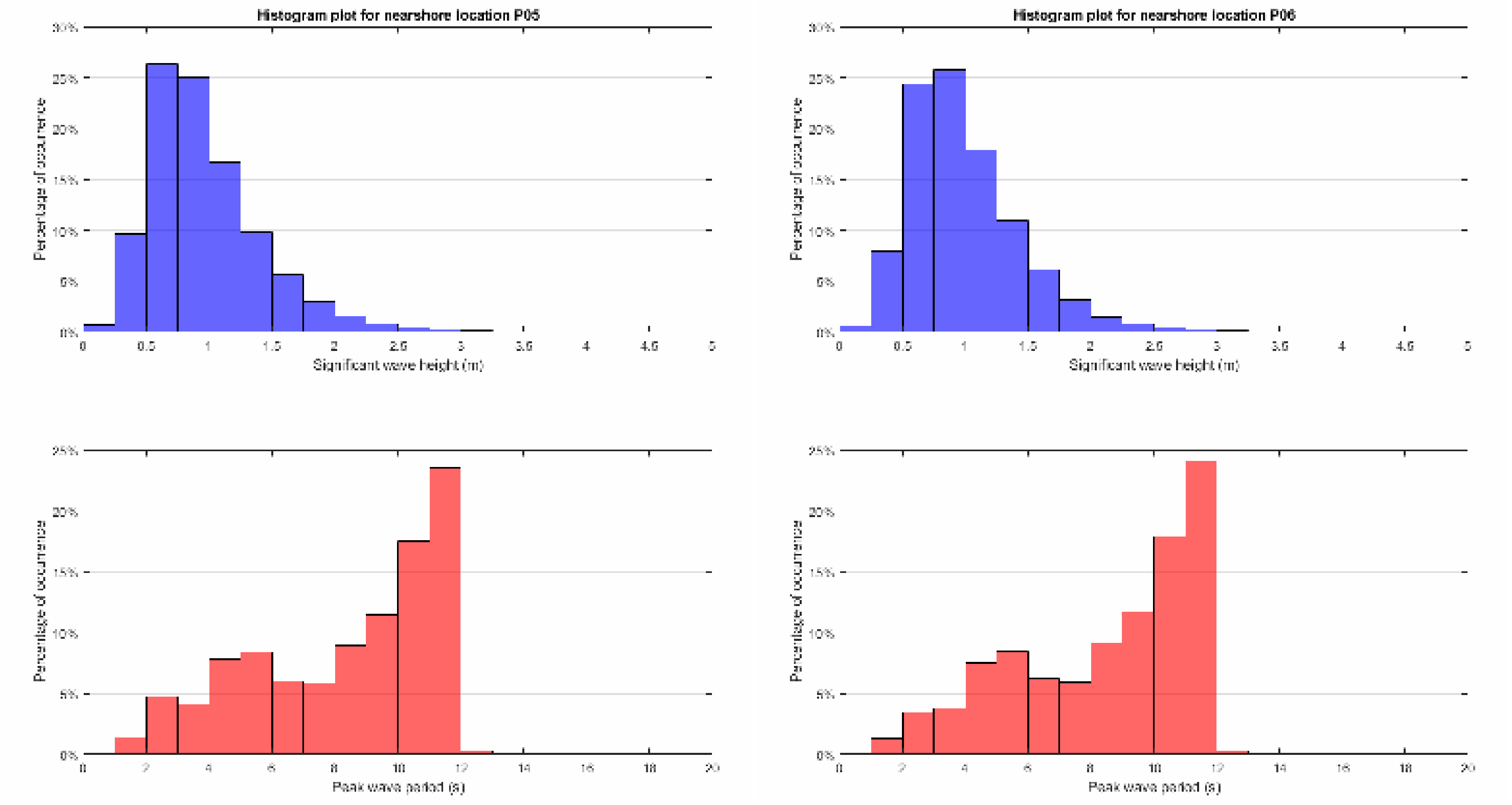

Figure B-55 Histograms of significant wave height (top) and peak wave period (bottom). P05 histograms (left) and P06 histograms (right)

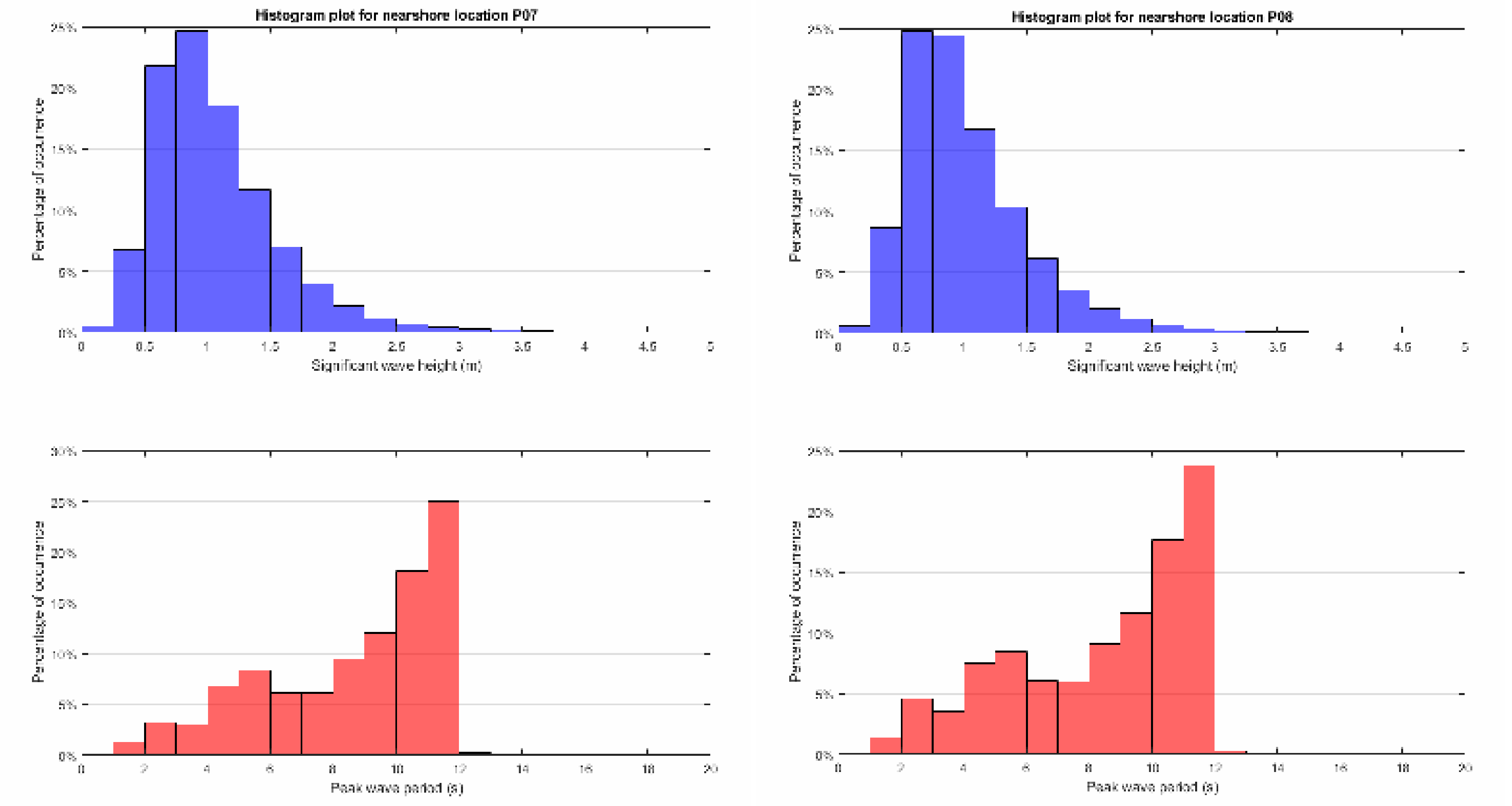

Figure B-56 Histograms of significant wave height (top) and peak wave period (bottom). P07 histograms (left) and P08 histograms (right)

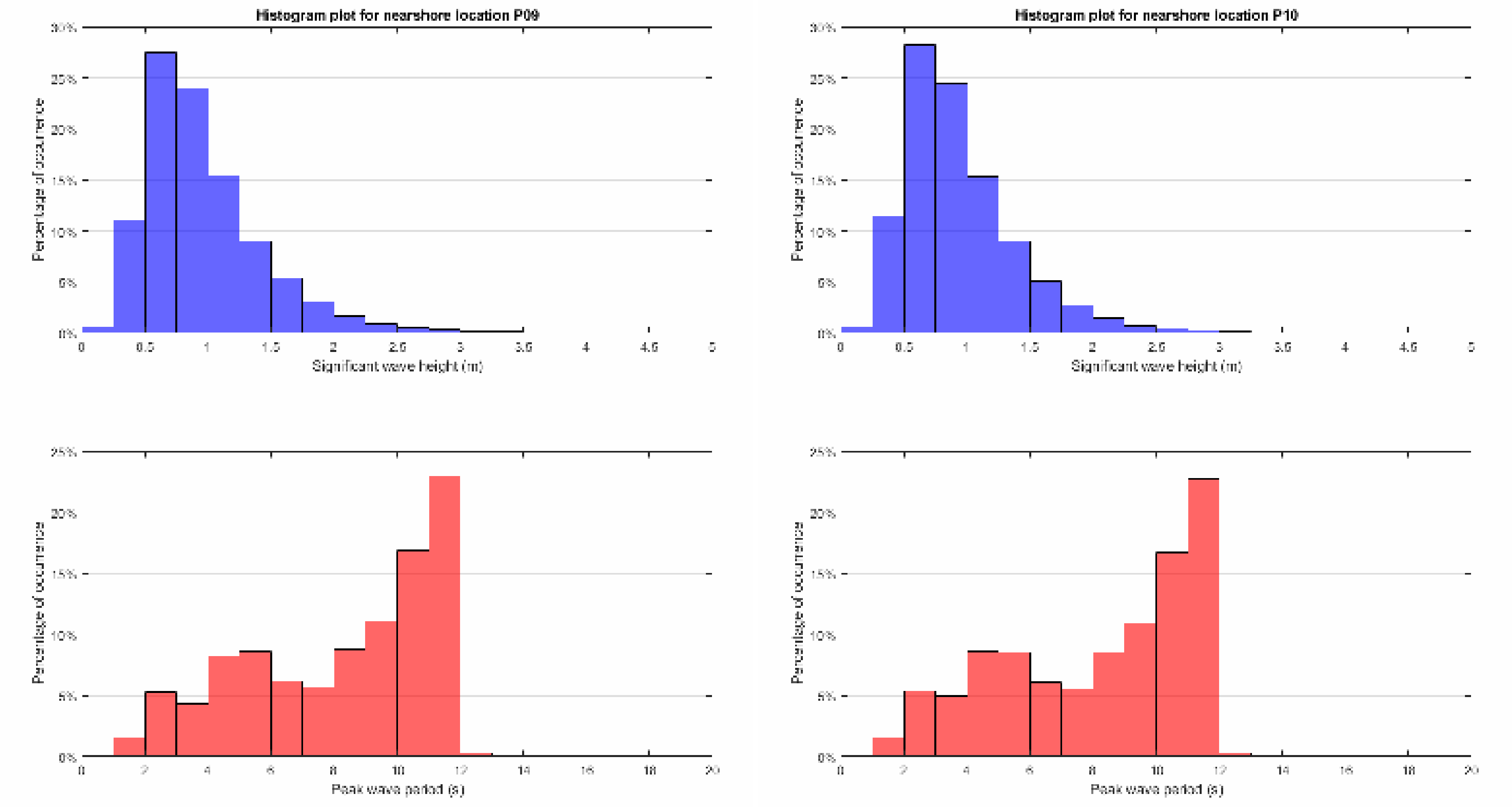

Figure B-57 Histograms of significant wave height (top) and peak wave period (bottom). P09 histograms (left) and P10 histograms (right)

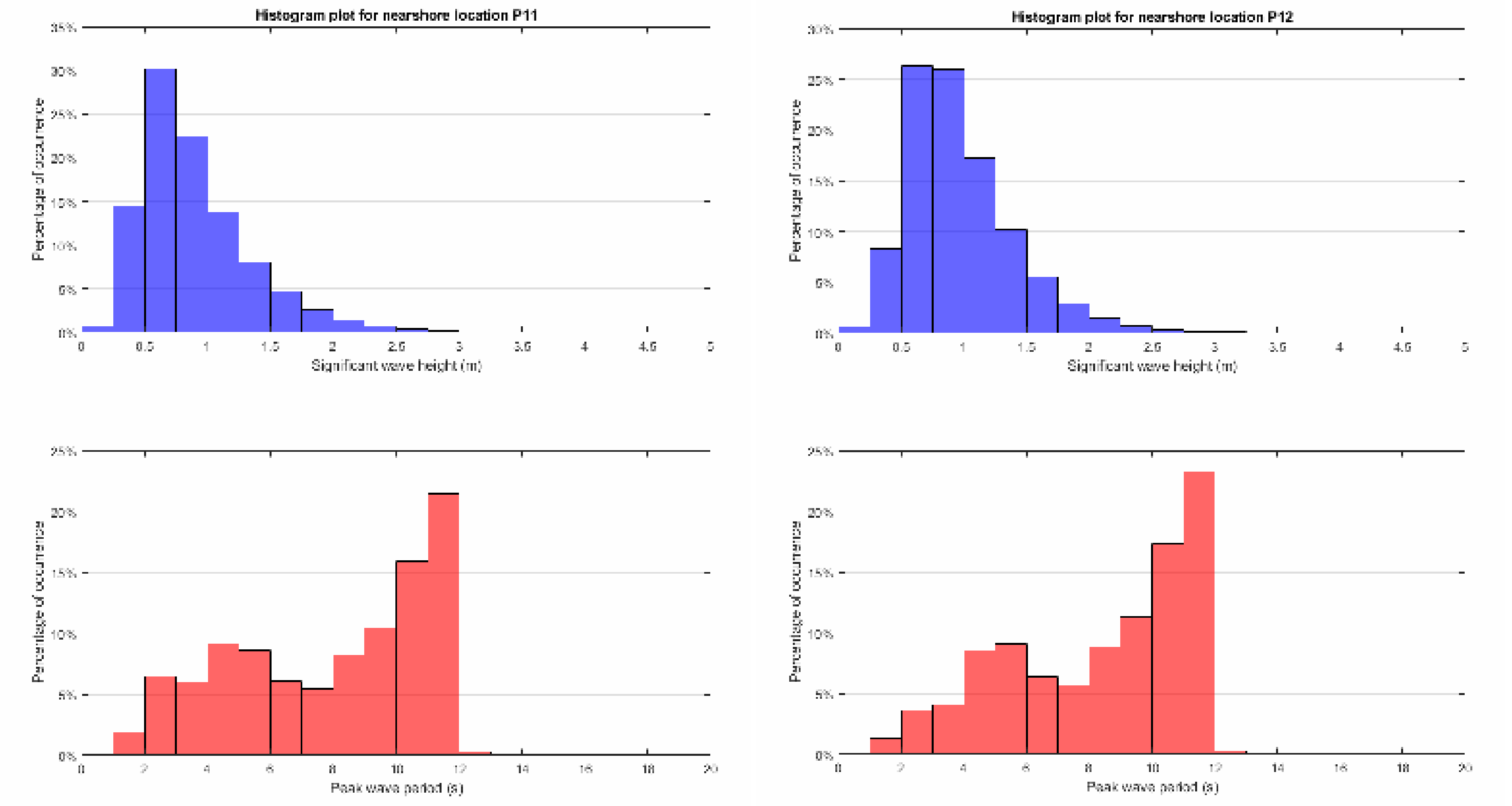

Figure B-58 Histograms of significant wave height (top) and peak wave period (bottom). P11 histograms (left) and P12 histograms (right)

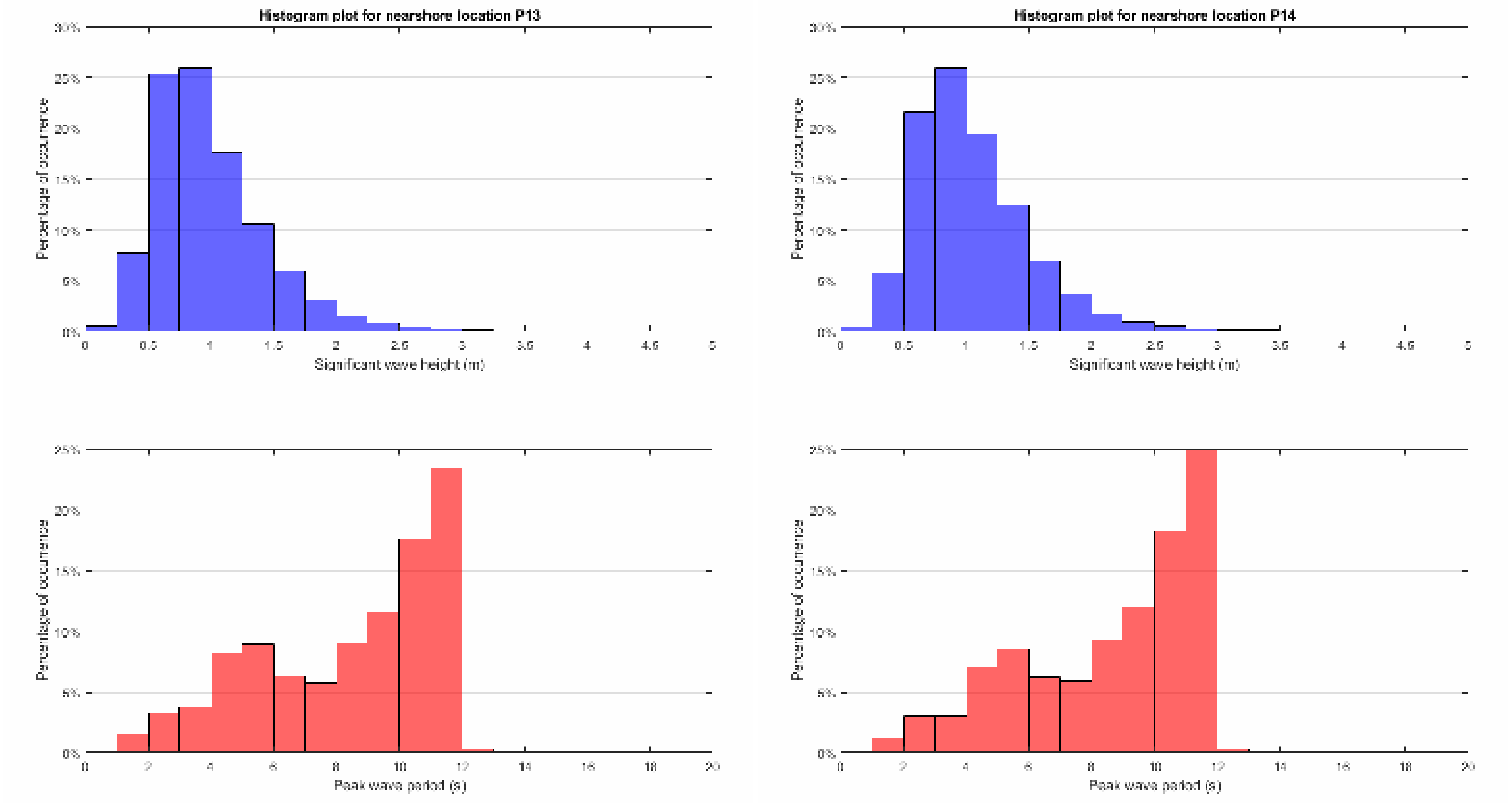

Figure B-59 Histograms of significant wave height (top) and peak wave period (bottom). P13 histograms (left) and P14 histograms (right)

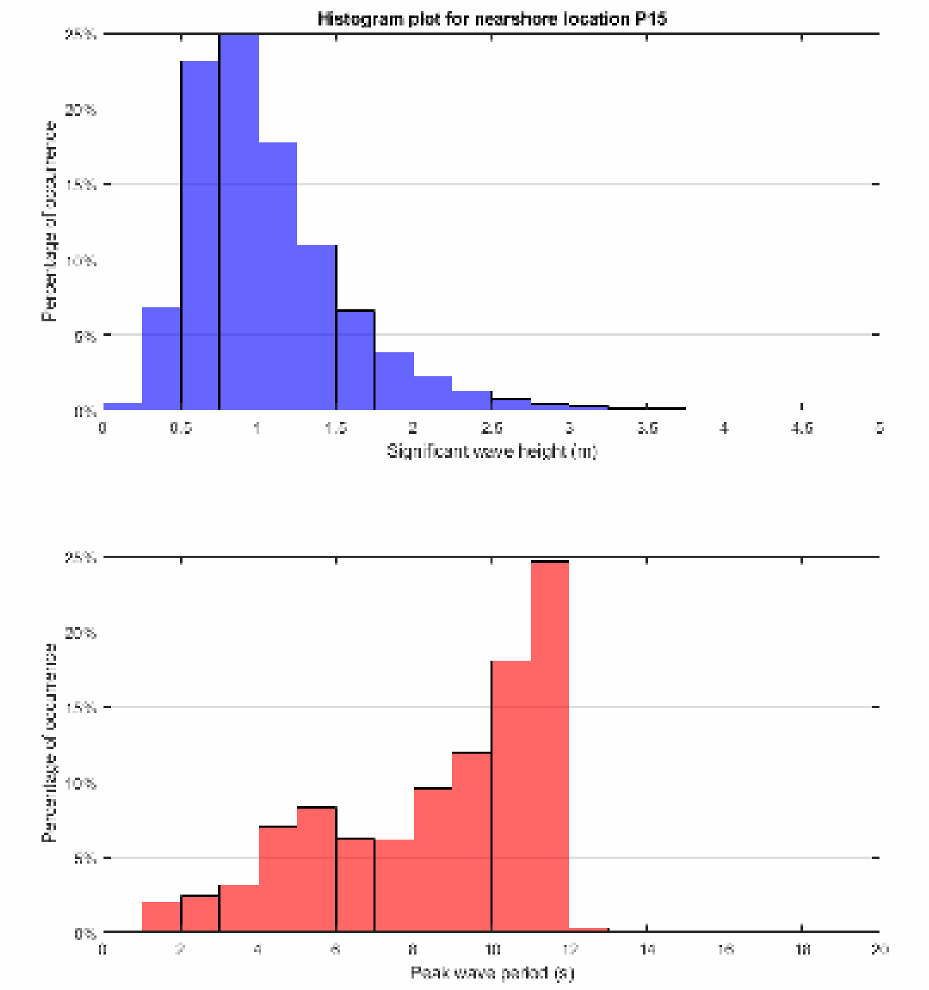

Figure B-60 Histograms of significant wave height (top) and peak wave period (bottom). P15 histograms (left) and P16 histograms (right)

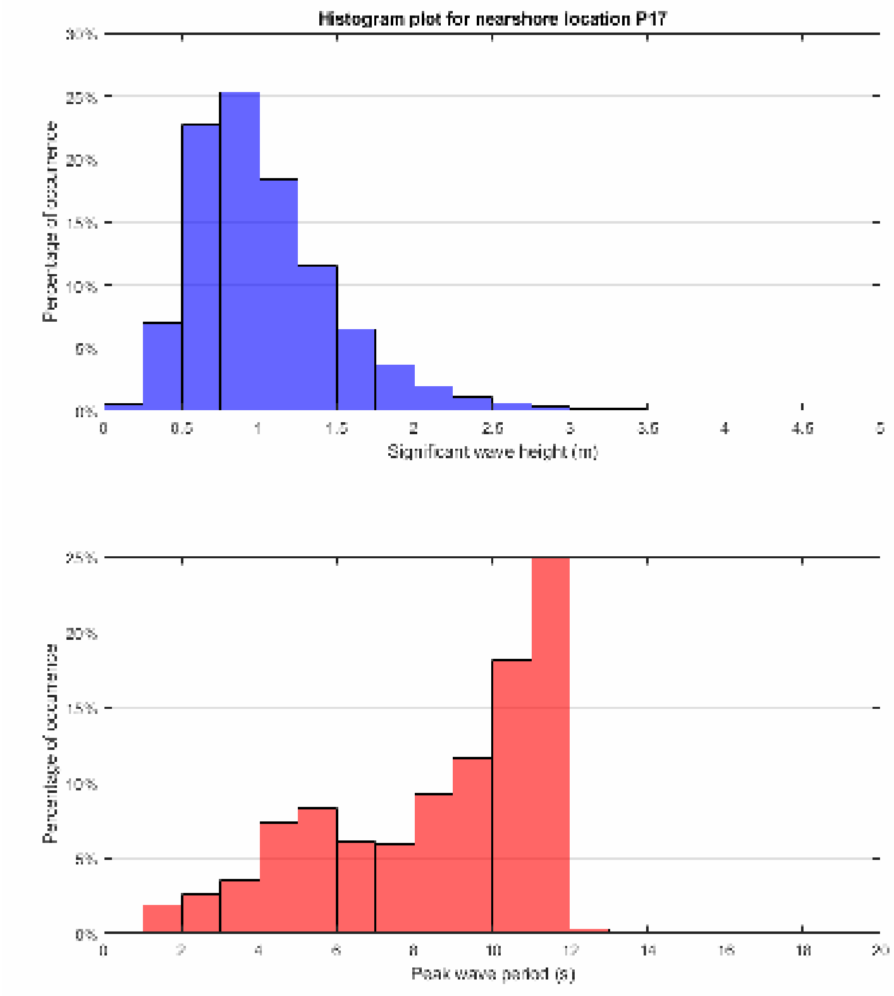

Figure B-61 Histograms of significant wave height (top) and peak wave period (bottom). P17 histograms (left) and P18 histograms (right)

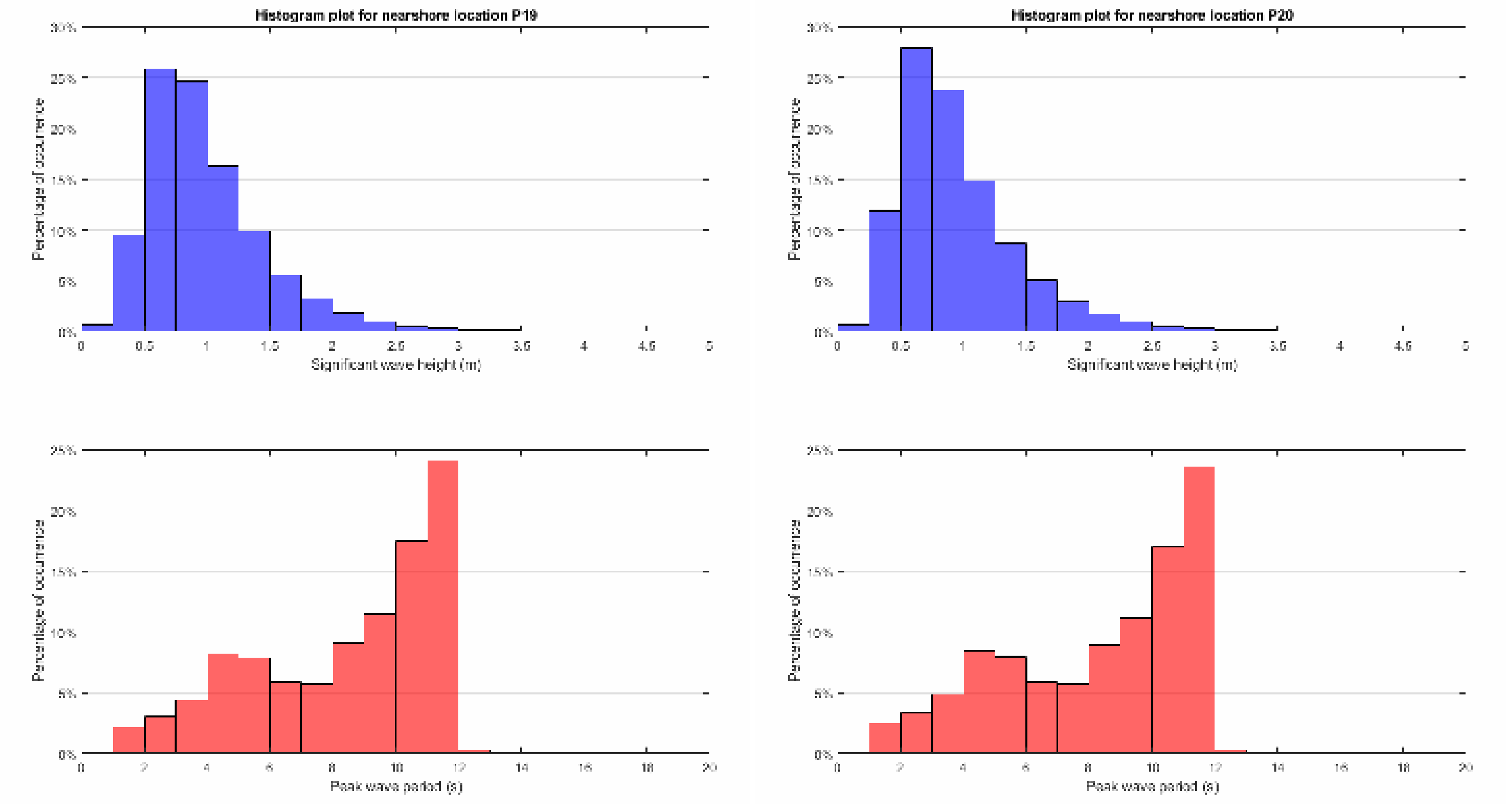

Figure B-62 Histograms of significant wave height (top) and peak wave period (bottom). P19 histograms (left) and P20 histograms (right)

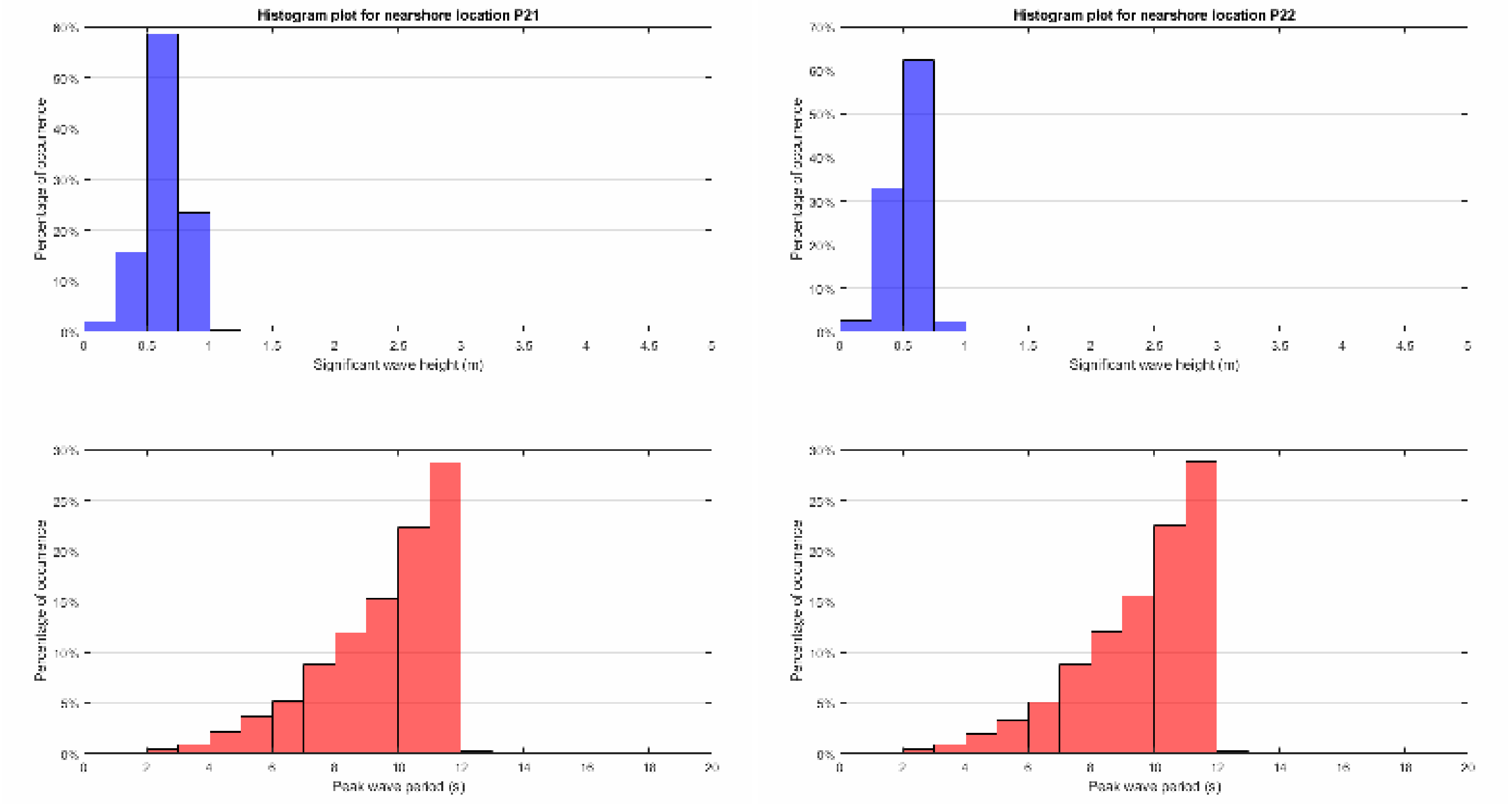

Figure B-63 Histograms of significant wave height (top) and peak wave period (bottom). P21 histograms (left) and P22 histograms (right)

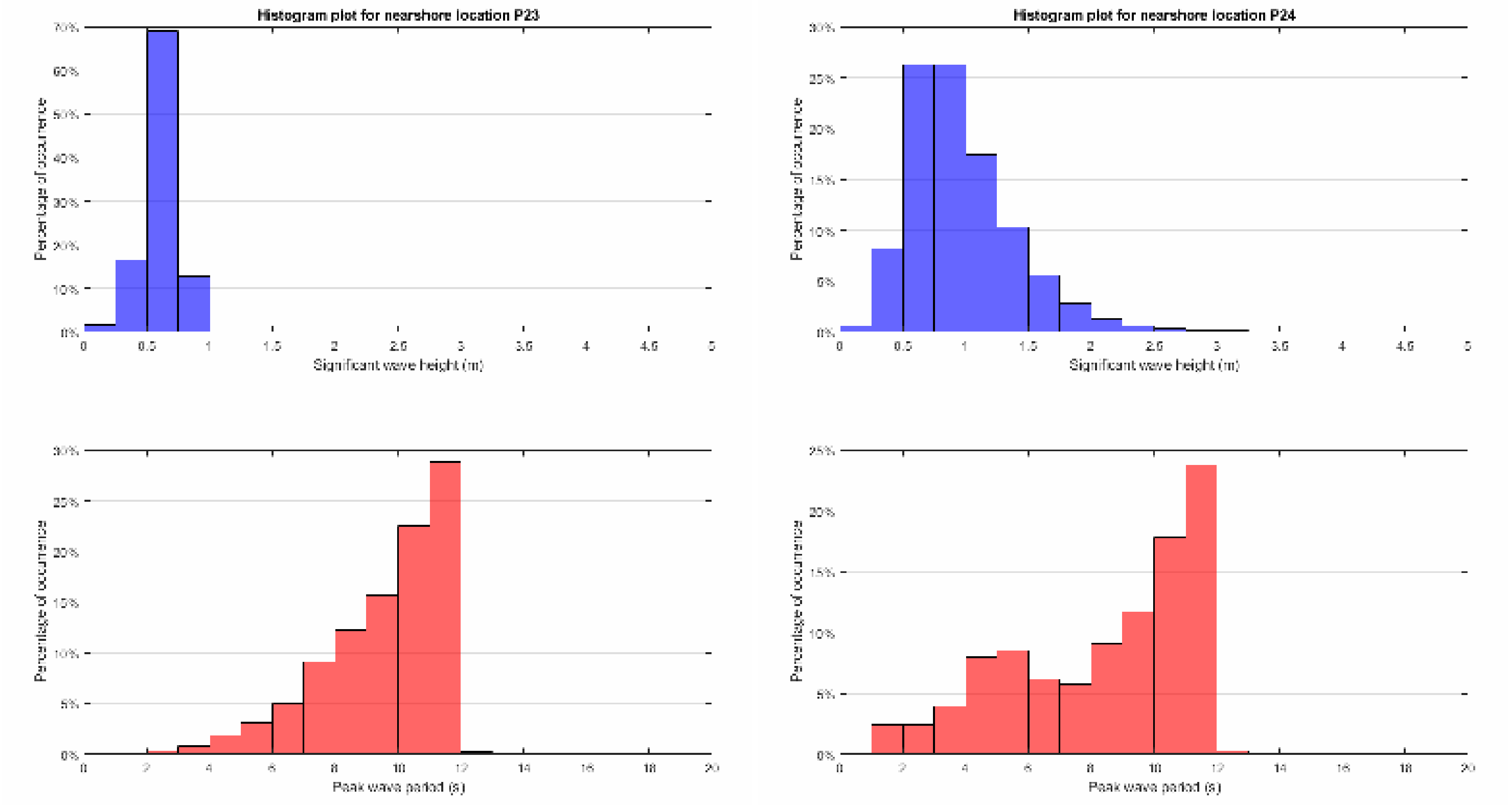

Figure B-64 Histograms of significant wave height (top) and peak wave period (bottom). P23 histograms (left) and P24 histograms (right)

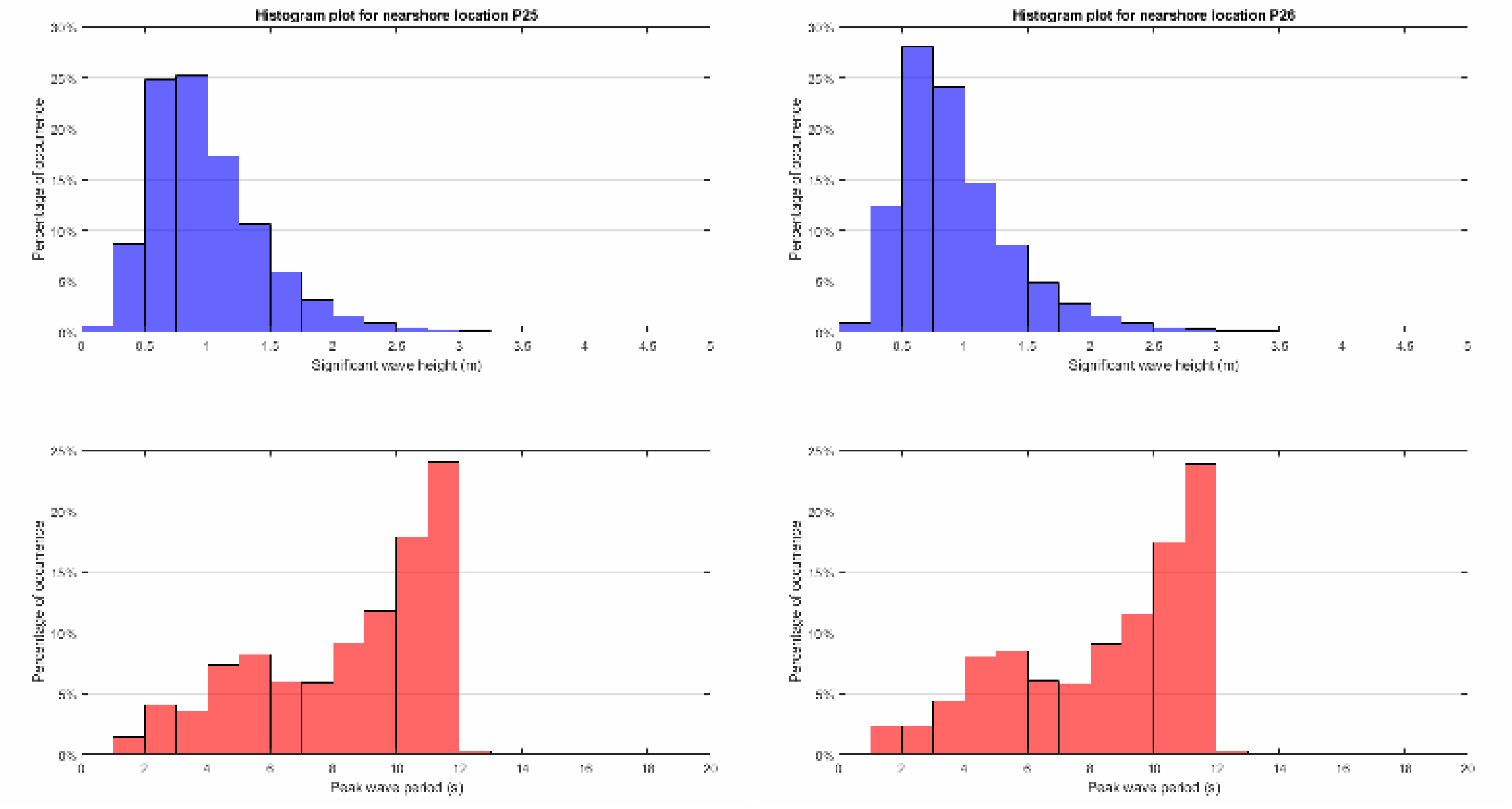

Figure B-65 Histograms of significant wave height (top) and peak wave period (bottom). P25 histograms (left) and P26 histograms (right)

Appendix C
UNIBEST-CL+ Modelling Software Description

The coastal evolution modelling software used in this study is UNIBEST-CL+. UNIBEST is a software package developed by Deltares capable of simulating longshore and cross-shore processes and related morphodynamics of beach profiles and coastline evolution. It constitutes a powerful coastal engineering tool to be used in coastal erosion control and coastal management.

The UNIBEST software suite consists of three separate modules:

- UNIBEST-TC: Designed for the computation of cross-shore transport and resulting beach changes induced by waves, tidal currents and wind;
- UNIBEST-DE: Designed for the computation of dune erosion during storm conditions; and
- UNIBEST-CL+: Designed for the simulation of coastline changes due to longshore sediment transport gradients. The longshore transports are induced by tide and wave driven longshore currents.

UNIBEST-CL+ consists of two integrated sub-modules:

- The Longshore Transport module (LT-module) is designed to compute tide- and wave-induced longshore currents and sediment transports on an alongshore uniform beach with an arbitrary profile.

  The surf zone dynamics are derived from a built-in random wave propagation and decay model that transforms the offshore wave data to the coast.

  The computational procedure takes any pre-defined wave climate and tidal regime in order to assess gross and yearly longshore transport, seasonal variation and storm events.
- The Coastline module (CL-module) is designed to simulate the coastline changes due to longshore sediment transport gradients of an alongshore nearly uniform coast on the basis of the single line theory.

The CL-module is capable of modelling the morphologic effects of various coastal situations:

- Sediment sources and sinks;
- Headlands;
- Coastal revetments and sea walls;
- Groynes and breakwaters;
- Offshore breakwaters;
- Artificial sand by-pass; and
- Beach nourishments.

St. Francis Bay Beach Long-Term Coastal Protection Phase 2

Preliminary Design Report

22/02/2018

31 Allen Drive
Loevenstein
Cape Town 7530
South Africa

C00729--01-PMT-PRE-0001

www.advisian.com

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WorleyParsons Group

Synopsis

This report documents the preliminary design undertaken as part of the St. Francis Bay Beach Long-Term Coastal Protection Phase 2 project.

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Project No: C00729--01-PMT-PRE-0001 – St. Francis Bay Beach Long-Term Coastal Protection Phase 2: Preliminary Design Report

Rev	Description	Author	Review	Advisian Approval	Date
00	Draft Report	SR/ GR	FS	GM	18/01/08
01	Final Report	GR	FS	GM	18/02/22

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Appendix List

Executive Summary

The sandy beach at St. Francis Bay has suffered from significant erosion events over the past few decades. This has effectively reduced the beach width and impacted on the recreational amenity of the area, as well as threatened backshore infrastructure. The 700 m long unprotected spit area has suffered even more aggressive erosion, with consequent loss of considerable sand material in the dune, and may be subject to a breach if not provided with some level of protection.

In 2014 WorleyParsons undertook a review of various studies and interventions undertaken in the past and compiled an updated review report, inclusive of indicative cost and time lines for possible remedial solutions to the erosion problem. During 2015 PRDW produced a design report for the maintenance and upgrade of rock revetments to protect ten privately owned properties and a design report for the maintenance and upgrade of the rest of the St Francis Bay shoreline.

Environmental authorisation was received during 2016 for the maintenance and upgrade of existing rock revetments and sandy beach backshore areas at Erven 720, 623, 2257, 185, 53, 184 and 625 along the coastline. This work was undertaken as Phase 1 of a 2-Phased approach to protect the coastline.

Advisian have been appointed by the St Francis Property Owners (SFPO) for the design and construction supervision of the second phase of the long term coastal protection and sand retention structures for St Francis Bay.

This preliminary design report presents

- An analysis of the available data, in particular beach surveys, to be considered in the design;
- The Phase 2 design basis;
- Wave, cross-shore transport and long-term shoreline modelling undertaken to assist in schemes assessments;
- The conceptual schemes developed for consideration;
- The preferred scheme as agreed by the SFPO and all other participants in the workshop held on 29/11/2017;
- The preliminary design of the preferred scheme, including plan layout and cross-sections;
- The cost estimate for the preferred scheme; and
- Scheme phasing options so as to align with the preferred approach of the SFPO.

Site Characterization

Bathymetry

Limited bathymetric data was available during the preliminary design stage. Based on the available data, the nearshore sea bed slope (200 to 300m from the coastline) varies between approximately between 1 in 40 and 1 in 70.

Beach Profiles

The St Francis Bay beach had been surveyed fairly often over the last 20 years. Survey data 2006 to 2017 were made available and analysed. The short term back and forth movement of beach over the last 10 years is approximately 15 m. The long term shoreline retreat is along the mid- and northern stretch of coastline is between 1.5 to 3.0 m per year. Along the southern end of the beach, slow long term rate of accretion is observed.

Water levels

The tidal planes provided at Port Elizabeth were adopted in the design. The storm surge was estimated by calculating the residual water levels from the hourly tidal measurements at Port Elizabeth and undertaking an extreme value analysis. Sea level rise (SLR) over the 50 year design life is 0.26 m. The extreme design water level, adopted for the coastal structures is 2.92 m CD, which is the sum of Mean High Water Spring, 100 year ARI storm surge and SLR.

Offshore Winds and Waves

Offshore wind and wave data was sourced from the National Centers for Environmental Prediction (NCEP) WaveWatch III (WW3) global model and the NCEP Global Data Assimilation System (GDAS) Climate Forecast System Reanalysis (CFSR).

The principal wave direction at the offshore data points is from the southwestern sector with an approximate occurrence of around 60% of the time. The maximum significant wave height is between 11 and 12 m with an associated peak wave period ranging between 12 and 19 s. The average significant wave height is about 3.5 m and the average peak wave period is around 11 s

The offshore wind and wave data sets are presented as annual wind and wave 'roses' with their associated frequency tables in Appendix B.

Coastal Processes Modelling

Wave Modelling

Offshore waves were transformed to nearshore using the Delft3D modelling suite. The dominant wave direction along the shoreline is from the south and south-east with a smaller component approaching the shoreline from the east. The average significant wave height, estimated over the last 17 years at -10 m CD, is around 1 m. The maximum significant wave height in the simulated time series along the -10 m CD depth contour is 4.5 m.

An extreme value analysis (EVA) was undertaken for the data sets to determine the extreme wave conditions for various average return intervals (ARI) at -10 m CD. However, the design wave conditions were based on depth limited conditions and shown in section 4.1.4.

Storm Induced Beach Erosion

The short term storm induced erosion for established extreme events were estimated with SBEACH software. The input beach profile was based on the present characteristics of the beach.

If SLR is not considered, the estimated recession of the beach crest (+3.8 m CD) ranges between 5 and 15 m. However, with SLR over 50 years, the recession increases to between 15 and 25 m with over wash of sediment reaching almost 40 m landward.

Long Term Shoreline Modelling

A shoreline evolution assessment was undertaken with UNIBEST modelling software to

- derive the initial changes in the shoreline position due to the estimated annual nearshore wave conditions in combination with the existing rock revetments, and
- to test shoreline response to the preferred option (Section 6) for the long term coastal protection and sand retention structures.

The model was calibrated to sufficiently represent the historical shoreline changes due to i) the reduction of available sand supply (damming of the Kromme River and stabilization of Santereme dunes) over the past decades and ii) the effect of the constructed rock revetments.

Conceptual Options

The following three options from the WorleyParsons 2014 report were selected by the SFPO for further investigation during the project inception are presented in Section 5 (also illustrated in the figure below):

1. Beach nourishment

The net long term coastline retreat was found to be relatively gradual over most of the coastal frontage (approx. 1m-3m/year). Based on international experience an intervention of beach nourishment to restore the historical wider beach would be considered a feasible solution. This option, which obviates the incorporation of coastal structures, is the least aesthetically intrusive and would have minimal environmental impacts if properly implemented. In order for this solution to be successfully executed, adequate large scale initial "capital" nourishment will be required with regular beach maintenance to maintain the beach width.

2. Beach Nourishment +Groynes

This option consists of 300m long groynes crossing the surfzone and extending to approximately -4 m CD. Shore perpendicular groyne structures are mainly used when the wave direction is oblique to the shoreline and where sediment transport is longshore dominant. Further, rip currents induced near the groynes may remove sediment from the littoral drift zone. These structures would require a large volume of rock and would require additional site investigations such as physical modelling to verify their adequacy and stability. This solution is not considered to be suitable for St Francis Bay's coastline.

3. Beach Nourishment + Offshore Breakwaters

Offshore breakwater structures would provide a high level of coastal protection and retention of sediment on the beaches. It would however require large and costly structures which would be environmentally intrusive and have a negative aesthetic impact on the coastline. Additionally it would require further site investigations and physical modelling to confirm the stability of the structures. This option would require a significant volume of sediment and would be complex to construct due to the need for offshore marine equipment. While this option is considered to be excellent for coastal protection, financial constraints of the community and the long construction duration makes this option less favourable.

The feasibility, advantages and disadvantages of each of the options are discussed in Section 5.

Two permutations of the beach nourishment option 1 were developed using smaller scale and modified groyne arrangements in order to reduce the ongoing beach maintenance requirement. These options were based on a coastal headland approach and are illustrated in the figure below.

Option 1A

This option provides rock groynes with similar overall length to Option 2, however, the groynes are angled obliquely to the predominant wave direction. The structures therefore terminate in shallower water than Option 2 (at approximately -3 m CD) and are expected to allow some sediment to bypass the cells. By terminating in shallower water the headland groynes have less volume and are therefore less costly and intrusive than the groyne option. They are also expected to have some advantages in retaining sediment in key areas of the frontage.

Option 1B

The second option consists of much shorter stub groynes which terminate at an approximate depth of -2 m CD or shallower. More sediment would bypass Option 1B than Option 1A however the groynes should require less material and have a shorter construction duration than Option 1A.

Option 1B is considered to be more suitable than Option 1A as it is less costly, could be implemented more easily in a phased approach, would require shorter construction duration and is less environmentally intrusive.

It is noted that the shoreline configurations depicted for Option 1A and Option 1B are purely conceptual, based on engineering judgement and not coastal modelling. Although shoreline configurations of the selected option can be somewhat better assessed in the detailed design phase, there are limitations in the numerical and empirical modelling of such solutions. If such options are adopted there is benefit in phasing the implementation to effectively test effectiveness of an initial structure in prototype.

Preferred Option

The options were presented during a Workshop meeting held on 29th November 2017. The preferred option as derived from the workshop was Beach Nourishment with Stub Groynes – Option 1B:

- Relatively short groynes allowing a percentage of sediment to pass
- Staged implementation of this solution was required due to financial constraints and the effectiveness of the solution will be evaluated.

Preliminary Design

The concept layout of the preferred option (Option 1B above) was further developed during the preliminary design. Coastal modelling demonstrated that the southernmost groyne of the second stage was not deemed beneficial, hence this structure was removed. The effectiveness of this solution would need to be monitored during the implementation of the various stages and the need for modification to the design would need to be re-evaluated.

General Layout

Five (5) groynes will be constructed from the back of the beach to a depth of -2 m CD. The groynes reach a length of between 170 m to 200 m offshore. Preliminary Design Drawings are included in Appendix A.

Beach Nourishment Profile

The design nourishment beach characteristics are as follows:

- dry beach width of 40 m;
- crest level of +3.8 m CD (+3.0 m MSL);
- upper beach slope of 1 in 20; and
- sub-aqueous beach profile based on an equilibrium beach profile (Dean, 1991)

Where appropriate the shoreline will be nourished in between the rock groynes (Section 6 and Appendix A).

Rock Groynes

The preliminary design plan layout and cross sections of the rock groynes are included Appendix A. Four (4) non-standard rock gradings are adopted long the length of the groyne.

Cost Estimate

The estimated cost for the completed solution was estimated to be R 89 million based on rates for locally sourced rock material.

Construction Duration

The construction duration for the completed project is estimated to be 23 months.

Way Forward

Typical cross-sections were developed based on the available information with the purpose of providing information for costing. The sections will be further developed in the detailed design stage based on:

- Material availability;
- Constructability;
- High resolution bathymetry data, if required.

Way forward:

1. Confirm available rock gradings from local quarry and modify design accordingly
2. Undertake bathymetric survey, if required (not currently in scope of works)
3. Update wave modelling
4. Detail rock Groynes based on existing topography / bathymetry
5. Update beach nourishment design based on sand source investigation (to be undertaken by SFPO)
6. Determine beach nourishment volume based on existing topography / bathymetry
7. Produce detailed design drawings

1 Introduction

1.1 Project Location and Background

St. Francis Bay beach lies on the southern shores of the greater St. Francis Bay, stretching between the Cape St. Francis headland in the south and the Kromme river mouth in the north as shown in Figure 1. The sandy beach at St. Francis Bay has suffered from significant erosion events over the past few decades which can be attributed to the stabilisation of large headland bypass dune-fields during the 1970's and 1980's. This has led to a reduction in sediment supply to the beach which resulted in a rapid retreat of the shoreline. The erosion problem was worsened by the construction of Impofu dam upstream of the Kromme river mouth (completed in 1983) which limited the supply of sediments that would be flushed out during floods and deposited on the adjacent beaches.

Figure 1: Locality Map – St. Francis Bay

The continued beach erosion has threatened to undermine beach properties and infrastructure, leading to the placement of rock revetments along much of the beach. Where properly maintained these revetment structures have provided some backshore protection but significant beach erosion has been experienced both in front of these structures and along unprotected areas. The unprotected northern most 700 m of the beach, known as the "Spit area", is backed by a narrow sand dune which has experienced significant erosion over recent years (Anderson, 2008). This is a narrow barrier dune and is in danger of being breached, with potential severe implications for the canal and Marina.

Numerous historic studies have been undertaken to investigate and evaluate the erosion problems and several studies have proposed possible remedial solutions. A time line of historic reports (WorleyParsons, 2014) is shown in Figure 2.

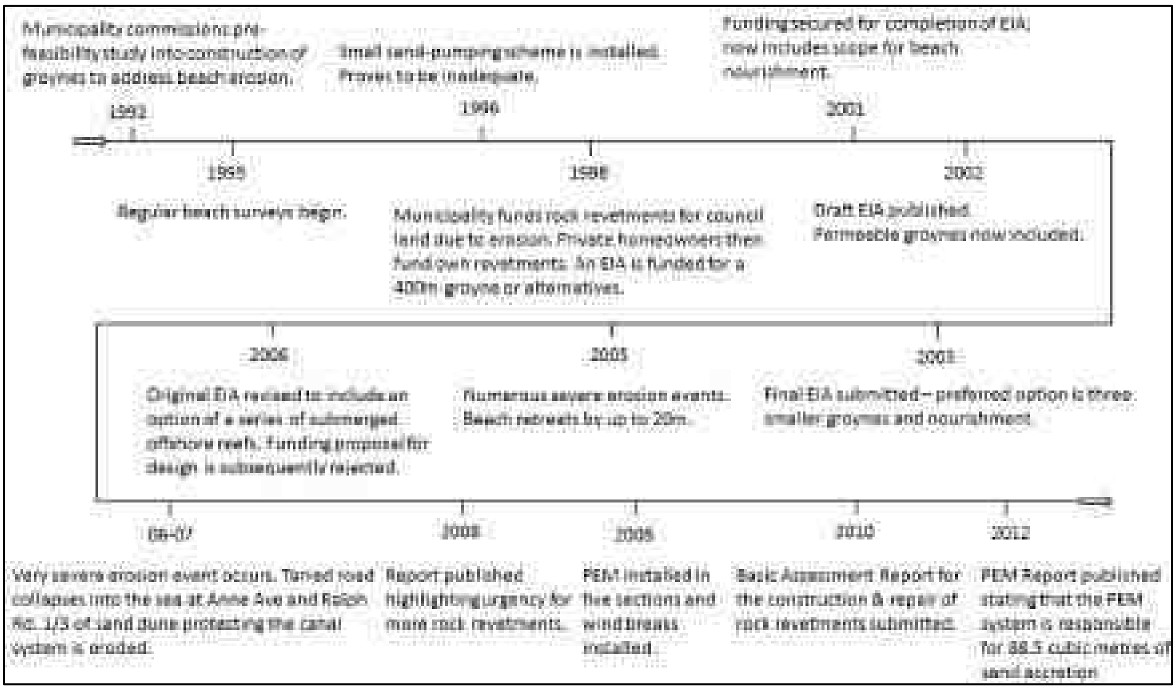

Figure 2: Time-line of St. Francis Bay historic reports

WorleyParsons collated and analysed the previous studies in a status review report in 2014 and proposed several conceptual erosion protection solutions (WorleyParsons, 2014).

PRDW issued a design report for the maintenance and upgrade of rock revetments to protect ten privately owned properties in March 2015, shown in Figure 3 (PRDW, March 2015).

Figure 3: Location of revetment upgrade (PRDW, 2015)

This was followed by a second design report during July 2015 focusing on revetments along the St Francis Bay shoreline, which was divided into 17 sub-areas as shown in Figure 4 (PRDW., July 2015)

Figure 4: Existing shoreline protection along St Francis Bay (PRDW, 2015)

Environmental authorisation was received during 2016 for the maintenance and upgrade of existing rock revetments and sandy beach backshore areas at Erven 720, 623, 2257, 185, 53, 184 and 625 along the St Francis Bay coastline. This work was undertaken as Phase 1 of an envisaged two-phased project to protect the coastline along St Francis.

1.2 Scope of Work (Phase 2)

The purpose of the present Project is the design and construction supervision of Phase 2 of the long term coastal protection and sand retention structures. This Project considers the work undertaken during Phase 1 regarding the upgrade of revetment structures as being completed and will therefore not need to be revisited during Phase 2. This Phase further does not include provision for revetment type shore protection options covering the Spit area.

The project scope of work is outlined below:

i. Provide feasible long-term solutions that will restore beach amenity, that is both time and cost effective:
    a. Present alternative long-term conceptual solutions.
    b. Select the preferred solution during a Workshop, to be further developed during the Preliminary Design;
    c. Detail and optimize the design with a focus on minimizing capital and maintenance costs during the detailed design stage;
ii. Interact with the environmental consultant on the project as required;
iii. Prepare construction drawings and tender documentation;
iv. Identify suitable contractors to undertake the work;
v. Assist during tendering and respond to contractors' queries;
vi. Assess submitted tenders and compile a tender report with recommendation;
vii. Carryout 6 months of construction monitoring during the implementation phase.

This report is related to the first task (Task i) listed in the scope of work and sets out the preliminary design of the scheme to be implemented under Phase 2.

1.3 Report Structure

The report is structured as follows:

Section 2 presents the basis of design for this project, including the design life and design standards utilised in the design. The physical and environmental site characteristics are described in Section 3, which serves as input to the coastal processes modelling presented in Section 4. The modelling comprise wave modelling, storm induced beach erosion modelling and long term shoreline modelling.

Four (4) conceptual layout options are briefly outlined in Section 5. The preliminary design of the preferred option is presented in Section 6 together with the associated estimated costs, material quantities and construction duration.

The report is concluded with recommendations given in Section 7 and followed by the list of references cited throughout the report in Section 8.

2 Basis of Design

2.1 Units

S.I Units are adopted throughout the drawings, calculations and documentation.

2.2 Chart Datum Reference

All levels in maritime works shall be relative to Chart Datum (CD) which is the Lowest Astronomical Tide (LAT) in all ports in South Africa. CD is 0.836 m below the Mean Sea Level (MSL) or Land Levelling Datum (LLD).

2.3 Coordinate System

The coordinate system to be used for all setting out and survey shall be UTM, Zone 34H, spheroid WGS84.

2.4 Design Life

The design life of the structures is 50 years. A design event with a return period of 100 years has been selected for design. This event has a probability of occurrence of approximately 40% during the structure design life.

2.5 Design standards

Marine works and coast protection and should be designed in accordance with the following codes, standards and guidance documents:

2.5.1.1 Standards:

- BS 6349-1:2000. British Standards for Maritime Structures: Part 1 Code of practice for general criteria.
- BS 6349-2: 1988. British Standards for Maritime Structures: Part 2. Design of Quay wall, jetties and dolphins.
- BS EN 1997. Eurocode 7: Geotechnical design.
- BS EN 1992. Eurocode 2: Design of Concrete Structures.
- BS EN 1993. Eurocode 3: Design of Steel Structures.
- BS EN 1998. Eurocode 8: Design of structures for earthquake resistance.
- UK National Annex to BS EN1997- Eurocode 7: Geotechnical design – Part 1: General rules.
- BS EN 13383 Parts 1 and 2 European Armourstone Specification.
- SANS 10160 Basis for structural design

- SANS 10100-1 Structural use of concrete

2.5.1.2 Best Practice Guidelines

- The Rock Manual: the use of rock in hydraulic engineering (2nd edition), C683, CIRIA. London (CIRIA, CUR, CETMEF, 2007).
- Wave overtopping of sea defences and related structures: Assessment Manual. Environment Agency, UK www.overtopping-manual.com (EurOtop, 2007).
- Coastal Engineering Manual, US Army Corps of Engineers, 2003.

3 Site Characterisation

3.1 Bathymetry

Nautical Chart data and beach profile data are available for the St. Francis Bay site. A detailed bathymetric survey study was also undertaken by Mr Dylan Anderson during 2005 as part of his MSc studies. The survey covered a large area of the bay as indicated in Figure 5 below. Despite study team requests this survey was unfortunately not made available.

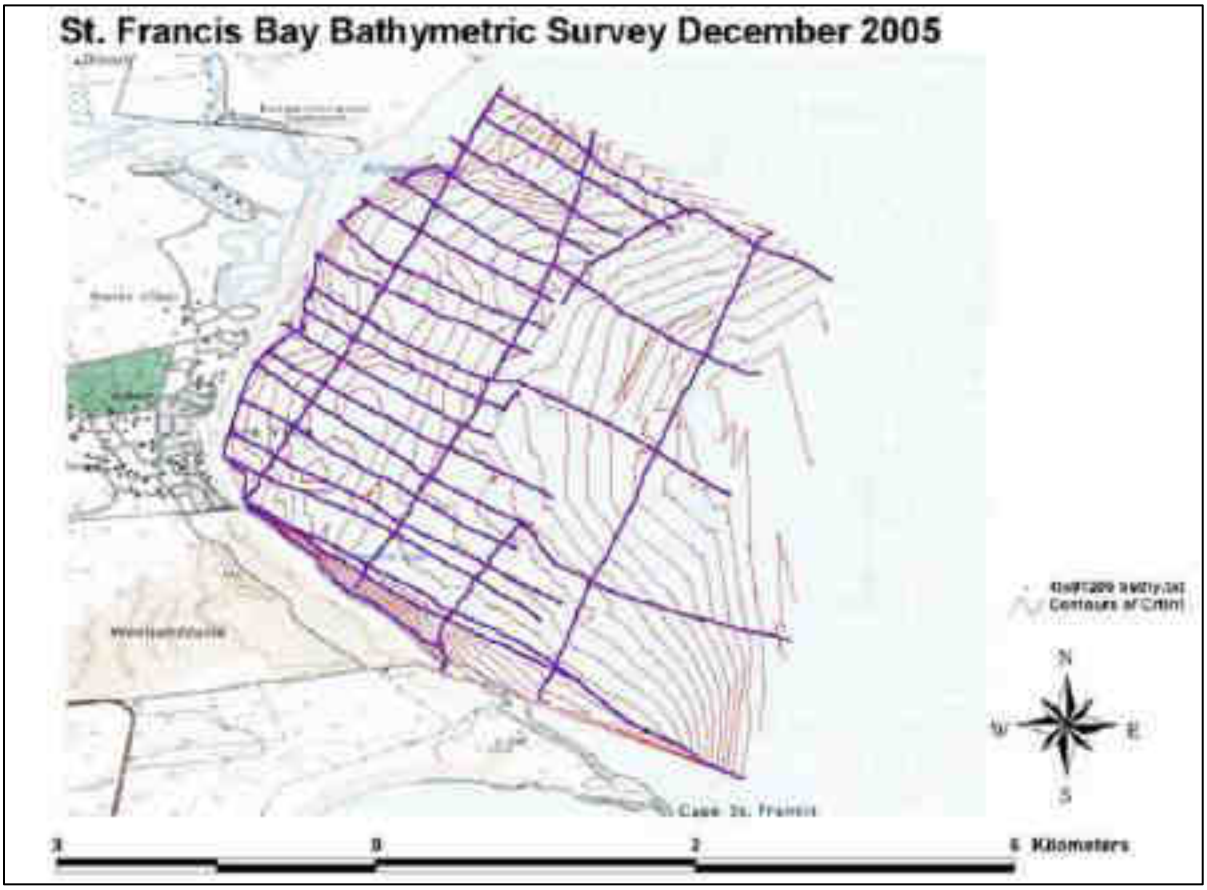

Figure 5: Bathymetric Chart showing the survey run-lines (ASR, 2006).

The nearshore sea bed slope (200 to 300m from the coastline) varies between approximately between 1 in 40 and 1 in 70.

3.2 Beach Profiles

3.2.1 Surveys undertaken

Maarschalk & Partners undertook beach profile surveys from 2006 to 2015 and again in 2017. Table 1 presents the months of the year when surveys were undertaken. The highest frequency of surveys was during 2007 and 2009.

Table 1: Beach Profile Surveys undertaken from 2006 to 2015 and 2017

Month	Year										
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	*2017*
Jan	✓	✓		✓	✓	✓	✓	✓	✓		
Feb		✓									
Mar		✓		✓	✓	✓	✓	✓		✓	
May		✓		✓	✓	✓	✓	✓			
Jun		✓		✓							
July		✓		✓	✓	✓	✓	✓			
Aug		✓	✓	✓		✓	✓				
Sep		✓	✓	✓	✓			✓			✓
Oct	✓	✓		✓				✓			
Nov	✓		✓	✓	✓	✓	✓				
Dec	✓	✓		✓				✓			

A map depicting survey profiles with their associated dates is shown in Figure 6. Surveys undertaken during 2006 and 2007 were not measured along beach profiles, but were scatter point surveys along the beach. This is indicated as light blue shading in Figure 6. The beach was surveyed 13 times during this period.

From 2008 to 2014, a total of 27 beach profiles were surveyed, each profile located at evenly spaced intervals along the shoreline (Figure 6). A total number of 39 surveys were undertaken during this period.

The location and number of beach profiles surveyed in 2015 and in 2017 differed from the previous surveys as indicated in Figure 6. A total number of 10 profiles were surveyed in 2015. The same profiles surveyed in 2015 were again surveyed in 2017 with 11 additional profiles added in-between.

Figure 6: Location of beach surveys

3.2.2 Profile variations over time

Beach profiles were compared to evaluate the fluctuations in the beach profiles over time and establish i) approximate short term variation envelopes for the profiles and ii) any discernible erosion or accretion trends.

The horizontal fluctuation of the 0 m, 0.5 m and 1 m elevation contours relevant to MSL for Profile 26 (north end, close to the spit) is illustrated in Figure 7. Based on the standard deviation of the data, the short term horizontal excursion is in the order of 15 m. Linear trend lines fitted through the data points indicate a long term erosion trend of between 10 m and 20 m over 11 years, thus on average about 1.5 to 2 m per year.

ASR (ASR, 2006) estimated the rate of retreat as between 1.5 and 3 m based on data sets from 1995 to 2005. ASR stated that based on previous studies and aerial photographs, the rate of erosion in recent years is lower than in previous decades (where the majority of rapid erosion took place). This could potentially be due to “a combination of the beach approaching a new equilibrium, with the non-erodible shallow subtidal reefs establishing a controlling effect” (pg. 26, ASR 2006).

The estimated rate of retreat is thus in line with the findings of (ASR, 2006).

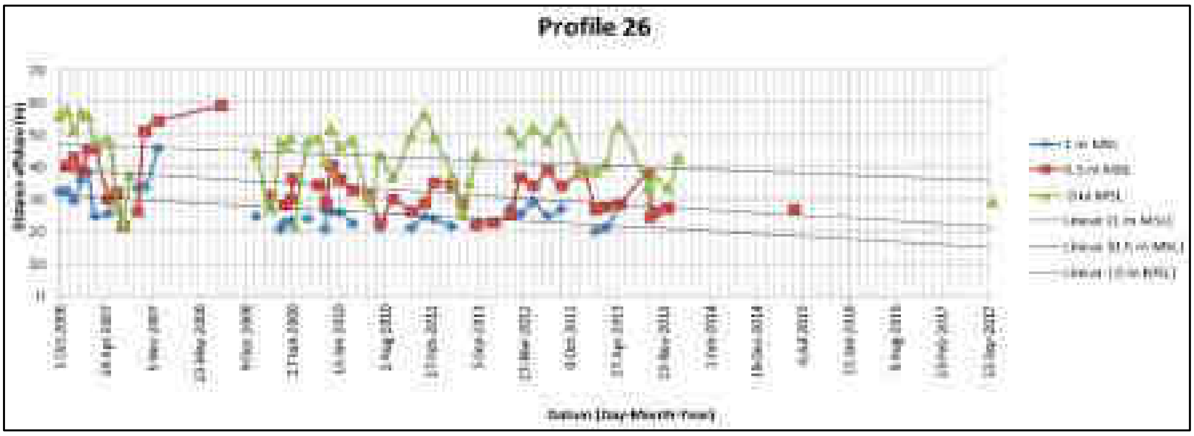

Figure 7: Horizontal movement of elevation contours at Profile 26 from 2006 to 2017.

Along the southern end of the beach at the location of Profile 4, the shore term horizontal movement is also estimated to be around 15 m. Over the long term, the beach accreted about 5 m seaward from 2006 to 2015, thus on average just over half a metre per year (Figure 8). However, the survey taken in 2017 indicates significant erosion between 2015 and 2017, likely the result of one or more significant storm events, which reversed the long term accretion trend.

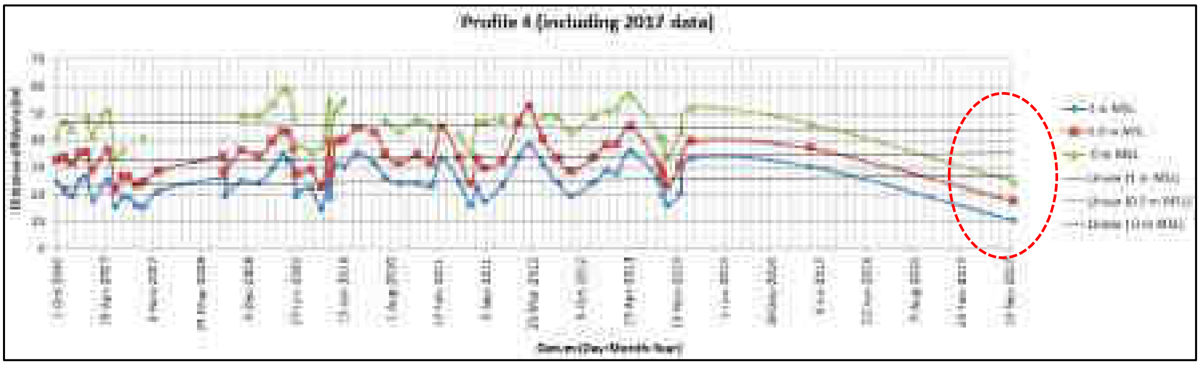

Figure 8: Horizontal movement of elevation contours at Profile 4 from 2006 to 2017

For further beach profiles refer to Appendix E.

3.2.3 Spit retreat

The shoreline evolution in the Spit area is of interest for several reasons, in particular to capture historical beach response in the absence of shore revetments. Several surveys were undertaken by Maarschalk & Partners between 2010 and 2017 to identify the retreat of the toe of the dune along the spit. The retreat was compared with the MHW tidal level of 1975. While a steady retreat is noticeable between 2010 and 2015, it was observed that the northern tip of the spit retreated significantly between 2015 and 2017, as shown in Figure 9.

Figure 9: Spit retreat

It is therefore strongly recommended that shore protection measures, such as the spit protection investigated during Phase 1, be implemented to prevent a breach. Without further study by Advisian it is not possible to provide a recommendation on preferred measures. The solutions provided in this study (Phase 2) would complement the spit protection proposed in Phase 1 but not replace the need for direct shore protection defences to be fully implemented.

3.2.4 Beach profile characteristics

The maximum beach elevation measured along the back of the beach over the last 11 years, occurred mostly along the southern and northern stretches of coastline and varied between +2.5 m and +3.5 m MSL (+3.3 to +4.3 m CD).

The slope of the beach above mean sea level was on average between 1 in 15 and 1 in 20.

3.3 Beach Sand Grain Size

Sediment surveys of the offshore seabed, beach and estuary were undertaken by ASR (2006). It was found that the beach sand and sand in the shallow sub-tidal areas is mostly of similar grain size along the beach. The local bathymetry is also likely to influence the distribution of the sediment in the cross-shore direction, with finer sediments accumulating in the deeper areas according to ASR (2006). According to the (Entech, 2002) sand source report the average median grain size, $D_{50,}$ of the upper beach was found to be 0.18 mm and the lower beach was 0.22 mm.

It is recommended for additional sand source investigations to be undertaken to identify possible variations in grain size at various depths at the potential sand sources.

3.4 Water Levels

3.4.1 Tidal Levels

Tides on the Southern African coasts are regular, semi-diurnal and their range seldom exceeds 2.2m. Tidal planes are provided at the South African ports by the SA Navy Hydrographer (2007). St Francis Bay is situated mid-way between Knysna Port and Port Elizabeth Port. The tidal planes at Port Elizabeth (Table 2) were adopted for this project.

Table 2: Tidal Levels (in meters CD) of Port Elizabeth (The SA Navy Hydrographer, 2017)

Location	LAT	MLWS	MLWN	ML	MHWN	MHWS	HAT
Port Elizabeth	0	0.21	0.79	1.04	1.29	1.86	2.12

Tidal measurements taken at the Port of Elizabeth were obtained from the University of Hawaii Sea Level Centre (UHSLC, 2017). The available hourly average water level dataset covers the period of 15 June 1978 to 31 May 2017. The hourly water levels represent the average of fifteen-minute values taken at 7.5 minutes before and after the hour. Accounting for gaps, the effective dataset length is 32.8 years as presented in Figure 10.

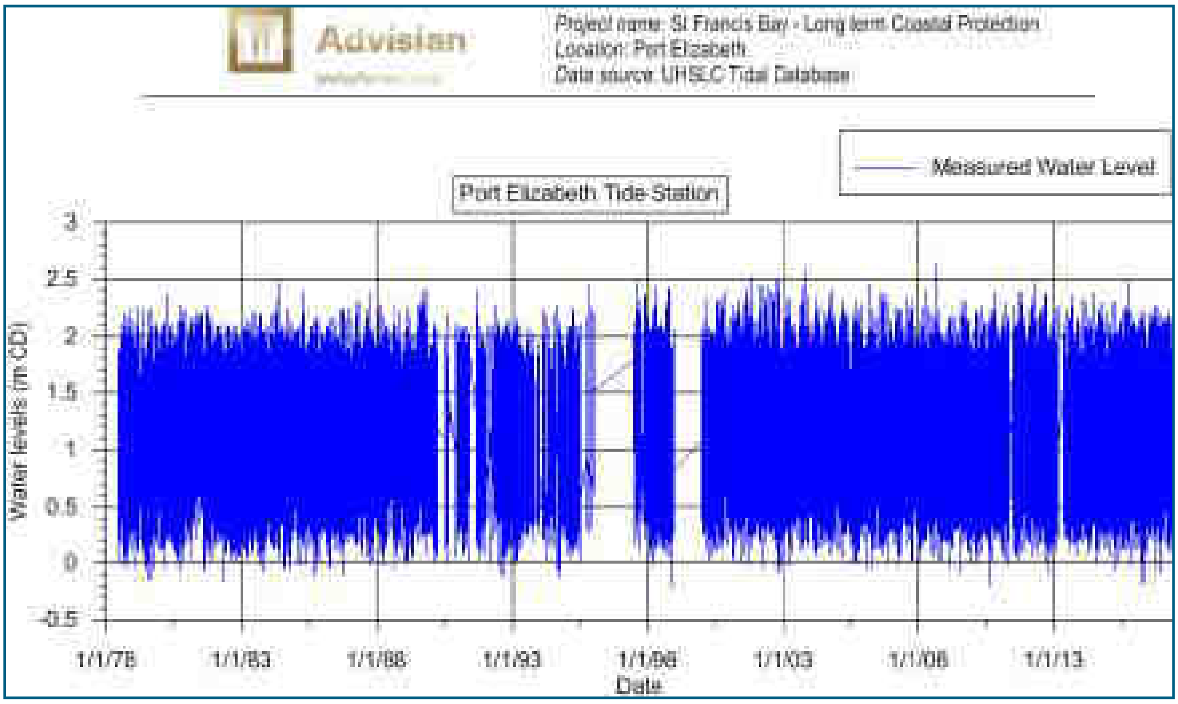

Figure 10: Measured water level at Port Elizabeth. Source: UHSLC (2017)

A tidal analysis was undertaken for the 32.8 years dataset using UTide Matlab Functions (Codiga, 2011), which is suitable for multi-year analysis and can handle the tidal analysis of either sea levels or currents. This analysis provided the tidal constants (amplitude and phase) as well as the predicted water levels based on the derived tidal constituents. The main tidal constituents are provided in the table below:

Table 3: Principal tidal constituents (Judith Bosboom, 2012)

Constituent	Symbol	Period (hours)
Semidiurnal		
Principal lunar	M2	12.42
Principal solar	S2	12.00
Lunar elliptical	N2	12.66
Lunar-solar declinational	K2	11.97
Diurnal		
Lunar-solar declinational	K1	23.93
Principal lunar	O1	25.82
Principal solar	P1	24.07
Lunar elliptical	Q1	26.87

3.4.2 Storm Surge

Storm surge is defined as the influence of meteorological effects such as winds and barometric pressure that result in the actual sea level being above or below the predicted astronomical tide level. The storm surge events have durations of hours to days and can thus be extracted from hourly tidal measurements.

The storm surge at Port Elizabeth was estimated by calculating the residual water levels from the 32.8 years hourly tidal measurements (UHSLC dataset) as the difference between the measured hourly water level and the predicted tide outlined in Section 3.4.1.

The measured, predicted and residual tides are presented in Figure 11. The maximum and minimum residuals determined from Port Elizabeth dataset are +0.76 m and -0.73 m, respectively.

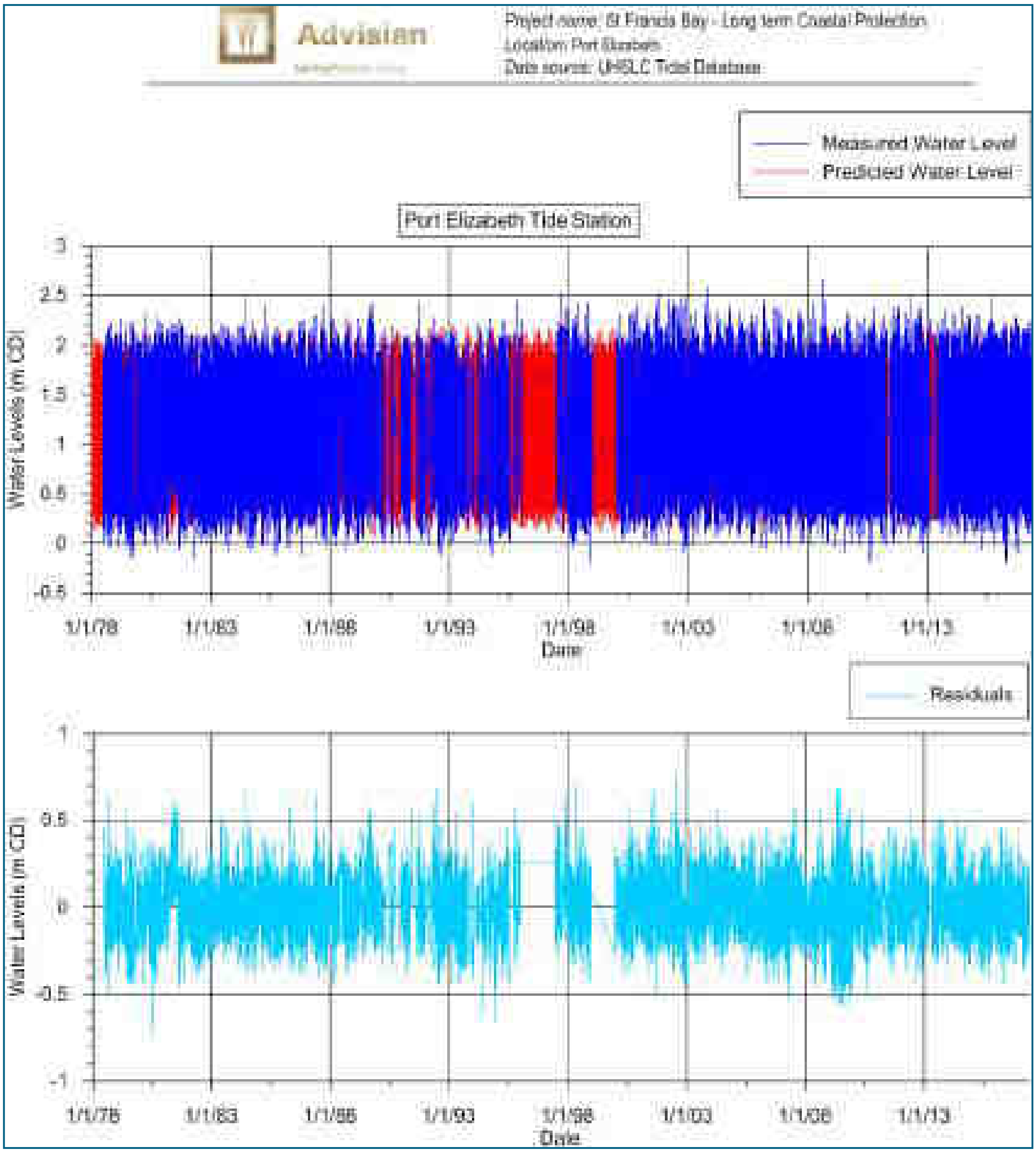

Figure 11: Predicted tide, measured water level and residual water level at Port Elizabeth.

An extreme analysis of the residuals was carried out to estimate the positive storm surge (water level higher than the predicted tide) for 1, 5, 10, 25, 50 and 100 year average return intervals.

The storm surge dataset was analysed to establish extreme estimates for the site by fitting a Weibull distribution to the highest independent values in the data set. In this case, independence was defined as maximum positive storm surge levels being at least three days apart.

The probability plot and extreme water levels resulting from the analysis are provided in Figure 12 and Table 4, respectively.

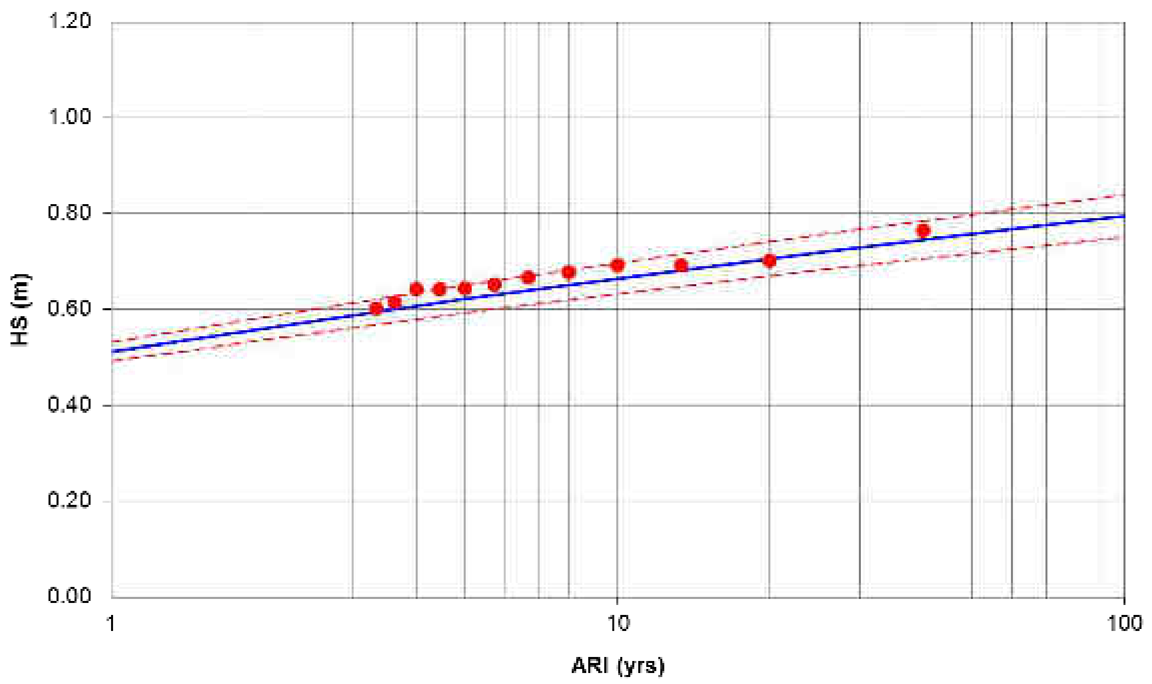

Figure 12: Probability plot of residual water level.

Table 4: Extreme storm surge based on Port Elizabeth tidal levels

ARI (year)	Average Surge	95% Confidence Interval Lower Limit	95% Confidence Interval Upper Limit
1	0.51	0.49	0.53
5	0.62	0.59	0.65
10	0.66	0.63	0.70
25	0.72	0.68	0.76
50	0.76	0.72	0.80
100	0.80	0.75	0.84

3.4.3 Sea Level Rise

Different projections of sea level rise have been made by the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2013). They present estimates for a number of different scenarios that depend on population growth, GDP growth, energy use, land use changes, resource availability and pace and direction of technology.

It is recommended to use the central projection of the RCP4.5 estimate (IPCC, 2013) (illustrated in Figure 13). Assuming the coastal protection solution is implemented in 2018 and has a 50 year design life, this means an increase in mean sea level of approximately 0.26 m by 2068.

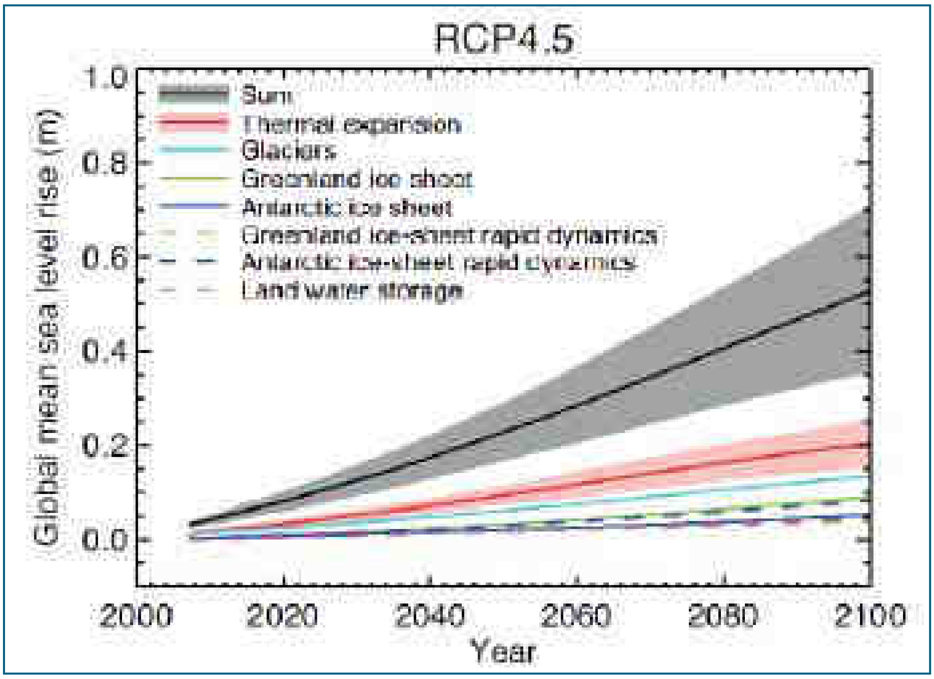

Figure 13: Time series of the projected global mean sea level for scenario RCP4.5 and the contributions made to the global mean sea level by various sources. Source: (IPCC, 2013).

3.4.4 Extreme Water Levels

For the extreme water level, the effects of sea level rise for the 50 year design life of the coastal structures, as well as the storm surge corresponding to the 100 year Average Return Interval (ARI) was superimposed onto the Mean High Water Spring Tide (MHWS).

Table 5: Extreme Water Levels

Parameter	Water level excluding SLR	Water level including SLR
Tide Level (MHWS)	+1.86 m CD	+1.86 m CD
Residual (1:100)	0.80 m	0.80 m
Sea-level rise	0 m	0.26 m
Total Water Level	**+2.66 m CD**	**+2.92 m CD**

3.4.5 Design Water Levels

Design Still High Water Level was defined based on the combination of tide, surge and sea level rise resulting in +2.92m above CD (Table 5). Design Still Low Water Level was defined as LAT (0.00 m CD).

3.5 Offshore winds

The available wind sources, extraction locations of these datasets and their details are provided in Table 6, Figure 14 and Table 7.

Table 6: Sources of wind data.

Source	Description	Information Provided
National Centers for Environmental Prediction (NCEP) WaveWatch III (WW3) global model	Three-hourly average wind direction and magnitude data (data period outlined in Table 7)	Offshore wind magnitude and direction.
National Centers for Environmental Prediction (NCEP) Global Data Assimilation System (GDAS) Climate Forecast System Reanalysis (CFSR)	Hourly wind direction and magnitude data (data period outlined in Table 7).	Onshore wind magnitude and direction data.

Figure 14: Wind sources location map.

Table 7: Summary of the wind data extracted.

Wind Datasets	Coordinates	Period of Recorded Data	% of Recorded Data	Type of dataset
NWW3 Wind 1	36.0 °S, 25.0 °E	From 01/01/1997 to 31/07/2015 [1]	99.99%	3 hourly
NWW3 Wind 2	36.0 °S, 27.5 °E	From 01/01/1997 to 31/07/2015 [2]	99.99%	3 hourly
GDAS Wind	34.18906 °S, 24.99997 °E	From 01/01/1979 to 31/12/2009	100%	1 hourly

[1] Combined dataset from existing NCEP WW3 model resolutions
[2] Combined dataset from existing NCEP WW3 model resolutions

Annual wind roses and annual wind speed–wind direction frequency tables were produced for each of the locations and are presented in Appendix B. As an example, the annual wind rose and wind speed–wind direction frequency table for the NWW3 Wind 1 location are presented in Figure 15 and Table 8, respectively.

The principal wind direction for the NWW3 Wind 1 dataset is from the western sector with an approximate occurrence of 33% of the time (combining W, WSW, and WNW directions). The second most predominant wind direction comes from the east-north-eastern sector with an approximate occurrence of 26% of the time (combining ENE, NE and E directions). The maximum wind speed from the extracted time series is 26.5 m/s, whilst the average wind speed is 8.3 m/s.

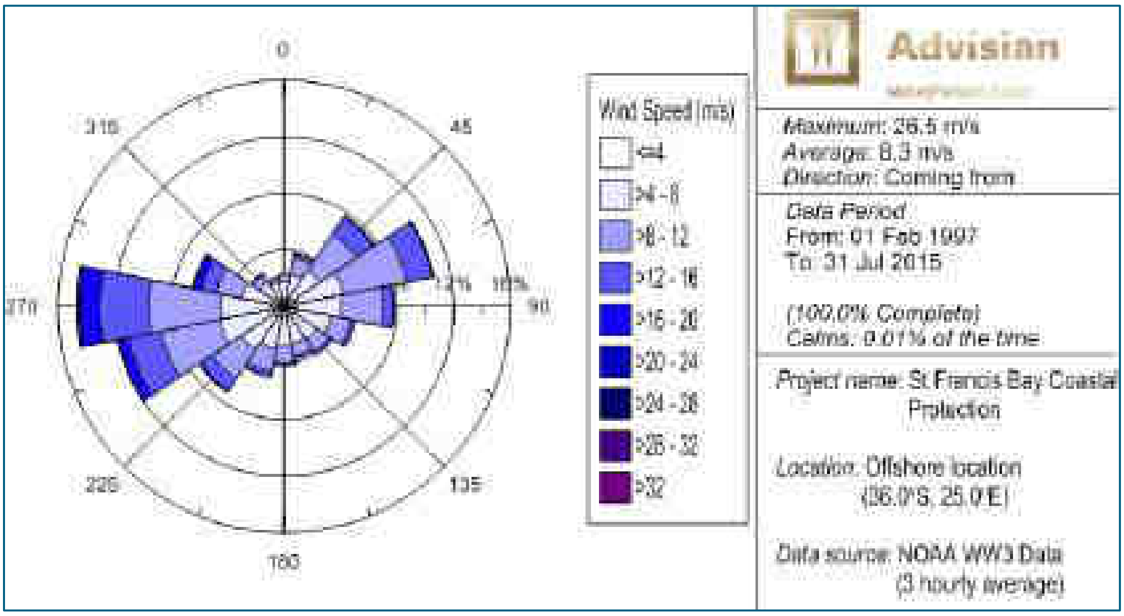

Figure 15: NWW3 Wind 1 – Annual wind rose.

Table 8: NWW3 Wind 1 – Annual wind speed – wind direction frequency table.

Annual		Wind speed, WS (m/s)										
		0	> 0 - 4	> 4 - 8	> 8 - 12	> 12 - 16	> 16 - 20	> 20 - 24	> 24 - 28	> 28	All WS	Cum WS
Wind Direction, WD (°N)	N		0.583	1.157	0.498	0.026	0	0	0	0	2.26	2.26
	NNE		0.633	1.693	1.192	0.274	0.015	0.002	0	0	3.81	6.07
	NE		0.711	2.337	3.083	1.477	0.111	0.006	0	0	7.72	13.80
	ENE		0.844	3.453	4.524	1.850	0.115	0.006	0	0	10.79	24.59
	E		0.862	3.187	2.953	0.670	0.087	0.002	0	0	7.76	32.35
	ESE		0.901	2.498	1.419	0.294	0.028	0	0	0	5.14	37.49
	SE		0.823	1.969	1.051	0.229	0.022	0	0	0	4.10	41.58
	SSE		0.781	1.878	0.896	0.155	0.009	0.004	0	0	3.72	45.31
	S		0.792	2.026	1.131	0.207	0.031	0.004	0	0	4.19	49.50
	SSW		0.836	2.226	1.595	0.372	0.050	0.002	0	0	5.08	54.58
	SW		0.903	2.770	2.485	0.936	0.163	0.006	0	0	7.26	61.84
	WSW		0.925	3.742	4.228	2.346	0.670	0.070	0	0	11.98	73.82
	W		0.984	3.484	5.080	3.499	1.384	0.215	0.007	0	14.65	88.48
	WNW		0.809	2.243	1.839	1.088	0.518	0.094	0.002	0	6.59	95.07
	NW		0.753	1.362	0.563	0.115	0.022	0.006	0.004	0	2.82	97.90
	NNW		0.607	1.164	0.313	0.013	0.002	0	0	0	2.10	99.99
	All WD	0.01	12.75	37.19	32.85	13.55	3.23	0.41	0.01	0.00		
	Cum WD	0.01	12.75	49.94	82.79	96.35	99.57	99.99	100.00	100.00		

The wind time series extracted from the NWW3 Wind 1 dataset were utilized to set up the forcing conditions for the wave model described in Section 4.1.

3.6 Offshore waves

The available offshore wave sources, extraction locations of these datasets and their details are provided in Table 9, Figure 16 and Table 10.

Table 9: Sources of wave data.

Source	Description	Information Provided
NCEP WaveWatch III (WW3) global model	Three-hourly significant wave height, peak wave period and direction data (data period outlined in Table 10).	Offshore significant wave height, peak wave period and direction data.

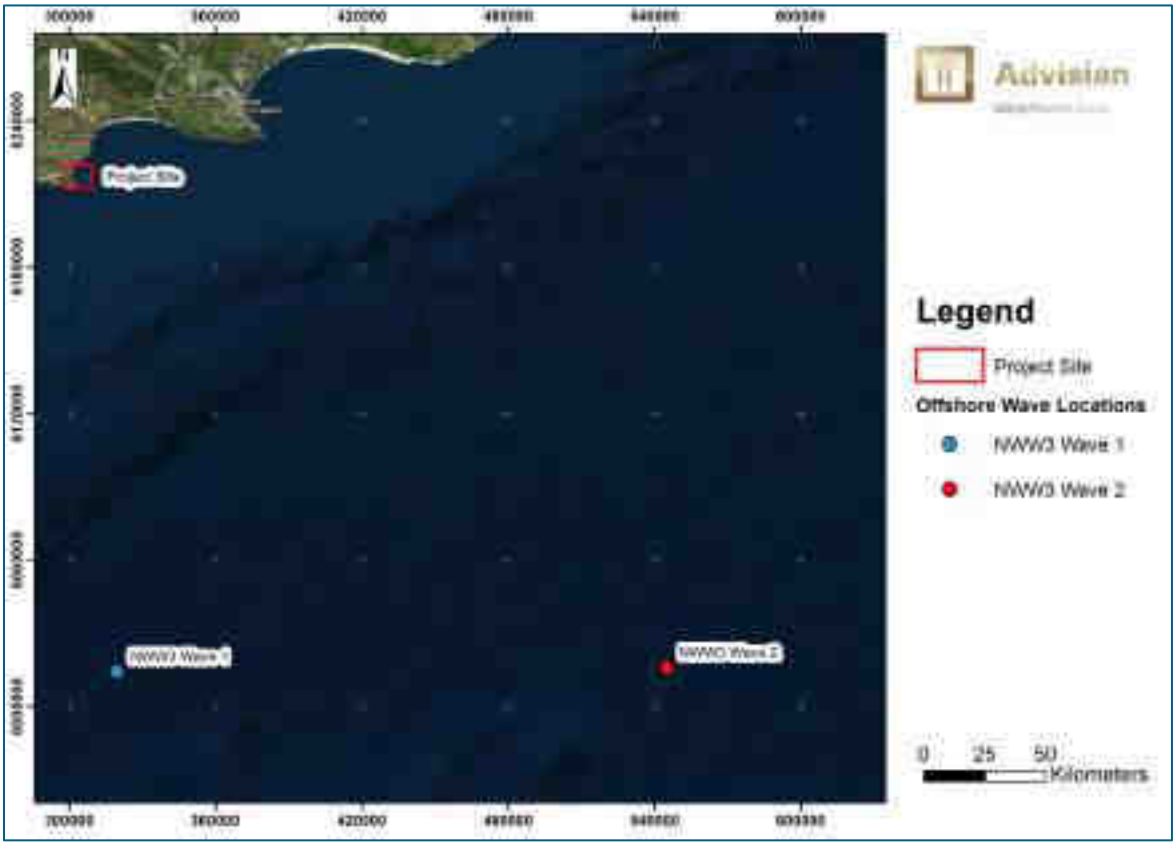

Figure 16: Wave sources location map.

Table 10: Detailed information of the wave data extracted.

Wave Datasets	Coordinates	Period of Recorded Data	% of Recorded Data	Type of dataset
NWW3 Wave 1	36.0 °S, 25.0 °E	From 01/01/1997 to 31/07/2015 [3]	100%	3 hourly
NWW3 Wave 2	36.0 °S, 27.5 °E	From 01/01/1997 to 31/07/2015 [4]	100%	3 hourly

Annual wave roses (H_{m0} –MWD and T_P – MWD) and annual frequency tables (T_P – MWD, H_{m0} – MWD and H_{m0} – T_P) were produced for the offshore locations and are presented in Appendix C. As an example, the annual wave roses and the annual frequency tables for the NWW3 Wave 1 location are provided in Figure 17 and Table 11, respectively.

[3] Combined dataset from existing NCEP WW3 model resolutions
[4] Combined dataset from existing NCEP WW3 model resolutions

The principal wave direction for the NWW3 Wave 1 dataset is from the southwestern sector with an approximate occurrence of 61% of the time (combining SW, WSW and SSW directions). The maximum significant wave height from the extracted time series is 11.5 m with an associated peak wave period ranging between 12 and 18s. The average significant wave height is 3.5 m and the average peak wave period is 11.1 s.

The wave time series extracted from the NWW3 Wave 1 dataset were utilized to set up the forcing conditions for the wave model described in Section 4.1.

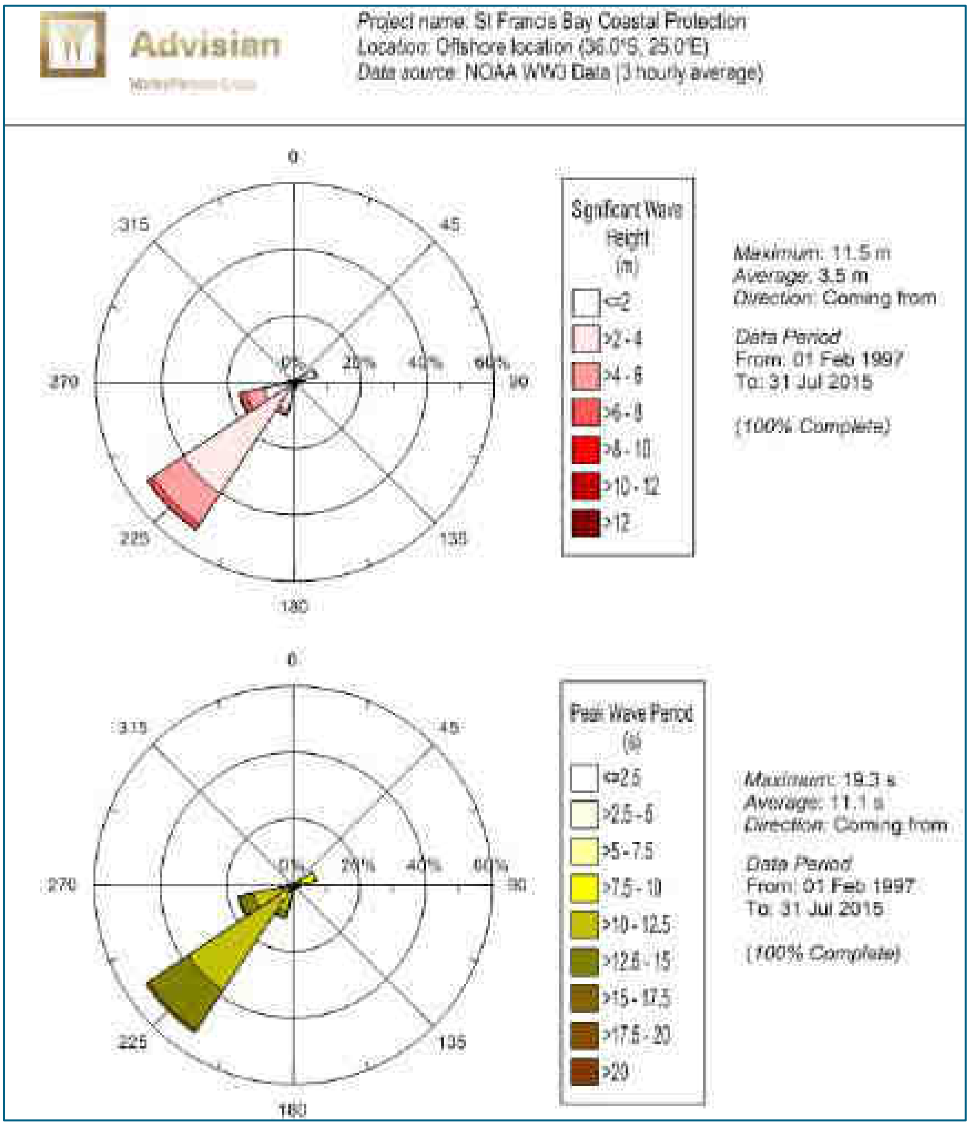

Figure 17: NWW3 Wave 1 – Annual significant wave height rose (top) and annual peak wave period rose (bottom).

Table 11: NWW3 Wave 1 – Annual frequency tables. T_P – MWD frequency table (top), H_{m0} – MWD frequency table (middle) and H_{m0} – T_P frequency table (bottom).

Annual	Wave Peak Period, T_P (s)											
Mean Wave Direction, MWD (°N, from)	< 2	> 2 - 4	> 4 - 6	> 6 - 8	> 8 - 10	> 10 - 12	> 12 - 14	> 14 - 16	> 16 - 18	> 18 - 20	> 20	All T_P	Cum T_P
N	0	0	0	0.006	0.006	0.002	0	0	0	0	0	0.01	0.01
NNE	0	0	0.017	0.017	0.009	0.002	0	0	0	0	0	0.04	0.06
NE	0	0	0.155	0.875	0.278	0.011	0	0	0	0	0	1.32	1.38
ENE	0	0.002	0.320	3.255	3.266	0.172	0	0.013	0	0	0	7.03	8.40
E	0	0	0.107	0.687	1.301	0.228	0.076	0.002	0	0	0	2.40	10.80
ESE	0	0	0.024	0.309	0.648	0.344	0.043	0	0	0	0	1.37	12.17
SE	0	0	0.017	0.191	0.616	0.366	0.048	0	0	0	0	1.24	13.41
SSE	0	0	0.017	0.141	0.714	0.551	0.048	0.013	0	0	0	1.48	14.89
S	0	0	0.015	0.133	0.859	0.944	0.141	0.041	0	0	0	2.13	17.03
SSW	0	0	0.013	0.194	1.897	5.089	2.374	0.640	0.061	0	0	10.27	27.29
SW	0	0	0.026	0.333	5.294	25.261	18.707	3.594	0.276	0.013	0	53.50	80.80
WSW	0	0	0.046	0.651	2.628	7.182	4.961	1.436	0.183	0.011	0	17.10	97.90
W	0	0	0.118	0.662	0.759	0.339	0.026	0.002	0	0	0	1.91	99.80
WNW	0	0.002	0.024	0.089	0.054	0.004	0	0	0	0	0	0.17	99.97
NW	0	0	0	0.006	0.009	0	0	0	0	0	0	0.01	99.99
NNW	0	0	0	0.006	0.006	0	0	0	0	0	0	0.01	100.00
All Dir	0.00	0.00	0.90	7.55	18.34	40.49	26.42	5.74	0.52	0.02	0.00		
Cum Dir	0.00	0.00	0.90	8.46	26.80	67.29	93.72	99.46	99.98	100.00	100.00		

Annual	Significant Wave Height, H_s (m)													
Mean Wave Direction, MWD (°N, from)	< 1	> 1 - 2	> 2 - 3	> 3 - 4	> 4 - 5	> 5 - 6	> 6 - 7	> 7 - 8	> 8 - 9	> 9 - 10	> 10 - 11	> 11 - 12	> 12	All Hs	Cum Hs
N	0	0	0.007	0.004	0	0.002	0	0	0	0	0	0	0	0.01	0.01
NNE	0	0.004	0.022	0.019	0	0	0	0	0	0	0	0	0	0.04	0.06
NE	0	0.026	0.474	0.694	0.124	0.002	0	0	0	0	0	0	0	1.32	1.38
ENE	0	0.272	3.155	2.994	0.538	0.054	0.015	0	0	0	0	0	0	7.03	8.40
E	0	0.205	1.182	0.761	0.185	0.046	0.011	0.009	0	0	0	0	0	2.40	10.80
ESE	0	0.089	0.622	0.450	0.168	0.039	0	0	0	0	0	0	0	1.37	12.17
SE	0	0.063	0.640	0.376	0.115	0.037	0.007	0	0	0	0	0	0	1.24	13.41
SSE	0	0.115	0.681	0.490	0.157	0.031	0.009	0	0	0	0	0	0	1.48	14.89
S	0	0.124	1.007	0.637	0.231	0.091	0.028	0.015	0	0	0	0	0	2.13	17.03
SSW	0	0.622	4.539	3.453	1.099	0.389	0.131	0.022	0.013	0	0	0	0	10.27	27.29
SW	0	1.939	20.333	18.177	7.802	3.203	1.323	0.476	0.179	0.054	0.013	0.004	0	53.50	80.80
WSW	0	0.520	4.471	4.532	3.181	2.228	1.099	0.637	0.254	0.107	0.057	0.013	0	17.10	97.90
W	0	0.050	0.374	0.674	0.457	0.205	0.105	0.033	0.004	0.004	0	0	0	1.91	99.80
WNW	0	0.007	0.043	0.094	0.022	0.004	0.002	0	0	0	0	0	0	0.17	99.97
NW	0	0.002	0.004	0.009	0	0	0	0	0	0	0	0	0	0.01	99.99
NNW	0	0.002	0.006	0.004	0	0	0	0	0	0	0	0	0	0.01	100.00
All Dir	0.00	4.04	37.56	33.37	14.08	6.33	2.73	1.19	0.45	0.16	0.07	0.02	0.00		
Cum Dir	0.00	4.04	41.60	74.96	89.05	95.38	98.11	99.30	99.75	99.91	99.98	100.00	100.00		

Annual	Wave Peak Period, T_P (s)											
Significant Wave Height, Hs (m)	< 2	> 2 - 4	> 4 - 6	> 6 - 8	> 8 - 10	> 10 - 12	> 12 - 14	> 14 - 16	> 16 - 18	> 18 - 20	> 20	All T_P	Cum T_P
< 1	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
> 1 - 2	0	0.004	0.122	0.518	1.801	1.334	0.207	0.039	0.015	0	0	4.04	4.04
> 2 - 3	0	0	0.727	3.317	8.347	18.732	5.378	0.925	0.133	0.006	0	37.57	41.61
> 3 - 4	0	0	0.050	3.485	5.193	12.147	10.474	1.854	0.152	0.017	0	33.37	74.98
> 4 - 5	0	0	0	0.235	2.456	4.583	5.436	1.260	0.111	0.002	0	14.08	89.06
> 5 - 6	0	0	0	0	0.518	2.391	2.539	0.822	0.061	0	0	6.33	95.39
> 6 - 7	0	0	0	0	0.030	1.016	1.266	0.396	0.024	0	0	2.73	98.12
> 7 - 8	0	0	0	0	0	0.276	0.685	0.218	0.013	0	0	1.19	99.32
> 8 - 9	0	0	0	0	0	0.022	0.316	0.111	0	0	0	0.45	99.76
> 9 - 10	0	0	0	0	0	0	0.096	0.067	0.002	0	0	0.16	99.93
> 10 -11	0	0	0	0	0	0	0.026	0.043	0.002	0	0	0.07	100.00
> 11 -12	0	0	0	0	0	0	0.004	0.006	0.007	0	0	0.02	100.02
> 12	0	0	0	0	0	0	0	0	0	0	0	0.00	100.02
All H_s	0.00	0.00	0.90	7.55	18.35	40.50	26.43	5.74	0.52	0.02	0.00		
Cum H_s	0.00	0.00	0.90	8.46	26.80	67.30	93.73	99.47	99.99	100.02	100.02		

4 Coastal Processes Modelling

The sediment transport along the St Francis Bay shoreline is largely driven by the nearshore wave climate. In the absence of local wave measurements at the project site, numerical wave modelling was undertaken to estimate the nearshore wave conditions.

Possible shoreline changes due to both cross-shore and long-shore sediment transport were evaluated through sediment transport models. The results served as input to prepare conceptual layout options to restore the beach and limit beach recession.

The modellings tasks are further detailed in the sub-sections that follow.

4.1 Wave Modelling

4.1.1 Model Set-up and Approach

A nested spectral wave model was prepared for St Francis Bay consisting of four (4) grids (Figure 18). The Delft3D modelling suite was used to set up the model domain and simulate the wave climate at the project site. For these simulations Delft3D-WAVE modelling module was used. The Delft3D-WAVE module uses SWAN (Simulating Waves Nearshore) numerical model to simulate the generation and propagation of wind-generated waves. For this study, the flow effect on waves was defined by a spatially uniform water level.

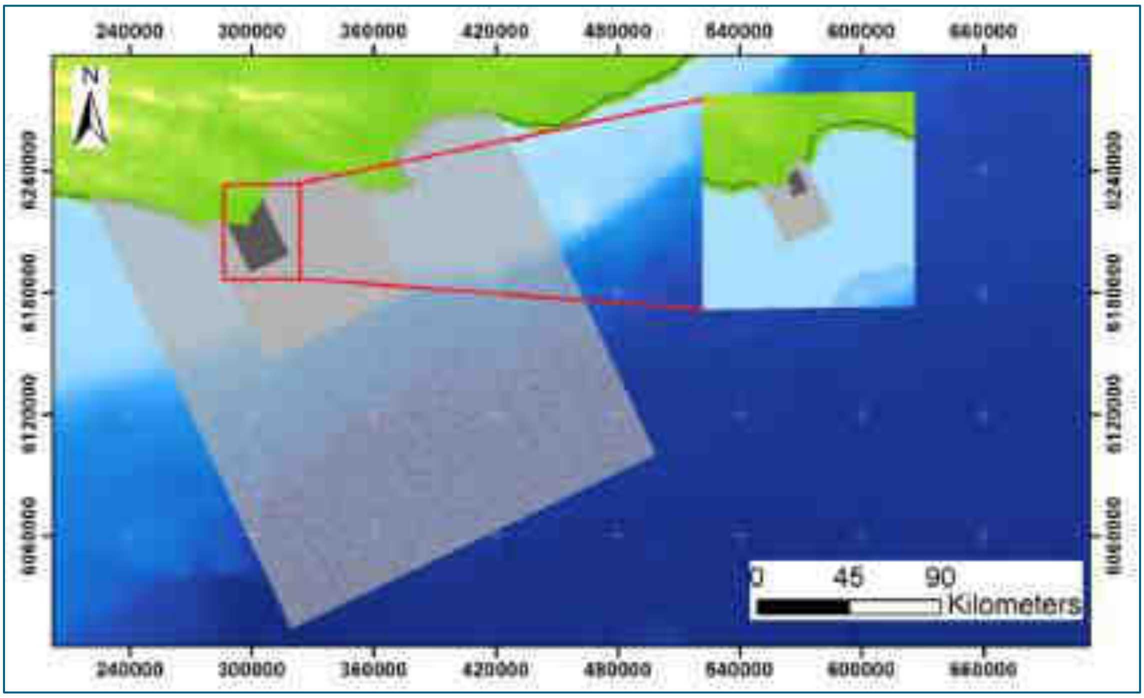

Figure 18: Extent of the computational domain for the nested wave model used for St Francis Bay.

Nesting is a modelling technique in which a larger model encloses a smaller model, and as the larger model runs it generates hydrodynamic and wave boundary conditions that can be applied to the smaller model. A benefit of this technique is the improved resolution provided by the inner, fine-scale model, while not substantially extending the model processing time.

Table 12 summarises the details of the computational grids used to establish the nearshore wave climates.

Table 12: Delft3D-WAVE computational grid details

Grid Description	Grid Length (km)	Grid Width (km)	Cell resolution (m)
Coarse	200	240	1000 x 1000
Intermediate 1	78	80	333 x 333
Intermediate 2	21	30	111 x 11
Fine	5.7	9.0	35 x 35

Offshore wave and wind conditions were extracted from the National Centers for Environmental Prediction (NCEP) WaveWatch III (WW3) global hindcast model (Section 3.5 and 3.6) was applied at the domain boundaries (coarse grid) and numerically propagated towards the shore.

Instead of running a continuous simulation for the entire 18 year period, combinations of significant wave height, direction, period, wind speed and wind direction were simulated. Sea (locally generated) and swell were simulated separately. The results from the discrete simulations are then linearly interpolated to the continuous time series data at the desired locations nearshore.

The characteristics of the simulated conditions are presented in Table 13.

Table 13: Simulated conditions.

Parameter	Range	Bin size	No. of Bins
H_{m0} (m)	0 – 12	2	6
T_P (s)	0 – 20	4	5
PWD (^{o})	0 – 315	45	8
WS (m/s)	0 – 28	4	7
WD (^{o})	0 - 330	30	12

The model was run in stationary mode with the water level set to Mean Sea Level.

4.1.2 Nearshore Wave Climate

The wave climate in St Francis Bay is considered mild since most of the swell wave energy is substantially reduced in wave height due to the shelter offered by Cape St Francis, as well as refraction and diffraction effects (Figure 19). However, local strong winds can generate strong short-period waves throughout St Francis Bay which enhances the harshness of the coastal environment. This is demonstrated in the wave height vector fields plotted in Figure 20 to

Figure 23, which provide the simulated wave conditions for the strongest easterly and westerly wind conditions in combination with easterly and south-westerly swell, respectively.

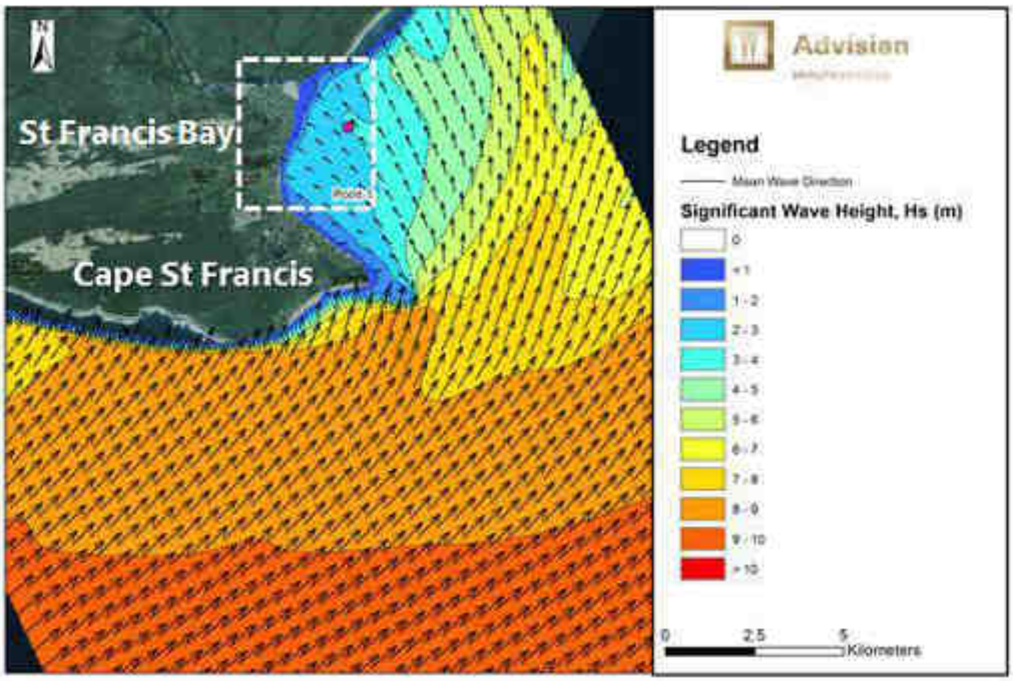

Figure 19: Extreme wave condition illustrating sheltering effects of Cape St Francis at St Francis Bay

The reductions in wave heights in the nearshore are due to the combined effects of offshore shoals, refraction, diffraction, bed friction losses and wave breaking.

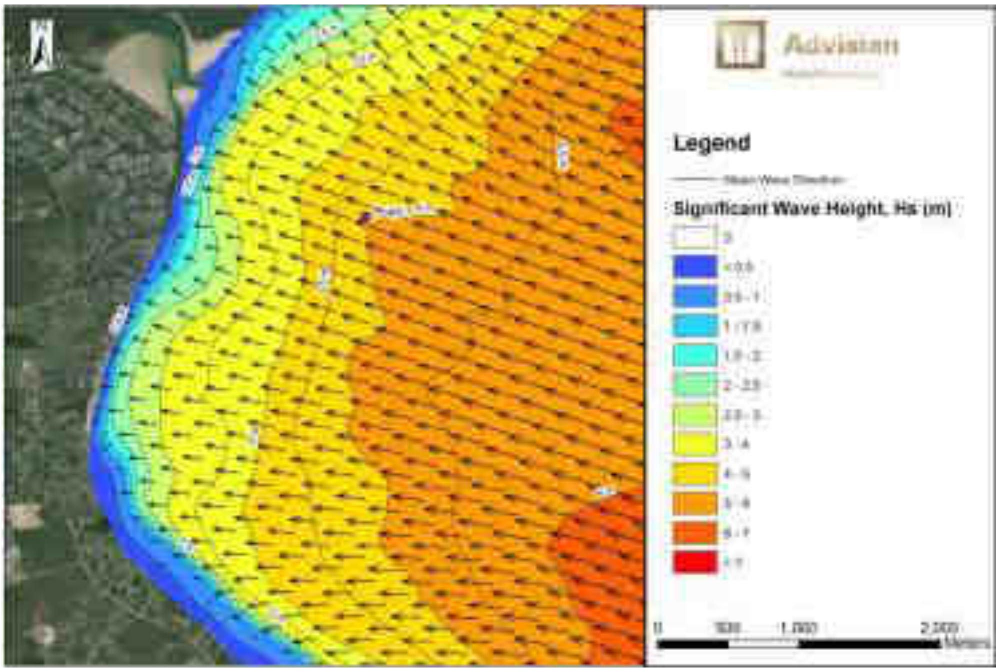

Figure 20: ***Simulated wave conditions for the strongest easterly wind and swell conditions - Offshore swell: H_S = 7.5m, T_P = 12s, Direction = 90 °N and winds: WS = 22.0m/s, Direction = 67.5°N along St Francis Bay***

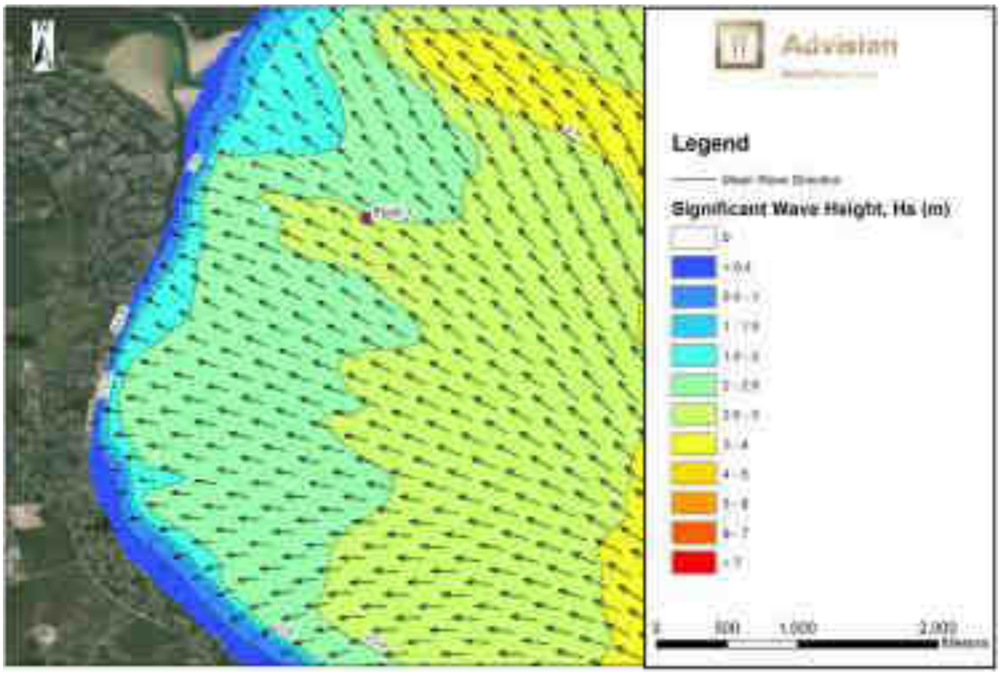

Figure 21: ***Simulated wave conditions for the strongest westerly wind conditions and easterly swell conditions - Offshore swell: H_S = 7.5m, T_P = 12s, Direction = 90 °N and winds: WS = 26.5m/s, Direction = 270°N along St Francis Bay***

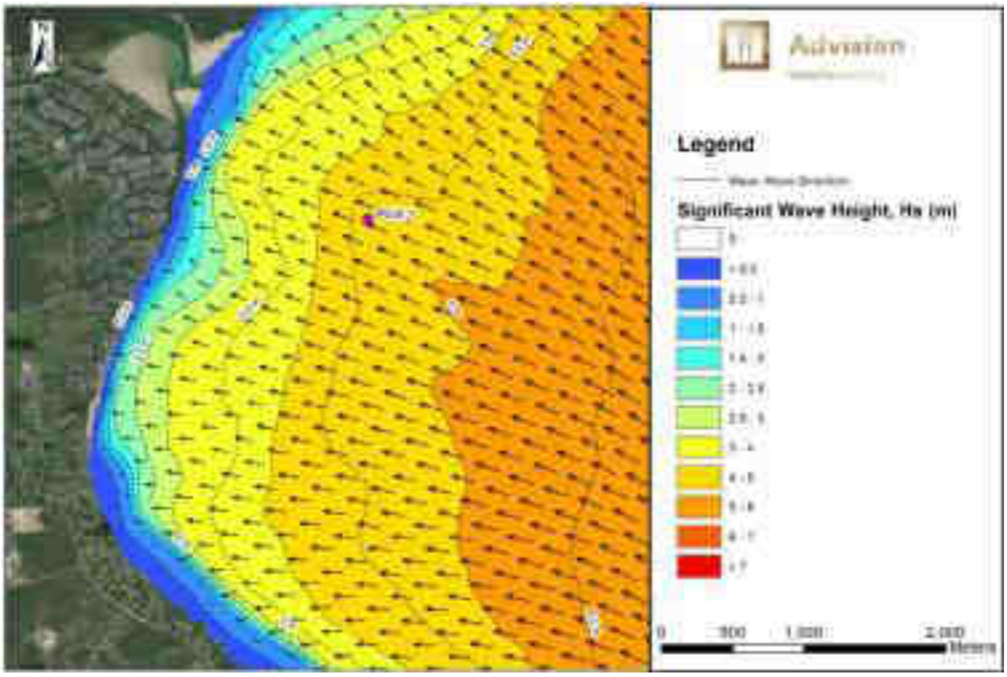

Figure 22: ***Simulated wave conditions for the strongest easterly wind condition and south-westerly swell conditions - Offshore swell: H_S = 11.5m, T_P = 15.6s, Direction = 240.5°N and winds: WS = 22m/s, Direction = 67.5°N along St Francis Bay***

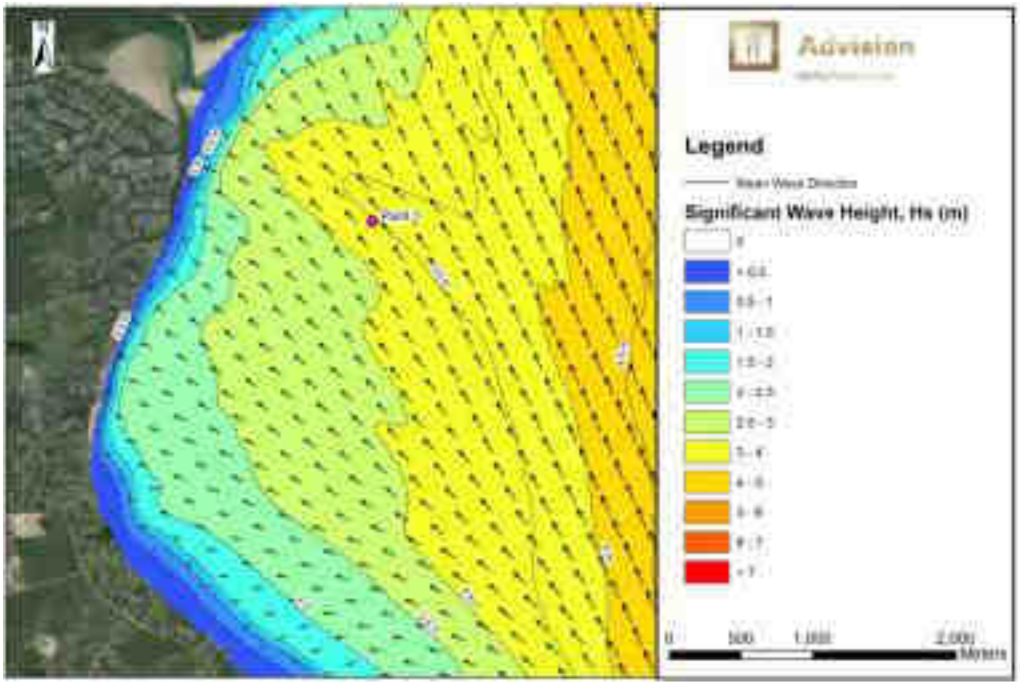

Figure 23: ***Simulated wave conditions for the strongest westerly wind condition and south-westerly swell conditions - Offshore swell: H_S = 11.5m, T_P = 15.6s, Direction = 240.5°N and winds: WS = 26.5m/s, Direction = 270°N along St Francis Bay***

The annual wave rose at Point 1 (x = 302103 m ; y = 6218852 m, WGS84 UTM 35S), location also indicated in Figures 19 to 22, at -10 m CD, is shown in Figure 24. The dominant wave direction is from the south-east with a smaller component approaching the shoreline from the east. The average significant wave height, estimated over the last 17 years, is 1.1 m. The maximum significant wave height in the simulated time series is 4.5 m.

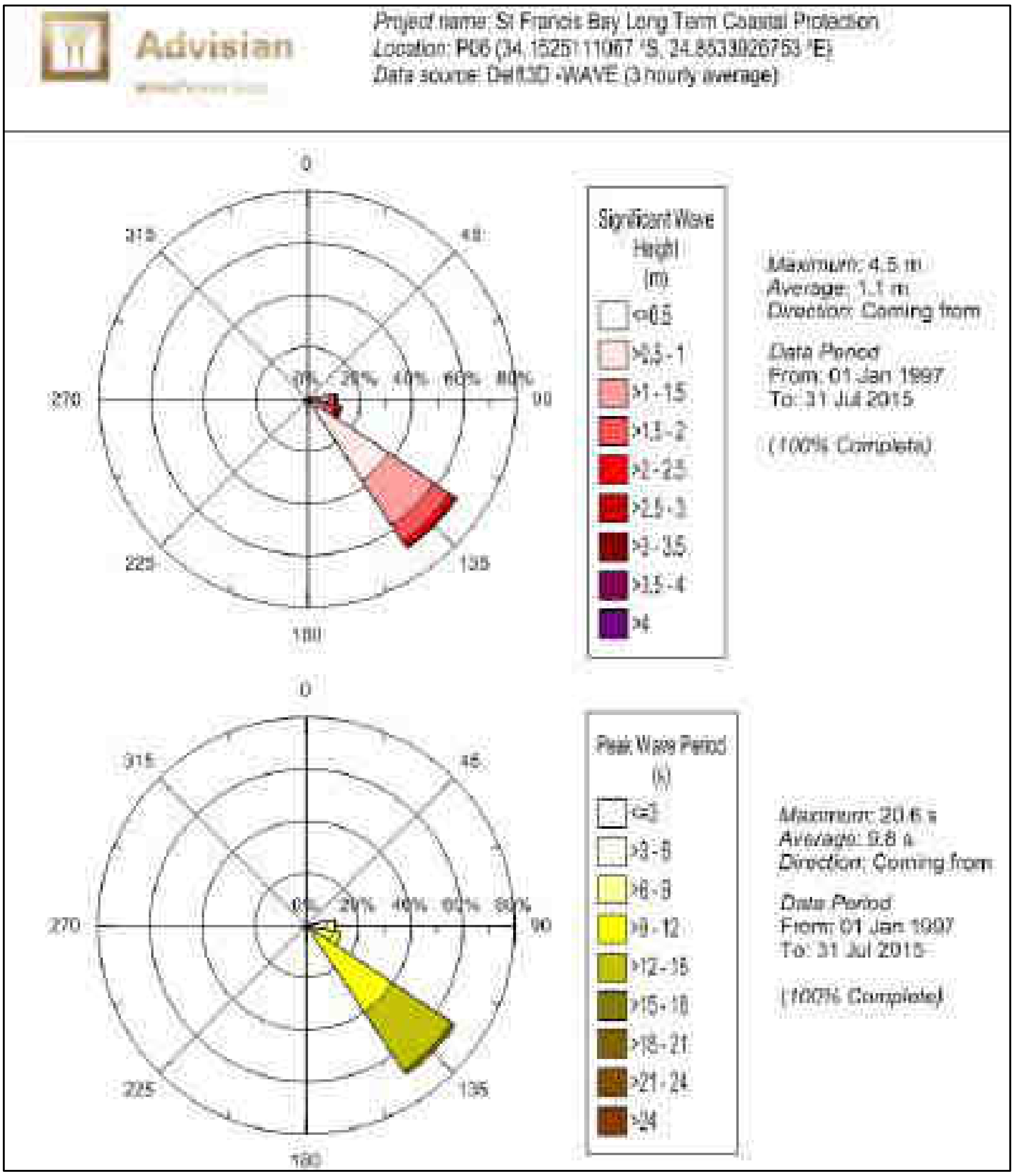

Figure 24: Annual wave rose at Point 1, -10 m CD

4.1.3 Extreme Waves

An extreme value analysis (EVA) was undertaken for the data sets to determine the extreme wave conditions for various average return intervals (ARI). Extreme events were selected based on a 'peaks over threshold' method, with the threshold defined as 2 m. Two successive events were extracted only if the time between the events exceeded 72 hours to ensure independence. The extreme value series was then fitted to a three parameter Weibull distribution.

Extreme wave height estimates and associated peak wave periods for various ARI's at the Point 1 location are presented in Table 14.

Table 14: Extreme significant wave height estimates (m) and associated 95% confidence intervals for Point 1*

ARI (yr)	Omni-directional			
	Wave characteristics		95% Confidence Interval	
	H_s	T_P	Lower Limit	Upper Limit
1	3.6	10.9	3.4	3.8
5	4.4	11.2	4.1	4.7
10	4.8	11.4	4.4	5.1
25	5.2	11.5	4.8	5.6
50	5.6	11.7	5.1	6.0
100	5.9	11.8	5.4	6.4

**** Point 1: x = 302103 m ; y = 6218852 m, WGS84 UTM 35S, -10 m CD***

4.1.4 Design Waves

The extreme wave conditions used as input for the design of the shoreline coastal structures were based on depth limited conditions as defined in (Kamphuis, 2000).

$$\frac{H_{sb}}{d_b} = 0.56e^{3.5m}$$

Where:

H_{sb}: Breaking wave height

d_b: Breaking depth

m: seabed slope

A summary of the design conditions is presented in Table 15.

Table 15: Extreme wave conditions (100 year ARI) based on depth-limited conditions

Seabed Elevation (mCD)	SWL (mCD)	Total water depth (m)	H_{m0b} (m)	T_P (s)
-4.0	2.9	6.9	4.0	11.8
-3.0	2.9	5.9	3.6	11.8
-2.0	2.9	4.9	3.0	11.8
-1.0	2.9	3.9	2.4	11.8
0.0	2.9	2.9	1.8	11.8

4.2 Storm Induced Beach Erosion

Short term cross-shore erosion is typically the consequence of extreme wave events, where sediment is temporarily transported seaward. During calmer conditions, the beach profile typically tends to recover as the sediment is shifted towards the shoreline and deposited on the beach.

The estimated extent of beach recession due to an extreme event informs the minimum beach width required to accommodate such an event without impacting the landside boundary.

4.2.1 SBEACH Software

Preliminary simulations of storm induced changes to the beach profile were carried out using SBEACH (Simulation of storm induced BEAch CHange). The software was developed jointly by the Department of Water Resources, University of Lund, Sweden and the Coastal Engineering Research Center, US Army Waterways Experiment Station, USA. SBEACH is a system for modelling the changes occurring in beach profiles, adapted to predicting the impact of storms in coastal areas (Larson, Kraus, & Byrnes, 1990). SBEACH describes the impacts of storms (short-term events) on upper and lower beach profiles.

The typical beach profile and sediment characteristics along St Francis shoreline is utilised to determine the expected beach recession. This will inform the minimum beach width required to maintain a useable beach after a storm event and optimise and limit beach maintenance as far as possible.

SBEACH model uses the conservation of sand mass equation:

$$q = \begin{cases} K\left(D - D_{eq} + \dfrac{\varepsilon}{K}\dfrac{dh}{dx}\right) & D > D_{eq} - \dfrac{\varepsilon}{K}\dfrac{dh}{dx} \\ 0 & D < D_{eq} - \dfrac{\varepsilon}{K}\dfrac{dh}{dx} \end{cases}$$

Where

- K is an empirical transport rate coefficient,

$$2.5x10^{-7}m^4/N \leq K \leq 2.5x10^{-6}m^4/N$$

- ε is a transport rate coefficient for the slope dependant term,

$$0.001m^2/s \leq \varepsilon \leq 0.003m^2/s$$

- D is a wave energy dissipation per unit volume, and
- D_{eq} is an equilibrium energy dissipation per unit volume

4.2.2 Model Input Parameters

In an effort to determine the input sediment transport parameters, an erosion event was modelled in SBEACH for which the following were known:

1. Significant wave height and peak period time series for the storm duration
2. Water elevation time series for the storm duration
3. Pre- and post-storm measured beach profiles

A storm which occurred between the 21st and 28th of October 2009 was selected as the beach profiles were surveyed on 19 October 2009 (pre-storm) and 17 November 2009 (post-storm). The transformed nearshore significant wave heights, extracted at the -10 m CD contour (Section 4.1) were applied together with the water level time series (Section 3.1).

Grain size of 0.22 mm was adopted (Section 3.3) together with an empirical transport rate coefficient K of 3.0 x 10-7 m^4/N; and a transport rate coefficient for the slope dependant term ε of 0.002 m^2/s.

The pre- and post-storm measured and modelled profiles are shown in Figure 25. With the chosen set of model parameters, the modelled and measured post-storm profiles compare reasonably well. These model parameters were adopted for subsequent SBEACH simulations.

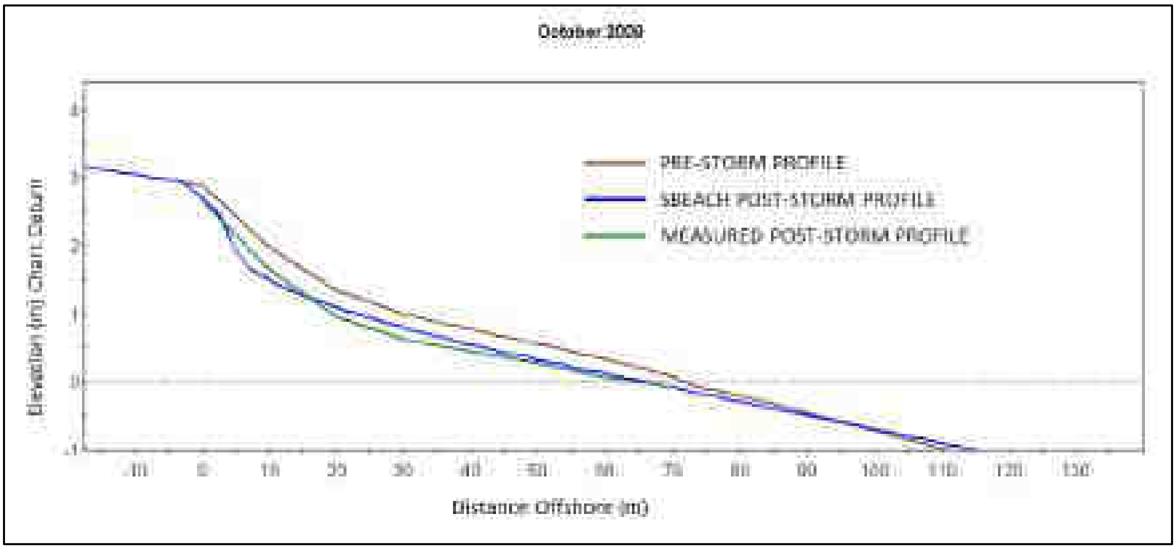

Figure 25: Comparison of measured and modelled beach erosion due to October 2009 storm event.

4.2.3 Input beach profile

The initial beach profile (pre-storm) utilised to estimate short term erosion is shown in Figure 26.

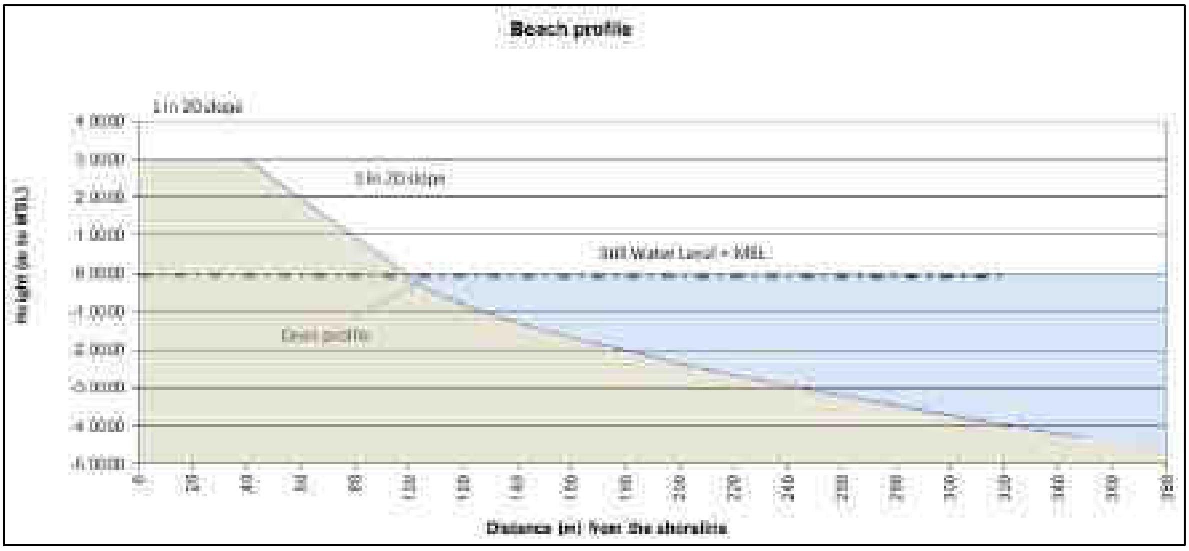

Figure 26: Initial pre-storm profile utilized in SBEACH simulations

The beach profile was based on the existing beach profile characteristics (Section 3.2.4). The highest elevation of the beach profile was adopted as +3 m MSL (+3.8 m CD) with a 1 in 20 slope to MSL (+0.836 m CD). The sub-aqueous section of the profile (below MSL) was assumed to be similar to the equilibrium beach profile based on Dean's equation (Dean, 1991):

$$d = Ax^{2/3}$$

$$A = 0.5082{D_{50}}^{0.44}$$

where x is the offshore distance from still water line, d is the water depth (measure from the still water level) and A is the Sediment Scale Parameter, a function of the sand grain size D_{50} (Figure 27). A particle grain size of 0.20 mm, thus slightly finer than the native sand of 0.22 mm, was adopted for the beach profile. This considered as a conservative approach as a smaller grain size will result in more higher rates of erosion.

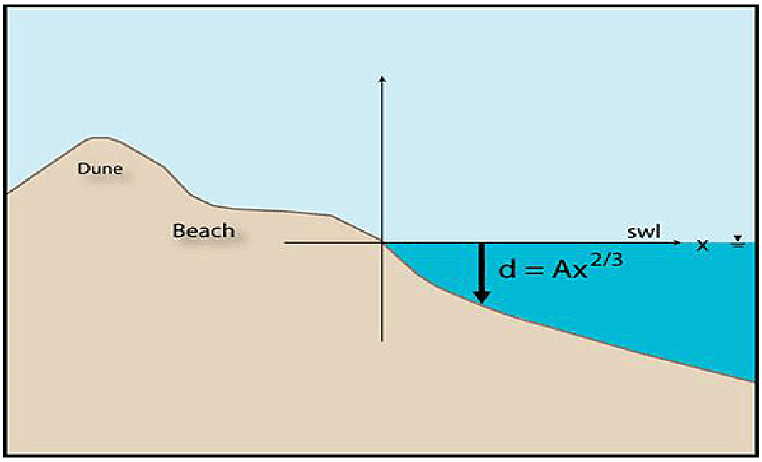

Figure 27: Dean's equilibrium profile shape definition sketch (Source: www.pilebuck.com)

4.2.4 Input storm events

A simplified joint probability analysis was undertaken to determine the probability of simultaneous occurrence of total significant wave heights and high water levels, using the established nearshore climate and the tidal data time series from UHSLC (Refer to Section 3.4.1 and Section 4.1).

The simplified method as presented in (Hawkes & Svensson, 2003) to compute the joint probability of extremes was used. This method constructs tables of joint exceedance using the extreme values estimated for the variables (total significant wave height and high water levels) and a single-parameter representing the dependence between the two variables. In this case the variables were assumed to be nearly completely independent. The combined conditions are called joint exceedance extremes and the associated joint exceedance return period refers to the average time between occasions when both variables exceed their specified values simultaneously.

The resulting joint probability curves for different average return intervals (ARI's) or return periods are shown in Figure 28. Preliminary simulations with SBEACH indicated that the combination of higher water levels and lower wave heights resulted in more severe erosion compared to lower water levels and higher wave heights (Figure 29).

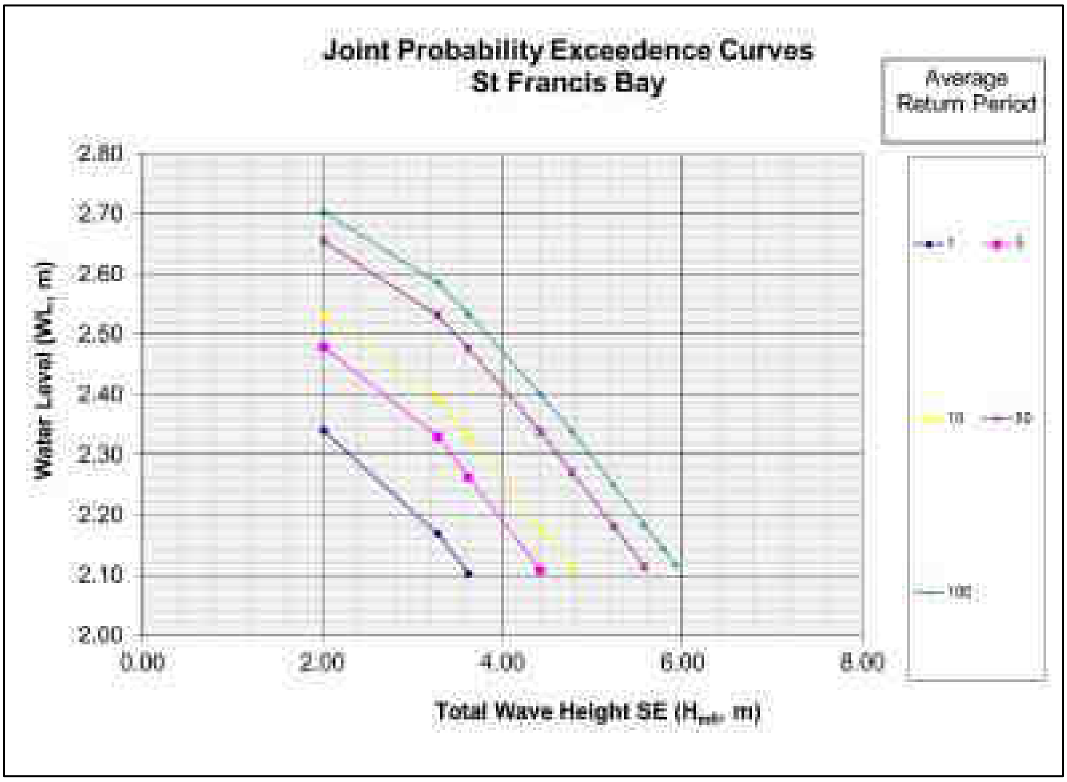

Figure 28: Joint Probability Curves for extreme significant wave heights and high water levels

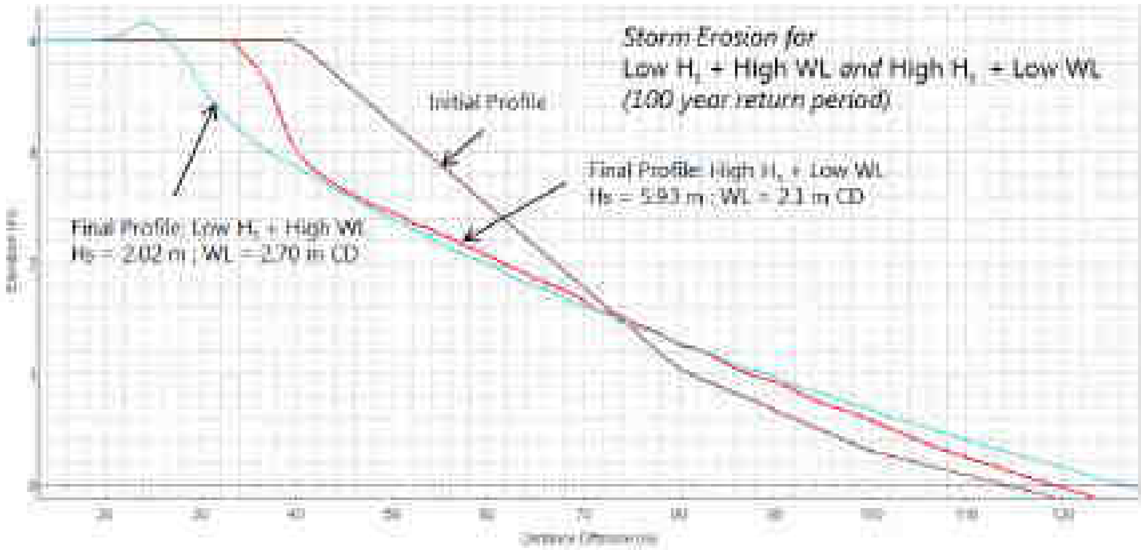

Figure 29: 100 year ARI simulated erosion: High Hs at low WL vs low Hs at high WL

The wave conditions selected for simulations with SBEACH are listed in Table 16.

Table 16: Selected peak storm conditions for SBEACH simulations

ARI (yr)	High WL (m CD)	High WL including SLR (m CD)	H_s (m)	T_p (s)
1	2.34	2.60	2.02	12
5	2.48	2.74	2.02	12
10	2.53	2.79	2.02	12
50	2.65	2.91	2.02	12
100	2.70	2.96	2.02	12

The SBEACH model is sensitive to the storm duration. To determine the typical storm duration at St Francis Bay, nine storms were selected from the wave climate time series at the -10 m CD contour (Figure 30). Two of the nine storms (Storm 1 and Storm 2, Figure 30) had durations of approximately 100 hours, including the build-up and tapering down of the wave heights. The duration of the other 7 storms ranged between roughly 30 and 60 hours.

For the selected storm events (Table 16), a storm duration of 84 hours was adopted.

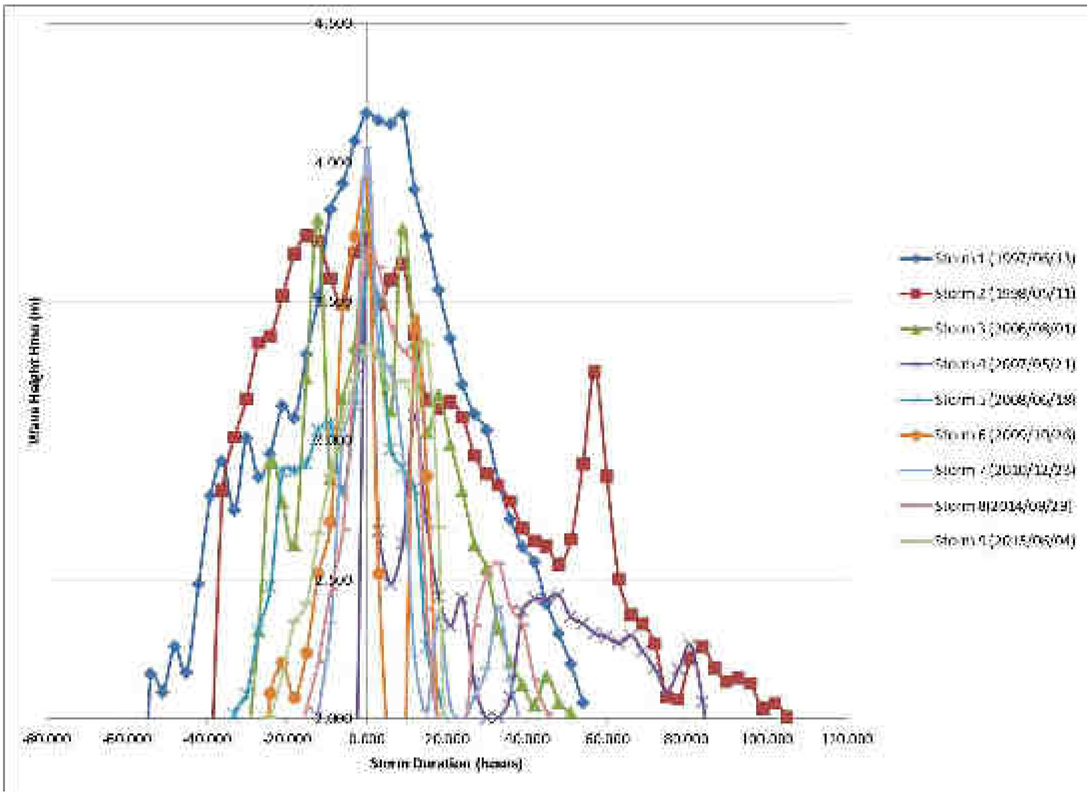

Figure 30: Storm duration of selected storms

4.2.5 Estimated short term erosion

The estimated cross shore eroded profiles resulting from the SBEACH model simulations for the 1 year and 100 year ARI, with and without sea level rise (SLR), are presented in Figure 31.

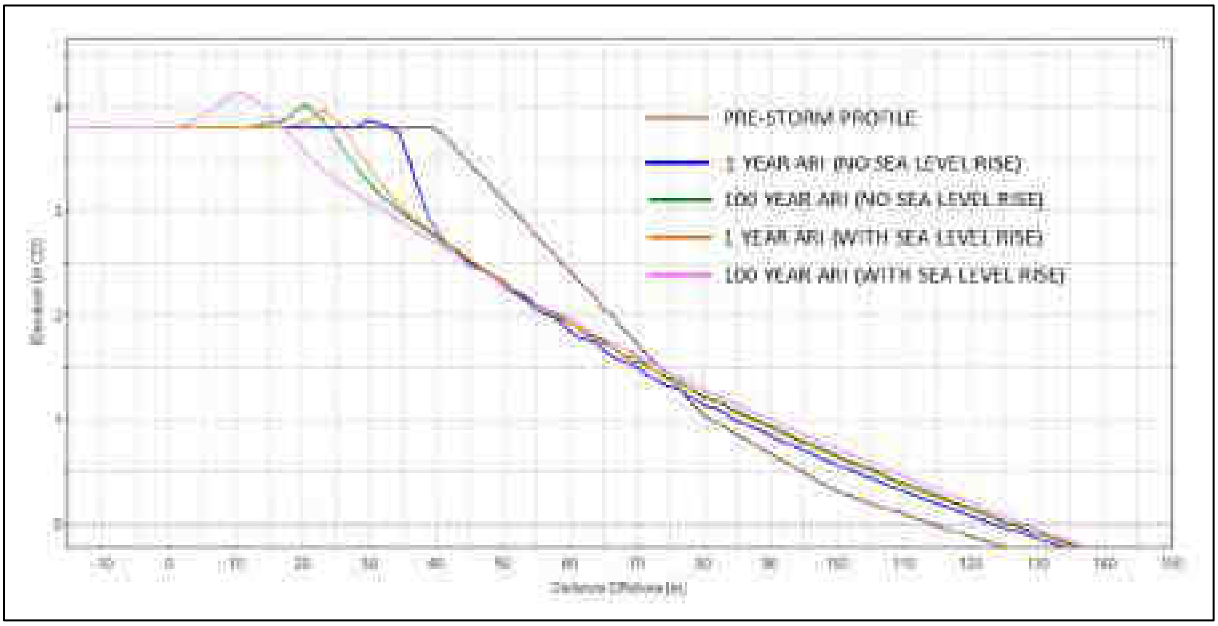

Figure 31: SBEACH storm erosion results (with and without SLR)

If SLR is not considered, the estimated recession of the beach crest (+3.8 m CD) ranges between 5 and 15 m. However, with SLR over 50 years, the recession increases to between 15 and 25 m with overwash of sediment reaching almost 40 m landward.

4.3 Long Term Shoreline Modelling

It is necessary to understand the movement or evolution of the shoreline in the long-term to establish shoreline response to beach protection schemes.

The long-term patterns of shoreline movement observed in nature can be classified as follows:

- Slow retreat of the shoreline due to long term erosion (shoreline moving landwards),
- Build-up of sediment over the long term pushing the shoreline seawards,
- Short-term back and forth movement of the shoreline in cycles due to episodic events and seasonal wave climate influences (shoreline is dynamically stable), and
- No signs of significant movement (shoreline is dynamically stable).

The long-term response of the shoreline is fundamentally dependant on the day-to-day environmental conditions influencing the longshore and cross-shore processes and related morphodynamics of beach profiles. These processes and the resulting shoreline response were estimated by the use of numerical modelling, outlined in the sub-sections that follow.

4.3.1 Modelling Suite Description

The UNIBEST (Uniform Beach Sediment Transport) software suite was used to setup the model domain and simulate the coastline change at the project site. The software has been developed by Deltares to study the longshore and cross-shore processes and related morphodynamics of beach profiles and coastline evolution.

UNIBEST-CL is a sediment balance model that computes longshore sediment transports at specific locations along the coast due to various oceanographic forcing like waves and currents. Thereafter, the longshore transports are translated to shoreline evolution by calculating the gradient in the longshore sediment transport as a function of the coastline orientation.

The engines of UNIBEST-CL consist of LT (longshore transport) and CL (coastline). The former computes longshore currents and sediment transports due to various oceanic forcing, like waves and currents, while the latter uses the divergence of transport rates to calculate the actual coastline change by assuming a single line theory.

Longshore transport and its distribution along the coastal profile can be evaluated according to several total-load sediment transport formulae for sand (such as Bijker, Kamphuis, van Rijn, etc.) or gravel (Van der Meer & Pilarczyk). As sections within the coastal cells accrete or erode, shoreline angle changes, and transport rates adjust to the changed wave approach angle.

A background description of the Deltares UNIBEST-CL+ software applied in this study is included in Appendix D.

4.3.2 Modelling Setup

4.3.2.1 Water Levels

Three water level conditions, based on the tidal levels outlined in Section 3.4.1, were applied in the coastline evolution model namely Mean High Water (MHW), Mean Sea Level (MSL) and Mean Low Water (MLW). These tidal levels together with their associated percentage of occurrence are listed in Table 17.

The percentage of occurrence at MHW and MLW are conservative and will tend to lead to slightly higher transport rates especially at the upper beach.

Table 17: Representative water level conditions for UNIBEST-LT model

Water level (m CD)	Percentage of occurrence (%)
1.68 (MHW)	25
1.00 (MSL)	50
0.50 (MLW)	25

SLR was not considered in the initial shoreline modelling as the intent is to investigate the shoreline response in the first 15 to 20 years after completion of the nourishment scheme.

4.3.2.2 Wave Conditions

Based on the coastline orientation of St Francis Bay and the number of existing coastal structures (revetments), 14 nearshore wave climate datasets, based on the numerical wave modelling outlined in Section 4.1, were used to define the wave forcing conditions along the beach and drive the shoreline evolution modelling as depicted in Figure 32.

Appendix C provides the annual wave roses for each local wave dataset.

Figure 32: Location map of the local wave conditions extracted for shoreline modelling at St Francis Bay

4.3.2.3 Beach Profiles

Based on the bathymetric and beach profile data summarised in Section 3.1 and 3.2, cross-shore profiles were derived along St Francis Bay for each of the local wave climate locations established above (Section 4.3.2.2). The beach profile extends from a water depth of -10 m CD to a beach elevation ranging between 2.5 m CD and 4.3 m CD.

4.3.2.4 Sediment Grain Diameter

The average median grain size (D_{50}) for the St Francis Bay beach was found to range between 0.18 mm and 0.22 mm (Section 3.3). An average grain diameter size of 0.20 mm was applied in the shoreline model.

4.3.2.5 Sediment Transport Formulation and Parameters

In coastal waters, sediment transport processes are strongly affected by waves and currents. Waves generally act as sediment stirring agents, while the mean currents will transport the stirred sediments.

Two main modes of sand transport are observed in nature:

- Suspended-load transport. Suspended sediments in the water column, which may have been stirred by waves and/or currents, will typically settle when the current speeds are reduced. This transport mode is dominated by turbulence-induced drag forces on the particles.
- Bed-load transport. When the sediment is coarser or the fine sediment is in a cohesive form, strong currents will generate a mud layer that will move along the seabed bottom. This transport mode is dominated by flow-induced drag forces and gravity forces acting on the particles.

Several formulations have been developed over the years to estimate the sediment transport in coastal waters, which combine the abovementioned transport mechanisms. For this study, the Soulsby – van Rijn formulation (Soulsby, 1997) were applied. The sediment transport parameters used in the formulation are ideally defined based on local field data. As data was limited at the time of undertaking this study, the default parameters provided in the UNIBEST software were adopted.

4.3.2.6 Shoreline Definition

UNIBEST-CL presents the position of the coastline using a single line, which is defined via two components: a reference line (that remains unmodified during the entire simulation) and the distance between this reference line and the coastline position at each time step. Therefore, Geographic Information System (GIS) software was used to establish the location of the reference line and the initial coastal position for St Francis Bay beach. The initial coastline was established as the 1 m CD contour.

A curvilinear grid was used in the model to distribute cross-shore profiles, which allows for higher resolution in the areas of interest, including the rock revetments and the sand spit. The shoreline model consisted of 167 grid points from the southern boundary to the northern boundary, stretching over a distance of approximately 3 km. The locations of the reference line, initial coastline position and computational grid applied in the model are shown in Figure 33.

Figure 33: Location map of the UNIBEST-CL reference line, initial coastline and computational grid for the shoreline model of St Francis Bay.

4.3.2.7 Existing coastal protection structures

The sandy beach at St. Francis Bay has suffered from significant erosion events over the past few decades. This has effectively reduced the beach width and threatened to undermine beach properties and infrastructure, which lead to the placement of rock revetments along the beach. These coastal protection structures, as depicted in Figure 34, have also been included in the model to derive the current shoreline situation.

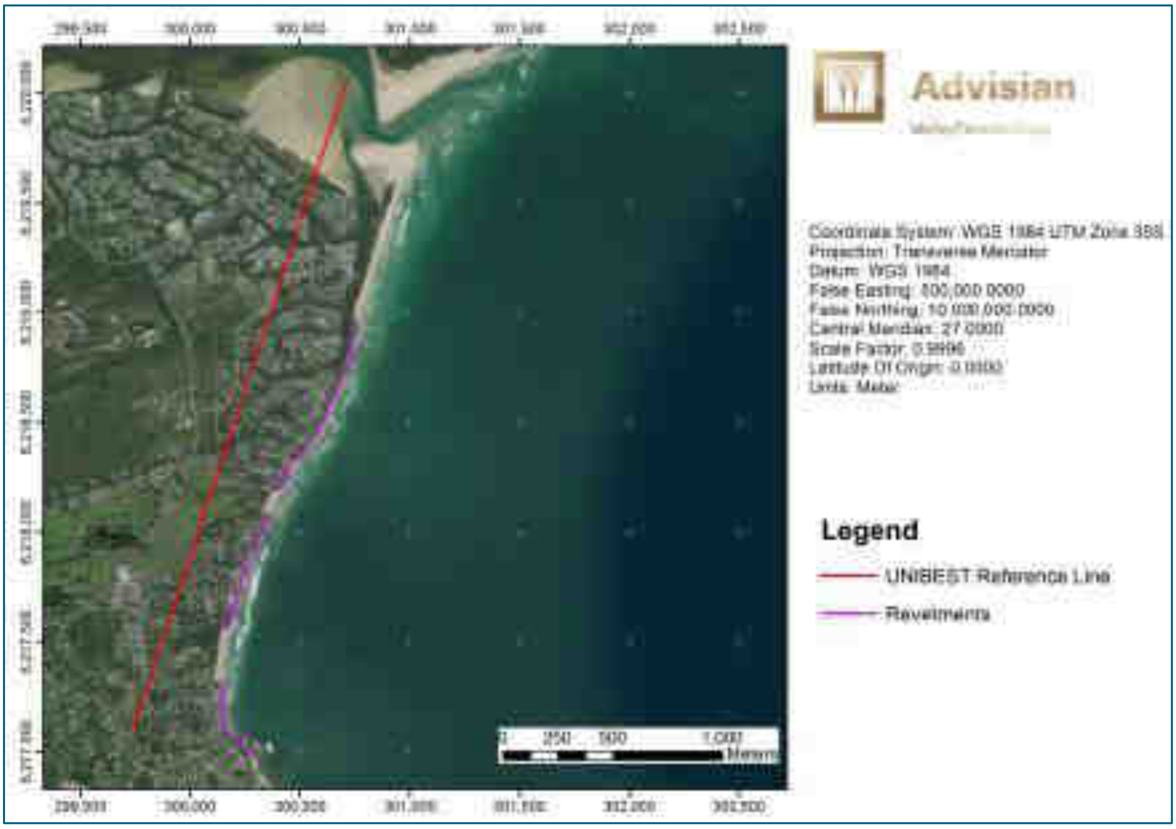

Figure 34: Location map of the UNIBEST-CL rock revetments for the shoreline model of St Francis Bay.

4.3.3 Shoreline Evolution Results (1975 – 2017)

A shoreline evolution assessment was undertaken to derive the initial changes in the shoreline position due to the estimated annual nearshore wave conditions along St. Francis Bay beach in combination with the existent rock revetments, as well as to test shoreline response to the preferred option (Section 6) for the long term coastal protection and sand retention structures.

The sediment transport along the coast is defined by the angle of incidence of the dominant wave direction and the energy in the waves. This information is computed in UNIBEST-LT module for the studied coastal stretch and then applied in the UNIBEST-CL module to determine the changes along the coastlines.

Figure 35 provides the shoreline evolution of St. Francis Bay beach for the 42 year modelling period considered (1975 – 2017).

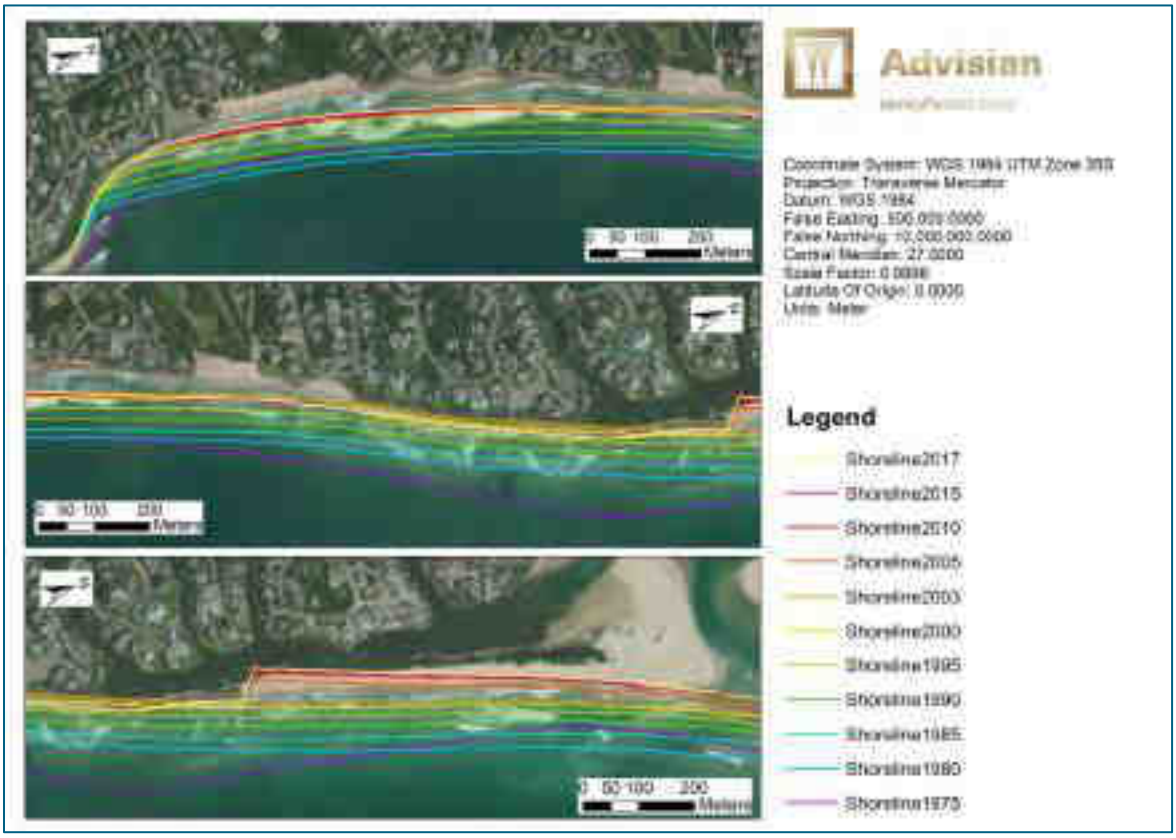

Figure 35: Simulated shorelines along St. Francis Bay for the considered simulation period (1975 – 2017).

The UNIBEST model for St Francis sufficiently represents the historical shoreline changes due to i) the reduction of available sand supply (damming of the Kromme River and stabilization of Santereme dunes) over the past decades and the effect of the constructed rock revetments.

5 Conceptual Options

During the project inception meeting held on 21st September 2017, updated costs and a multi criteria analysis was presented for the options provided in the WorleyParsons 2014 report. The options are listed in Table 18.

Table 18: Conceptual Options

Key	Option
A	Do-nothing
B	Beach nourishment only
C	Spit protection only
B+C	Beach nourishment + spit protection
B+D	Beach nourishment + single groyne
B+C+F	Beach nourishment + spit protection + offshore breakwaters
B+C+E	Beach nourishment + spit protection + groyne field
B+C+C_1	Beach nourishment + spit protection + revetment re-armouring at vulnerable locations
C+C_1	Spit protection + revetment re-armouring at vulnerable locations
B+D+F	Beach nourishment + single groyne + offshore breakwaters

During the inception meeting Advisian recommended and SFPO agreed to advance the following three options from the WorleyParsons 2014 report:

1. Beach nourishment
2. Beach Nourishment +Groynes
3. Beach Nourishment + Offshore Breakwaters

These options were presented during a Workshop meeting held on 29th November 2017 including two alternative groyne arrangement options.

The alternative arrangement options were developed based on a headland groyne approach offering better protection to the coastline than straight groynes and allowing slightly larges beach amenity areas to be developed near the groynes.

5.1 Option 1: Beach Nourishment

One of the least environmentally intrusive methods of protecting the St. Francis Bay coastline from further erosion is to artificially nourish the beach with sediment from suitable borrow sources. Beach nourishment or beach recharging involves the importation of sand to an eroding beach. Sand can be delivered to the beach by pipelines, trucks or dredgers. The placements of sand could be either directly on the dry beach or within the surf-zone. This additional sand will provide added protection against wave attack as waves will dissipate their energy before reaching the existing eroding area.

Figure 36: Beach nourishment (Source: https://www.dredgingtoday.com-)

Small beach nourishment operations were initiated in St. Francis Bay beach in 1996, where sand was dredged from the Kromme river estuary and supplied via a 150 mm flexible pipe to discharge locations on the beach. This system proved inadequate to make a significant improvement in beach nourishment and was abandoned.

The implementation of this option will require a large volume of initial nourishment (capital nourishment) to be placed on the beach to allow the creation of a sufficiently wide beach crest (Figure 37). This would provide both a beach amenity and provide a buffer for storm events. The likely source of sand for beach nourishment has still to be identified from a comprehensive sand source investigation (not part of the Advisian study), but is likely to include sourcing from the sand banks in the river mouth as was previously done. During a previous study in 2002 potential sand sources were identified upstream of the Kromme river estuary, the sand river and the remaining open dune fields at the south of Santareme that could be used for the nourishment of the beach (Entech, 2002).

It is strongly recommended that a comprehensive updated sand source investigation to be undertaken to verify the volume and suitability of the sand for beach nourishment and to apply for environmental approval.

Figure 37: Beach nourishment conceptual option

The preliminary estimate of sand volume required for beach nourishment for St Francis Bay shoreline is detailed in the sections below.

5.1.1 Depth of Closure

The depth of closure is defined as the seaward limit of the active beach profile (Birkemeier, 1985):

$$h_* = 1.75H_{s,12h/y} - 57.9\,\frac{H_{s,12h/y}^2}{gT_s^2}$$

Where $H_{s,12h/y}$ is the significant wave height exceeded on average 12 hours per year and T_s is the associated wave period. The depth of closure has been calculated based on the wave climate from the spectral wave model. The depth of closure is estimated as -4.6 m CD.

5.1.2 Nourishment Beach Profile

The beach profile used as input in the storm induced beach erosion simulations (Section 4.2) were adopted as the preliminary nourishment profile. A horizontal dry beach width of 40 m was adopted in the design, as confirmed by SFBHOA. This will allow for short term horizontal movement of the shoreline of 15 m (Section 3.2) and the estimated extreme storm induced erosion of 15 m (associated to the 100 year ARI event without SLR and the 1 year ARI event with SLR), thus maintaining a beach width of approximately 10 m.

The design nourishment beach profile is illustrated in Figure 38.

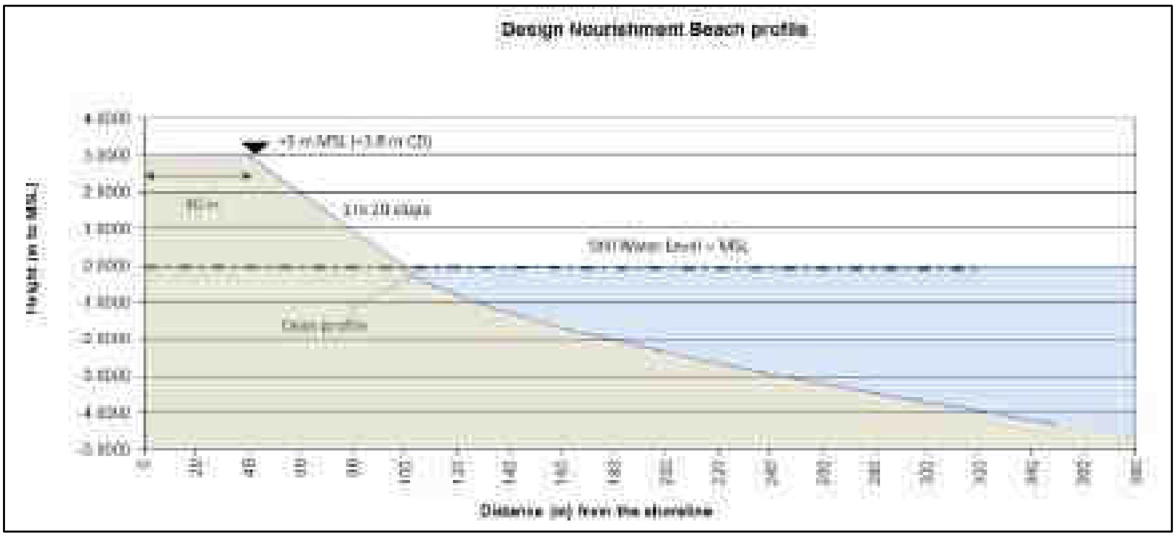

Figure 38: Design nourishment beach profile

5.1.3 Volume of Nourishment

The beach profile adopted in the storm induced beach erosion simulations (Section 4.2.3) were adopted as the preliminary nourishment profile.

The volume of beach nourishment was estimated based on the Equilibrium Beach Profile (EBP) methodology (Dean, 1991), assuming the nourishment grain size to be similar to that of the native sand (Figure 39):

$$\Delta y = \frac{V}{h_* + B}$$

where

- V = Volume of nourishment
- Δy = horizontal width of nourished material
- h_* = depth of closure
- B = berm height measured from the mean water level to the crest of the beach

Surf zone width W_* is the horizontal distance from the beach crest to the depth of closure.

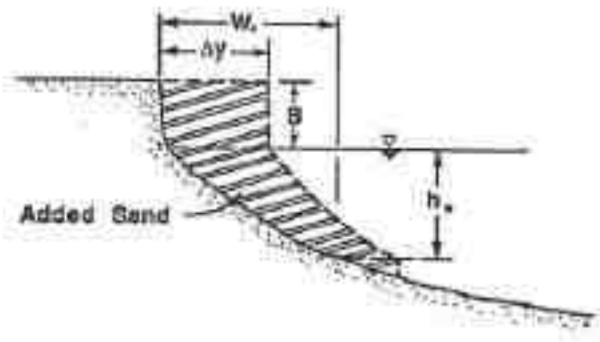

Figure 39: Non-intersecting profiles (Dean, 1991)

The approximate volume of sand require per linear metre of beach length for various crest widths is provided in Table 19.

Table 19: Estimated Volume of nourishment required

Crest width (m)	Volume of Sand (m^3)/m
20	168
30	252
40*	**336**
50	420
60	504

***Preliminary design beach profile**

For the preliminary design beach profile with a crest width of 40 m, the estimated volume of sand is 336 m^3/m.

Note that the volumes shown in Table 19 do not account for potential overfill required if the nourishment sand differs from the native beach or if the fines are washed away during placement. Overfill could increase the nourishment volumes required by up to 40%.

It is also noted that if the sourced sand is finer than the native beach, it would result in a gentler beach profile and require larger volumes of nourishment to achieve the same beach crest width as coarser sand (Dean, 1991).

5.1.4 Summary

The net long term coastline retreat was found to be relatively gradual over most of the coastal frontage (approx. 1m-3m/year). Based on international experience an intervention of beach nourishment to restore the historical wider beach would be considered a feasible solution. This option, which obviates the incorporation of coastal structures, is the least aesthetically intrusive and would have minimal environmental impacts if properly implemented. In order for this solution to be successfully executed, adequate large scale initial "capital" nourishment will be required with regular beach maintenance to maintain the beach width.

5.2 Option 2: Groyne Field and Nourishment

The conceptual layout for groyne field in combination with beach nourishment is illustrated in Figure 40. The methodology and estimated dimensions for this layout is presented in the sub-sections that follow.

5.2.1 Methodology

The groyne field layout was developed based on the available site information, CEM (USACE, 2002) and (Van Rijn, 2013) guidelines. The CEM states that the main parameters to define a groyne field are:

- Length
- Elevation
- Porosity
- Orientation
- Spacing
- Sediment characteristics
- Wave and currents

Although groynes have been around a long time and many references exist, most only provide a few rules of thumb:

- Groynes function best on beaches with pre-dominant longshore transport direction
- Groyne spacing should be about two to four times the groyne length
- Groyne fields should be filled (nourished)
- Sand by-passing depend on groyne length, permeability and elevation
- Groynes offer little reduction in wave energy to shore-normal waves during storms
- The width of the crest should not be smaller than 3m and at least 0.5m above MSL to allow the passage of construction equipment
- For the root of the groyne, the crest level should be approximately 0.5m above the required beach level

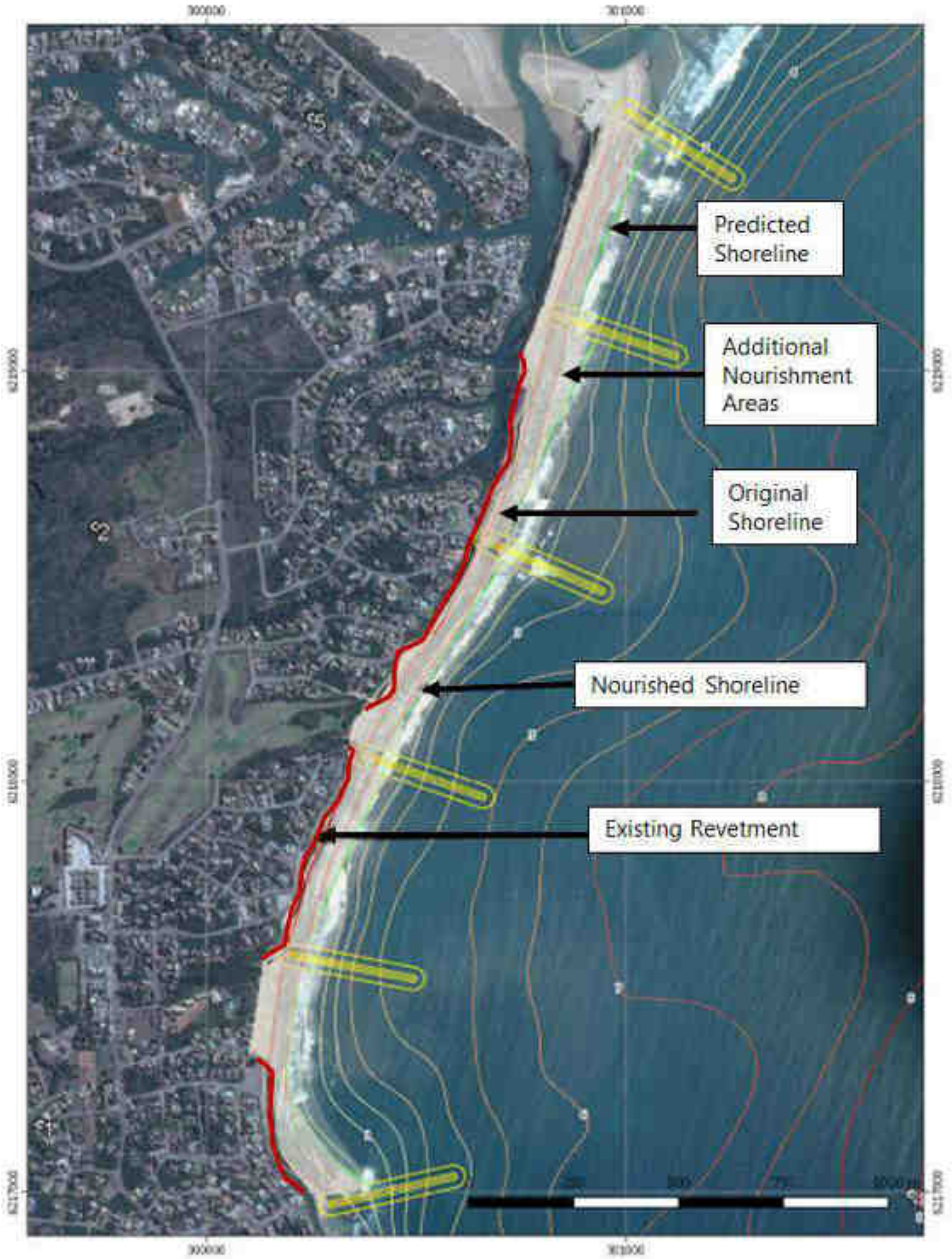

Figure 40: Groyne conceptual layout

The key variables adopted for the layout development are illustrated in Figure 41 and defined in Table 20.

Table 20: Definition of groyne key variables

Abbreviation	Definition
X_g	Groyne spacing
Y_g	Cross-shore distance from nourished shoreline to tip of groyne
W	Design beach width

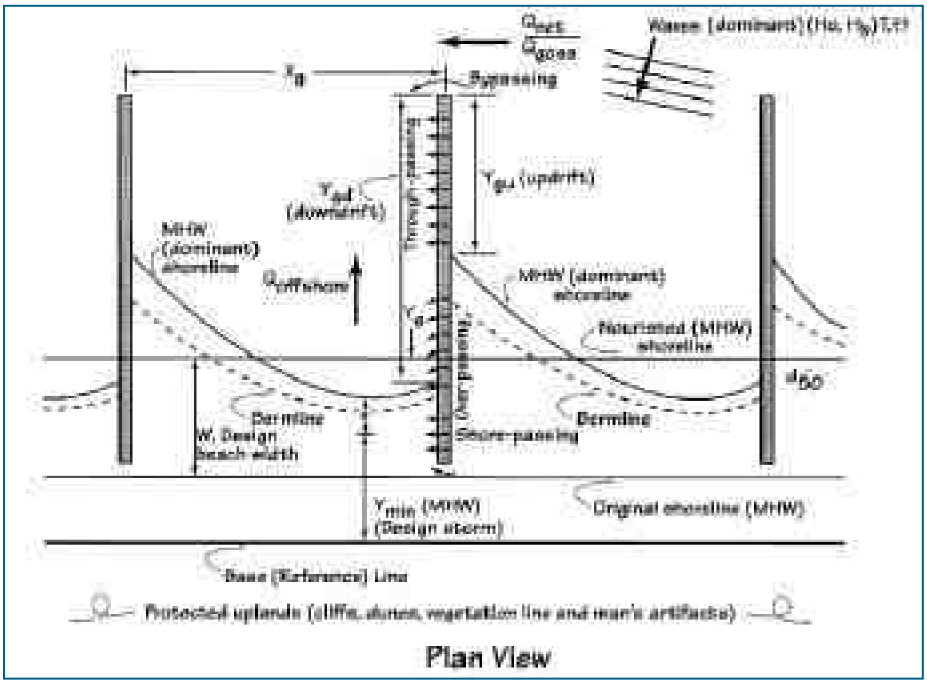

Figure 41: Definition sketch of groyne key variables. Source: (USACE, 2002)

5.2.2 Layout Dimensions

The tip of the groynes was established within the active profile at a seabed elevation of approximately -4.0 m CD in order to allow some sediment by-pass and reduce overall costs.

A groyne length of 300 m and spacing between breakwaters of 600 m (2 times the groyne length) was adopted in the conceptual layout. The actual groyne layout (length and spacing) was adjusted based on the bathymetric information and shoreline constraints. The groyne lengths could potentially be optimised through shoreline modelling in subsequent stages.

Initial beach nourishment of 40 m would be placed widening the back of the beach and additional nourishment would be added to form the expected coastline response. This would reduce the possible erosion of the coastline as it responds to changes to the wave climate caused by the structures.

5.2.3 Summary

These structures would require a large volume of rock and would require additional site investigations such as physical modelling to verify their adequacy and stability. The structures are not well suited for low cross-shore sediment transport and currents induced near the groynes may remove sediment from the littoral drift zone. These structures are mainly used when the wave direction is oblique to the shoreline and where sediment transport is longshore dominant. This solution is not considered to be the most efficient solution for St Francis Bay's coastline.

5.3 Option 3: Detached Breakwaters and Nourishment

The conceptual layout for detached breakwaters in combination with beach nourishment is illustrated in Figure 42. The methodology and estimated dimensions for this layout are presented in the sub-sections that follow.

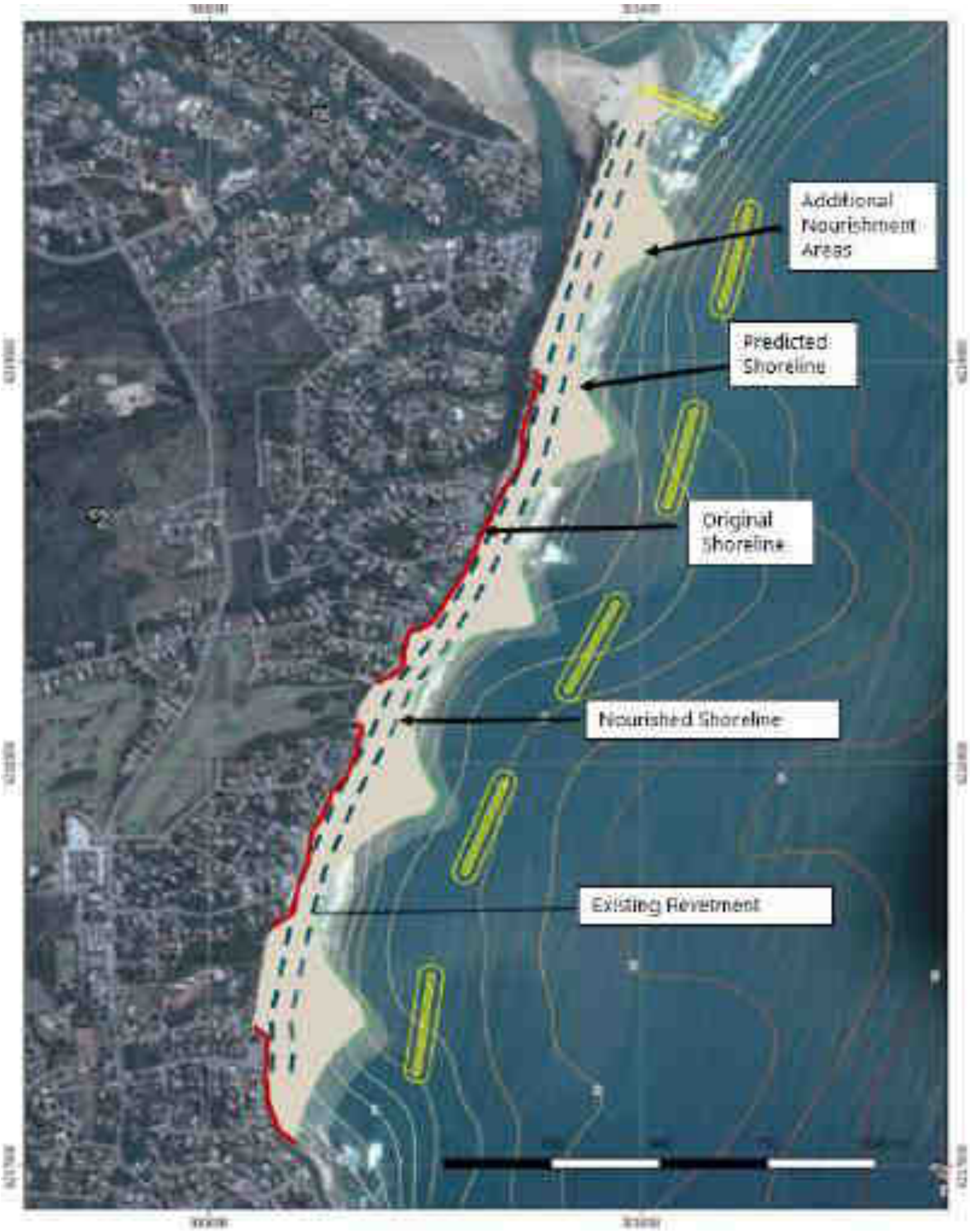

Figure 42: Detached breakwater conceptual layout

5.3.1 Methodology

The detached breakwater layout was developed based on the available site information, the UK Environment Agency (Environment Agency UK, 2010) and CEM (USACE, 2002) guidelines. The predicted shoreline planform shape was obtained with MEPBAY (Klein, 2003) which determines the equilibrium beach alignment based on the parabolic bay-shape equations.

MEPBAY (Klein, 2003) calculates the idealized shoreline planform of a headland-bay beach in static equilibrium based on the parabolic model. It then presents the results graphically on a screen display overlaying the image of the existing beach. It thus allows the stability of a headland-bay beach to be assessed visually by comparing the existing shoreline periphery with the static equilibrium planform. The software offers a friendly environment from simple input to instant visualization of the results. MEPBAY not only helps students understand the morphological process, but also provides engineers with a valuable tool for practical applications on shoreline protection and coastal management.

The final layout was adjusted based on previous experience and engineering judgment. The key variables adopted for the layout development are illustrated in Figure 43 and described in Table 21.

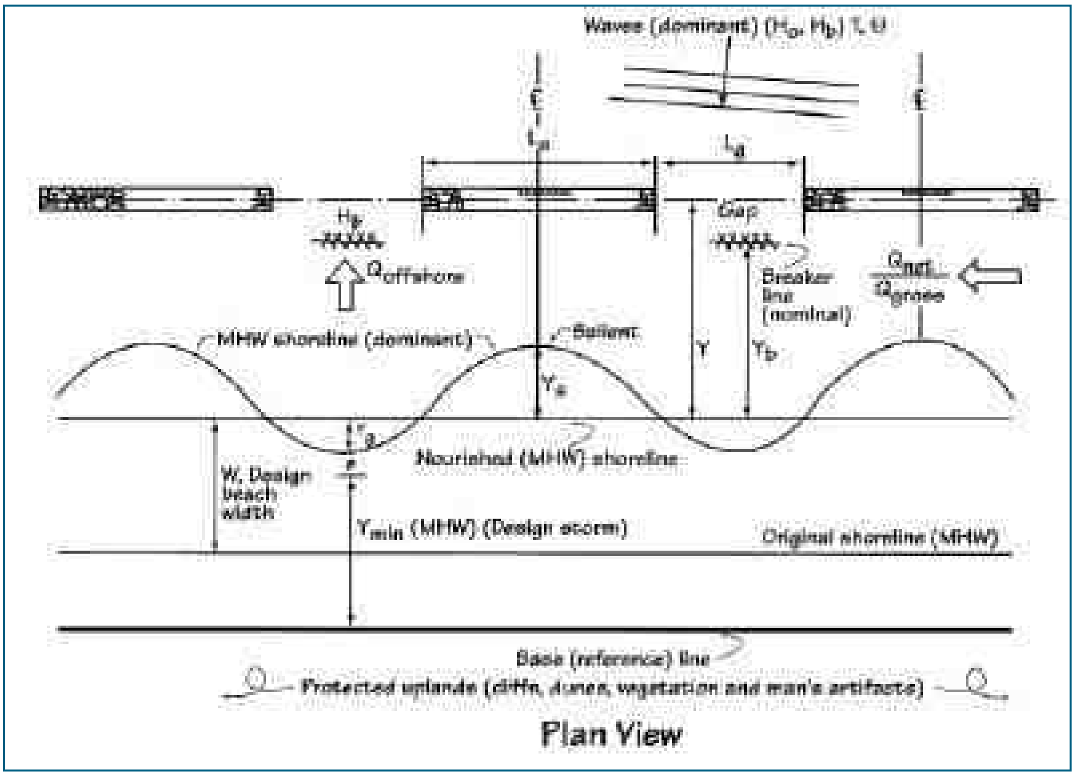

Figure 43: Definition sketch of nearshore breakwater key variables. Source: (USACE, 2002)

Table 21: Definition of nearshore breakwater key variables

Abbreviation	Definition
L_S	Length of breakwater
L_G	Gap, distance between two adjacent breakwaters
Y	Cross-shore distance from shoreline to breakwater
Y_B	Cross-shore distance from shoreline to breaker line
Y_S	Salient size
W	Design beach width
d_S	Depth at breakwater structure

5.3.2 Layout Dimensions

A summary of the input and output parameters for the detached breakwater main dimensions are presented in Table 22. It was decided to keep the structure within the active profile at a seabed elevation of approximately -4.0 m CD in order to allow some sediment by-pass and reduce overall costs.

Table 22: Input and output parameters for the detached breakwater solution

Parameter	Abbreviation	Unit	Value	Notes
Significant wave height exceeded 12h/y	$H_{m0\ 12h/yr}$	m	3.4	Based on wave climate
Peak wave period	T_P	s	9.0	Based on wave climate
Breakwater Location				
Depth of closure	d_C	m CD	-4.6	-
Distance from beach crest to depth of closure	Y_{dc}	m	450	Based on typical profile
Distance from shoreline to structure	Y	m	300	Based on typical profile
Depth at structure location	d_S	m CD	-4.0	Assumed
Breakwater length and accretion				
Structure length/distance from shoreline to structure	L_S/Y	-	0.8	For salient formation
Structure length	L_S	m	240	-
Gap width/distance from shoreline to structure	L_G/Y	-	0.80	To avoid erosion within the embayment
Gap width	L_G		240	-

The configuration results in a detached breakwater located 300 m from the nourished shoreline with a length of 240 m and a gap between breakwaters of 240 m. This configuration was tested in MEPBAY and the final configuration is presented in Figure 42.

5.3.3 Summary

The offshore breakwater structures would provide a high level of coastal protection and retention of sediment on the beaches. It would however require large and costly structures which would be environmentally intrusive and have a negative aesthetic impact on the coastline. Additionally it would require further site investigations and physical modelling to confirm the stability of the structures. This option would require a significant volume of sediment, making it “sand hungry”, and would be complex to construct due to the need for offshore marine equipment. While this option is considered to be excellent for coastal protection, financial demands and the long environmental study and construction durations makes this option less favourable for implementation.

5.4 Alternative Beach Nourishment Options: Headland Structures and Nourishment

As noted above although beach nourishment alone is a possible solution for St Francis Bay it will require regular beach maintenance. The determination of this nourishment quantity will need further study in the detailed design stage, at which point it is expected to have further information on available sand sources.

Advisian took the initiative to investigate possible alternatives to Option 1, whereby shoreline structures smaller than the groyne configuration (Option 2) are introduced to try to reduce the rate of sand loss and consequent maintenance nourishment. Also investigated was the benefit of restricting initial & maintenance nourishment to specific shoreline sections where the implementation is most beneficial. It needs to be clear that such options will not eliminate the need for ongoing maintenance nourishment. As depicted in (Figure 44) below two conceptual layouts were developed for so called headland structures in combination with beach nourishment:

- Option 1A: relatively long rock groynes angled obliquely to the predominant wave direction;
- Option 1B: shorter groynes.

The methodology and layout dimensions for the two options are described in the sub-sections that follow.

Figure 44: Headland and beach nourishment layout options

5.4.1 Methodology

No specific guidance exists for the development of a headland system. CEM (USACE, 2002) recommends using the parabolic bay-shape equations to determine embayment equilibrium shape. The layout was developed using MEPBAY (Klein, 2003) which determines the equilibrium beach alignment based on the parabolic bay-shape equations. A definition sketch of a headland system is presented in Figure 45.

Two options have been developed for this concept and are presented in 5.4.2 and 5.4.3.

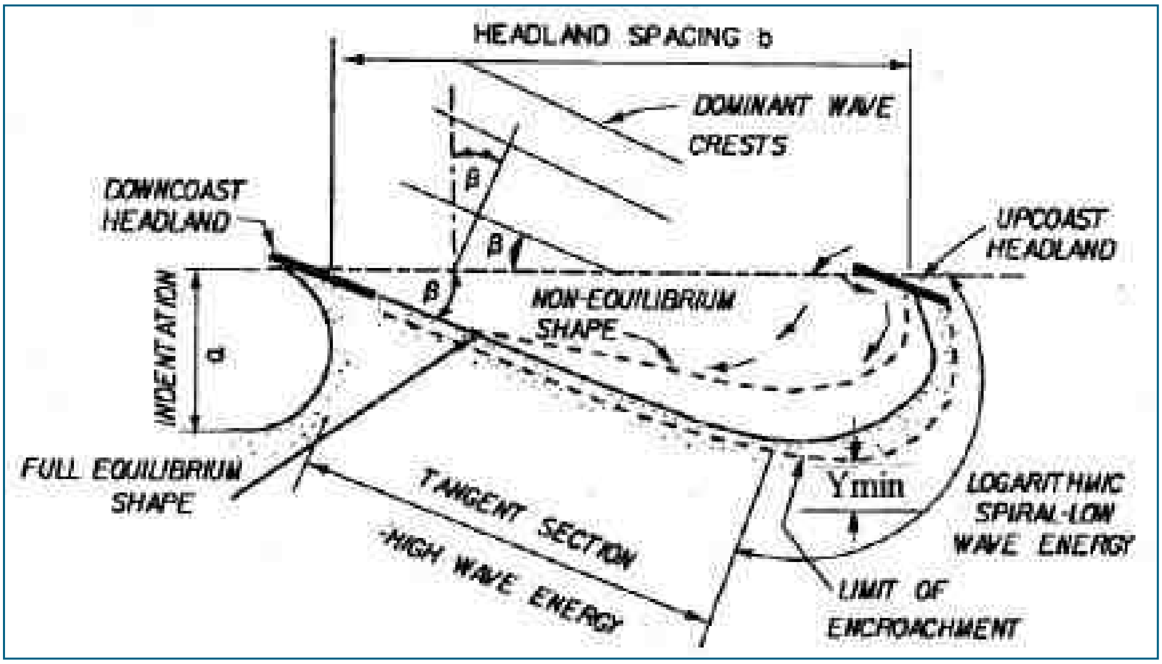

Figure 45: Definition sketch of artificial headland system. Source: (USACE, 2002)

5.4.2 Option 1A

This option provides rock groynes with similar overall length to Option 2, however, the groynes are angled obliquely to the predominant wave direction. The structures therefore terminate in shallower water than Option 2 (at approximately -3 m CD) and are expected to allow some sediment to bypass the cells. By terminating in shallower water the headland groynes have less volume and are therefore less costly and intrusive than the groyne option. They are also expected to have some advantages in retaining sediment in key areas of the frontage. The headland field conceptual layout for St. Francis bay is presented in Figure 46.

For this option beach nourishment of 40 m would also be placed widening the back of the beach and additional nourishment would be added to form the expected coastline response.

Figure 46: Headlands conceptual layout – Option 1A

5.4.3 Option 1B

The second option consists of much shorter stub groynes which terminate at an approximate depth of -2 m CD or shallower. More sediment would bypass this Option 1B than Option 1A however the groynes should require less material and have a shorter construction duration than Option 1A. The second headland field conceptual layout for St. Francis bay is presented in Figure 47.

Beach nourishment would be placed between the groynes as shown in Figure 47. It is advised not to reclaim the central section of the coastline as highlighted since the coastline orientation of the central section does not lend itself to a stable beach orientation. This area was found to be a divergence point for the sediment transport with sediment moving at the northern section to north and the southern section to the south. If this area needs to be protected and a beach reinstated, a T-shaped groyne structure may need to be constructed near the centre of this area.

5.4.4 Summary

Option 1B is considered to be more suitable than Option 1A as it is less costly, could be implemented more easily in a phased approach, would require shorter construction duration and is less environmentally intrusive.

It needs to be noted that the shoreline configurations depicted above are purely conceptual, based on engineering judgement and not coastal modelling. Although shoreline configurations of the selected option can be somewhat better assessed in the detailed design phase, there are limitations in the numerical and empirical modelling of such solutions. If such options are adopted there is benefit in phasing the implementation to effectively test effectiveness of an initial structure in prototype.

Figure 47: Headlands conceptual layout – Option 1B

5.5 Options Comparison

5.5.1 Cost comparison and Schedule

During the workshop meeting high level cost estimates and the expected construction durations for the aforementioned options were presented (refer to Table 23 below).

Rock for the groynes and breakwaters could either be sourced locally near Humansdorp or imported to St Francis from quarries near Port Elizabeth. It is known that the local quarry produces rock which has a tabular shape and may not be suitable for the marine structures or may require the designs to be adjusted. Further investigations will need to be undertaken to determine the suitability of the rock produced at the quarries. For the cost comparison it was assumed that the rock would be sourced from local quarries.

Table 23: Cost and schedule comparison

Option	Cost[5]	Construction Duration (months)
1: Beach Nourishment	R72,000,000	16
1A: Beach nourishment + Headland Option1A	R174,000,000	30
1B: Beach nourishment + Headland Option 1B	R86,000,000	23
2: Beach nourishment + Groyne fields	R191,000,000	26
3: Offshore breakwaters	R363,000,000	58

The most cost effective option is beach nourishment only. This option would however require more maintenance than the other options. The most expensive option is the offshore breakwaters which offers the best level of coastal protection and would require the least maintenance.

For assumptions used for the cost estimate refer to section 6.6.

[5] Rock prices are based on a quotation received from the nearby SupaCrush Quarries, with no guarantee of rock suitability (size, shape and material) for marine construction.

5.5.2 Advantages and Disadvantages

A summary of the advantages/disadvantages for each option described in the previous sections is presented in Table 24.

Table 24: Summary of advantages/disadvantages for each option

OPTION	ADVANTAGES	DISADVANTAGES
1. Nourishment Only	Soft solution (no hard structures) More economical compared to "hard" structures Simple construction Aesthetically attractive Least environmental impact	Sand expected to be lost more rapidly Highest maintenance requirement Initial high levels of erosion
2. Groyne Field and Nourishment	Contains sediment in compartments, limits loss of sediment from St Francis Bay system	Expensive Not suited for near perpendicular wave attack Can induce local currents Can cause downdrift erosion Interrupts traversing of beach
3. Detached Breakwaters and Nourishment	High level of coastal protection Less beach maintenance expected	More complex constructability Larger volumes of sand nourishment required Large visual impact May cause hazardous rip currents Expensive High level of environmental impact
1A. Headland Structures and Nourishment	Moderate level of coastal protection Additional area behind headland would be protected and could be used to create amenity features Angled alignment ensures some beach areas would be stable Offers both partial longshore and cross-shore transport control	Some beach maintenance required Expensive Can induce local currents Moderate environmental impact
1B. Headland Structures and Nourishment	More economical than Option 1A, 2 and 3. Angled alignment ensures some pockets will be stable Low environmental impact Staged approach	Low level of coastal protection Beach maintenance required Sand in some stretches of coast will not be retained by coastal structures

5.6 Workshop Recommendation & Preferred Option

Given all the considerations presented above, including a relatively low long term recession rate, Advisian recommended the following:

Beach nourishment (Option1) to establish a beach width of approximately 40 m. Following the initial capital nourishment operation regular beach maintenance would still be required;

An alternative recommended intervention would be:

Headlands (Option 1B). This option could be implemented in various stages to evaluate performance & as finances become available. This option would still require regular beach maintenance, however, the short stub groynes would somewhat reduce the beach maintenance required.

The consensus from the November workshop was that the latter option would be adopted, with the SFPO requesting that consideration be given to a staged solution, with an associated proposed sequence of implementation. Five (5) areas were identified as shown in Figure 48 with the fifth area being optional as this area is deemed to be unstable and not suitable for beach nourishment.

Area 1	Area 2	Area 3	Area 4	Area 5 (optional)
650m beach nourishment 2x 200m groynes	300m beach nourishment 2x 170m groyne	300m beach nourishment 2x 170m groynes	400m beach nourishment	650m beach nourishment

Possible staged implementation of Headlands Options 2 is shown in Figure 48:

Figure 48: Staged implementation of Headlands Option 1B

The agreed preferred option was implementing nourishment and stub groyne structures in area 1 near the Spit. The solutions for the other areas would be implemented as and when finances become available.

As the stub groynes will not extend to the full depth of closure and exact shoreline response is difficult to quantify through modelling, a staged approach will represent an excellent opportunity to evaluate the effectiveness of the stub groyne measures. By monitoring effectiveness of the initial stage in prototype, modifications could be made to subsequent areas prior to their implementation.

Notwithstanding the initiation of beach restoration measures in area 1 the current Advisian advice is that shore armouring in the Spit area will still be required. This relates in part to the extent of time required to obtain environmental approvals & construct the solution, whereas permits are already approved for Phase 1 type shore armouring in this area.

Advisian would need to carry out a separate study to better understand the implications of no dune armouring as well as implementation delays such as extended environmental approval periods and a staged nourishment exercise in Area 1.

6 Preliminary Design

This chapter presents the preliminary design of the preferred option. The general layout, beach nourishment, staged implementation, expected costs, construction programme and the hydraulic stability calculations for the preferred solution is discussed.

Three typical sections have been developed for groynes at seabed levels of -2 m CD, -1 m CD and for the back of the beach. An intermediate damage level, S_D, was adopted since groynes are not critical structures and will perform its functional requirements even in case of some damage.

The crest level was defined at +2.1 m CD (HAT) in order for the groynes to be constructed using land based plant. The width of the crest is defined as $3xD_{n50}$ rocks as per recommendations of (CIRIA/CUR/CETMEF, 2007) and (USACE, 2002).

The concept layout of the staged development as shown in Figure 48 above was further developed during the preliminary design. Coastal modelling demonstrated that the southernmost groyne of the second stage was not overly beneficial, hence this structure was removed as shown in Figure 49 below. The effectiveness of the single groyne would need to be monitored during the implementation of this stage and the need for the second groyne would be re-evaluated during the implementation of the third stage.

Figure 49: Revised staged solution

6.1 Beach nourishment

A minimum horizontal dry beach width of 40 m was adopted in the design. The nourishment design beach profile is shown in Section 5.1.2, Figure 38. This will allow the short term horizontal movement of the shoreline of 15 m (Section 3.2) and the estimated extreme storm induced erosion of 15 m while maintaining a minimum beach width of approximately 10 m.

6.2 General Layout

The general layout plan were developed using the results from the lonshore numerical modelling and guidelines provided in the (USACE, 2002), (CIRIA/CUR/CETMEF, 2007) and (Van Rijn, 2013). The preliminary design layout drawing are included in Appendix A.

Figure 50: General Layout Plan (Appendix A)

The tips of the groynes are within the surf zone allowing for some sand bypassing of the structure. The groynes are spaced approximately two to three times their length apart. To present outflanking of the groynes during storm events the root of the groynes are extended to the back of the beach.

Beach nourishment will be placed between the groynes and is extended 50 m further on either side of the groynes in order to reduce possible further erosion of the adjacent unnourished downstream beaches.

6.3 Rock Groynes

The rock groynes are designed to have three distinct sections with the rock armour increasing as the groynes advance into deeper water and encounter larger wave conditions. The sections are applied to the following water depths:

1. Section A: Between back of the beach until 0 m CD (shown in Figure 51)
2. Section B: Between 0 m CD until -1 m CD (shown in Figure 52)
3. Section C: Between -1 m CD until -2 m CD (shown in Figure 53)

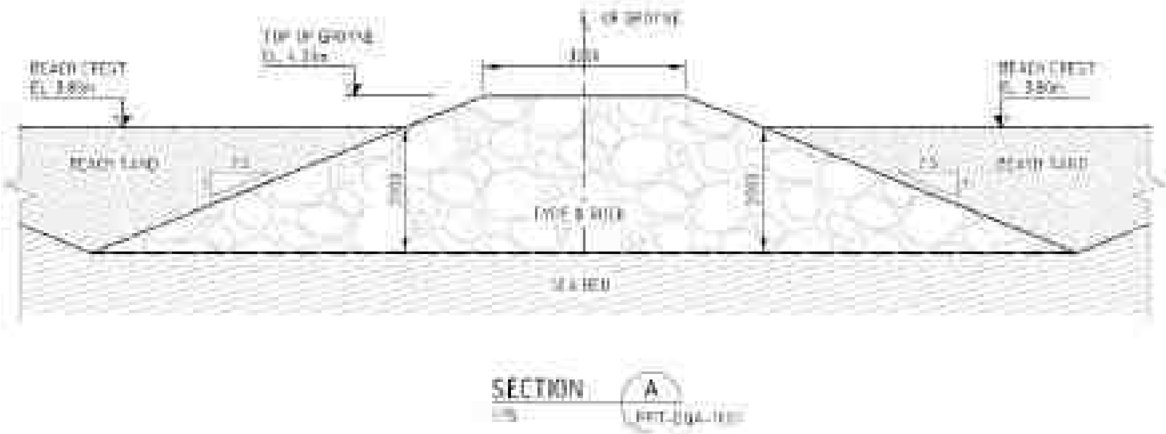

Figure 51: Groyne Section A

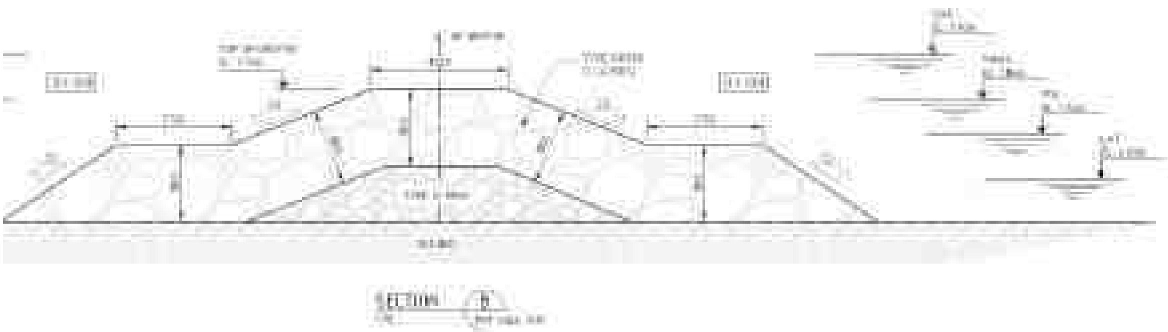

Figure 52: Groyne Section B

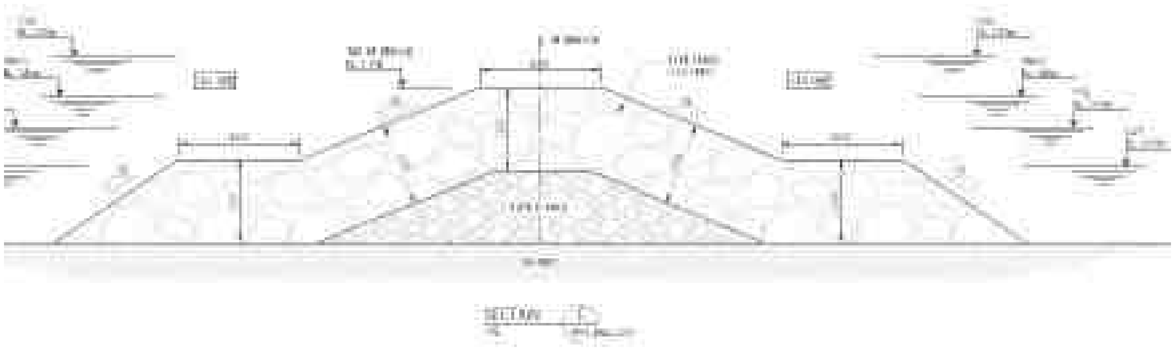

Figure 53: Groyne Section C

For more detail of the sections please refer to the drawing in Appendix A.

6.4 Armour Stability

Armour stability was calculated based on the Van der Meer deep water equations and the Van der Meer and Van Gent shallow water equations (CIRIA/CUR/CETMEF, 2007).

6.4.1 Section at -2 m CD

The input design parameters for the rock armour stability calculation are listed in Table 25. The required median rock size is 3,176 kg. A non-standard rock grading of 2.2 to 4.6 tonne (TYPE I) will therefore be stable.

The grading will be refined during detailed design based on the availability of rock from the local quarries and guidelines provided in The Rock Manual.

Table 25: Rock armour design parameters – Section at -2.0 m CD

Parameter	Abbreviation	
Seabed elevation	h	-2.0 m CD
Design High Water Level	DHWL	+2.9 m CD
Spectral significant (breaking) wave height	H_{m0}	3.0 m
Significant wave height	H_S	3.1 m
2% exceedance wave height	$H_{2\%}$	3.8 m
Spectral wave period	$T_{m-1,0}$	10.8 s
Density of sea water	ρ_s	1,025 kg/m^3
Density of rock	ρ_r	2,650 kg/m^3
Number of waves in 6h	N	2178
Damage parameter	S_d	5
Notional permeability	P	0.4
Water depth at toe of structure to significant wave height ratio	h_t/H_s	[1.6<3] (Shallow water)
Armour slope	cot α	1V:2.5H
Median rock mass	$\mathbf{W_{50}}$	**3,176 kg**

6.4.2 Section at -1 m CD

The input design parameters for the rock armour stability calculation are listed in Table 26. The required median rock size is 1,920 kg. A non-standard rock grading of 1.3 to 2.8 tonne (TYPE II) will therefore be stable.

The grading will be refined during detailed design based on the availability of rock from the local quarries and guidelines provided in The Rock Manual.

Table 26: Rock armour design parameters – Section at -1.0mCD

Parameter	**Abbreviation**	
Seabed elevation	h	-1.0 m CD
Design High Water Level	DHWL	+2.9 m CD
Spectral significant (breaking) wave height	H_{m0}	2.4 m
Significant wave height	H_S	2.48 m
2% exceedance wave height	$H_{2\%}$	3.04 m
Spectral wave period	$T_{m-1,0}$	10.7 s
Density of sea water	ρ_s	1,025 kg/m^3
Density of rock	ρ_r	2,650 kg/m^3
Number of waves in 6h	N	2178
Damage parameter	S_d	5
Notional permeability	P	0.5
Water depth at toe of structure to significant wave height ratio	h_t/H_s	[1.6<3] (Shallow water)
Armour slope	cot α	1V:2.5H
Median rock mass	$\mathbf{W_{50}}$	**1,920 kg**

6.4.3 Section at 0 m CD

The input design parameters for the rock armour stability calculation are listed in Table 26. The required median rock size is 650 kg. A non-standard rock grading of 500 kg to 900 tonne (TYPE III) will therefore be stable.

The grading will be refined during detailed design based on the availability of rock from the local quarries and guidelines provided in The Rock Manual.

Table 27: Rock armour design parameters – Section at -1.0 m CD

Parameter	Abbreviation	
Seabed elevation	h	0.0 m CD
Design High Water Level	DHWL	+2.9 m CD
Spectral significant (breaking) wave height	H_{m0}	1.8 m
Significant wave height	H_S	1.86 m
2% exceedance wave height	$H_{2\%}$	2.28 m
Spectral wave period	$T_{m-1,0}$	10.7 s
Density of sea water	ρ_s	1,025 kg/m^3
Density of rock	ρ_r	2,650 kg/m^3
Number of waves in 6h	N	2178
Damage parameter	S_d	5
Notional permeability	P	0.5
Water depth at toe of structure to significant wave height ratio	h_t/H_s	[1.6<3] (Shallow water)
Armour slope	cot α	1V:2.5H
Median rock mass	$\mathbf{W_{50}}$	**650 kg**

6.4.4 Toe and apron stability

The toe armour is designed the methods as presented in (CIRIA/CUR/CETMEF, 2007) using the lowest non-zero proposed value of the damage parameter, N_{od} = 0.5, corresponding to the "start of damage". The apron is designed taking N_{od} = 2, corresponding to "some reshaping of the berm". The toe width was defined as 3 x D_{n50} rocks.

The required toe stability median rock size was found to be less than the median rock size required for the primary armour. In order to reduce the complexity during the construction it was decided to keep the toe armour the same as the primary armour.

6.5 Estimated Quantities

The approximate quantities of material required for the preliminary design is provided in Table 28 below.

Table 28: Estimated quantities

Option	Rock W50= 3.2t (m^3)	Rock W50= 1.92t (m^3)	Rock W50= 650kg (m^3)	Rock Core (m^3)	Sand (m^3)
Complete Solution	13,750	9,900	11,300	6,600	854,000
Area 1	5,500	3,300	4,700	2,200	379,000
Area 2	2,750	1,650	2,350	1,100	250,000
Area 3	5,500	3,300	4,700	2,200	205,000
Area 4					134,000
****Area 5 (Optional)**					218,000

* The Complete Solution excludes the development of Area 5.

**Area 5 may experience high levels of erosion and require significantly more beach maintenance than the other 4 areas. This area is not recommended for further development.

6.6 Cost Estimates

The cost estimates are provided in Table 29 for both a staged and non-staged approach. Rock could either be sourced locally near Humansdorp or imported to St Francis from quarries near Port Elizabeth. It is known that the local quarry produces rock which has a tabular shape and may not be suitable for the marine structures or may require the designs to be adjusted. Further investigations will need to be undertaken to determine the suitability of the rock produced at the quarries. For the cost estimate it was assumed that the rock would be sourced from local quarries.

Table 29: Cost Estimate

Option	Cost[6]
***Complete Solution**	R89,000,000
Area 1	R38,000,000
Area 2	R24,000,000
Area 3	R26,000,000
Area 4	R11,000,000
****Area 5 (Optional)**	R17,000,000

* The Complete Solution excludes the development of Area 5.

** Area 5 may experience high levels of erosion and require significantly more beach maintenance than the other 4 areas. This area is not recommended for further development.

It may cost between 10-15% more to implement the solution in stages rather than one complete solution. Additional costs due to inflation must also be considered.

It should be noted that the following assumptions were made in preparing the preliminary cost estimate:

- All rates are exclusive of VAT
- Sand pumping rate to the beach: R 58.85/m^3
- Supply of rock to site (larger than 1t): R 266/t
- Supply of rock (smaller than 1t): R 171/t
- P&Gs: 10%
- Contingency: 10%

[6] Rock prices are based on a quotation received from the nearby SupaCrush Quarries, with no guarantee of rock suitability (size, shape and material) for marine construction.

6.7 Construction Duration

The approximate construction duration for the various areas are provided in the Table 30 below. The groyne construction and nourishment would be undertaken concurrently.

Table 30: Estimated Construction Duration

Option	Lead time (months)	Mobilisation (months)	Groyne Construction (months)	Nourishment (months)	Demobilisation (months)	Total Construction Duration (months)
***Complete Solution**	3	2	7	16	2	**23**
Area 1	2	1	3	8	1	**12**
Area 2	2	1	2	5	1	**9**
Area 3	2	1	3	4	1	**8**
Area 4	2	1		3	1	**7**
****Area 5**	2	1		5	1	**9**

* The Complete Solution excludes the development of Area 5.

**Optional Area which may experience high levels of erosion and require significantly more beach maintenance than the other 4 areas. This area is not recommended for further development.

7 The Way Forward

This report presents the preliminary design for St. Francis coastal protection project. It includes the basis of design used to undertaken the design and modelling of coastal protection solutions.

Several layout options were identified and evaluated for suitability to provide a beach amenity at St Francis Bay. The preferred layouts and shore configurations were at this stage derived based on empirical formulations, initial numerical modelling and engineering judgement. The preferred layout will be further assessed during the detailed design with more refined numerical modelling of shoreline evolution behaviour.

Typical beach profiles and coastal structure cross-sections were developed based on the available information with the purpose of providing information for costing. The structural sections will be further developed in the detailed design stage based on:

- Material availability;
- Constructability;
- High resolution bathymetry data, if required;
- Bed geotechnical characteristics (if available)

Way forward:

1) Update sediment transport modelling;
2) Detailed design of rock groynes (based on available topography / bathymetry);
3) Update beach nourishment design based on sand source investigation (to be undertaken by SFPO);
4) Updated beach nourishment volumes based on existing topography / bathymetry;
5) Produce detailed design drawings.

The following additional studies and investigations will be required in order to complete the detailed design and/or prior to the construction of the preferred solution which is not part of current study:

a) Detailed bathymetric survey, if required;

b) Shore protection design of spit area;

c) Suitability study of rock sources;

d) Sand source investigation;

e) Environmental Impact Assessment.

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Appendix A Drawings

FOR INFORMATION ONLY AND NOT TO BE USED FOR CONSTRUCTION

GENERAL ARRANGEMENT

1:4000

LEGENDS:

- PREDICTED SHORELINE (green line)
- ORIGINAL SHORELINE (red line)
- EXISTING REVETMENT (black line)

NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. ALL ELEVATIONS ARE IN METRES AND RELATIVE TO CHART DATUM (CD).
3. THE PREDICTED SHORELINE IS INDICATIVE ONLY AND MAY VARY SIGNIFICANTLY.

m 0 50 100 200m

1:4000

FOR INFORMATION ONLY	✓
PRELIMINARY	
FOR APPROVAL	
FOR TENDER PURPOSES	
FOR CONSTRUCTION	
AS BUILT	

REV	DATE	REVISION DESCRIPTION	DRAWN	DESIGNED	REV ENGINEER
A	09/01/2018	FOR INFORMATION ONLY	PERM	SANP	AVRP

CONSULTING ENGINEER

DATE

CLIENT

DATE

0 10 20 30 40 50 60 70 80 90 100

100mm ON ORIGINAL PLAN

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

CLIENT

ST FRANCIS PROPERTY OWNERS
Saving St Francis

PROJECT

ST. FRANCIS BAY BEACH LONG TERM COASTAL PROTECTION PHASE 2

DRAWING DESCRIPTION

GENERAL LAYOUT PLAN PHASE WISE DEVELOPMENT

WorleyParsons
resources & energy
P.O.Box 398
BELLVILLE 7535
TEL:+27 21912 3000
FAX:+27 21912 3222
e-mail: capetown.office@worleyparsons.com

DATE	SCALE: (ORIGINAL A1)
JAN 2018	1:4000

DRG No.	REV.
C00729-00-PMT-DAL-1001	A

FOR INFORMATION ONLY AND NOT TO BE USED FOR CONSTRUCTION

GROYNE - TYPICAL PLAN

1:300

LEGENDS:

PREDICTED SHORELINE

ORIGINAL SHORELINE

NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. ALL ELEVATIONS ARE IN METRES AND RELATIVE TO CHART DATUM (CD).
3. REFERENCE DRAWINGS : C00729-00-PMT-DAL-1001, C00729-00-PMT-DSE-1001 & C00729-00-PMT-DSE-1002,
4. THE PREDICTED SHORELINE IS INDICATIVE ONLY.

m 0 5 10 15 m

1:300

FOR INFORMATION ONLY	✓
PRELIMINARY	
FOR APPROVAL	
FOR TENDER PURPOSES	
FOR CONSTRUCTION	
AS BUILT	

REV	DATE	REVISION DESCRIPTION	DRAWN	DESIGNED	REV ENGINEER
A	09/01/2018	FOR INFORMATION ONLY	PERM	SANP	AVRP

CONSULTING ENGINEER

DATE

CLIENT

DATE

0 10 20 30 40 50 60 70 80 90 100

100mm ON ORIGINAL PLAN

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

CLIENT

ST FRANCIS PROPERTY OWNERS

Saving St Francis

PROJECT

ST. FRANCIS BAY BEACH LONG TERM COASTAL PROTECTION PHASE 2

DRAWING DESCRIPTION

GROYNE TYPICAL PLAN

WorleyParsons
resources & energy
P.O.Box 398
BELLVILLE 7535
TEL:+27 21912 3000
FAX:+27 21912 3222
e-mail: capetown.office@worleyparsons.com

DATE JAN 2018

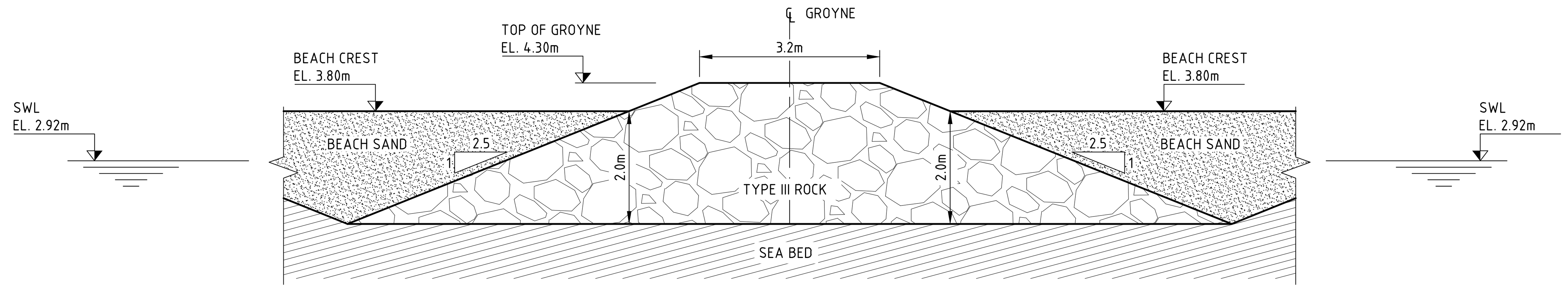
SCALE: (ORIGINAL A1) 1:300

DRG No. C00729-00-PMT-DGA-1001

REV. A

FOR INFORMATION ONLY AND NOT TO BE USED FOR CONSTRUCTION

ROCK CLASS	GRADING	W50 (kg)
ARMOUR ROCK - TYPE I	W=2200-4600 kg	3200
ARMOUR ROCK - TYPE II	W=1300-2800 kg	1920
ARMOUR ROCK - TYPE III	W=500-900 kg	650
ARMOUR ROCK - TYPE IV	W=200-500 kg	320



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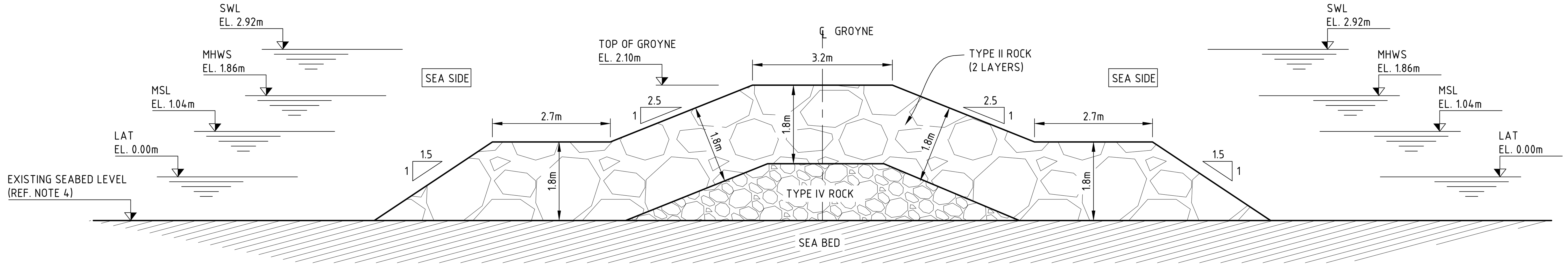
PMT-DGA-1001



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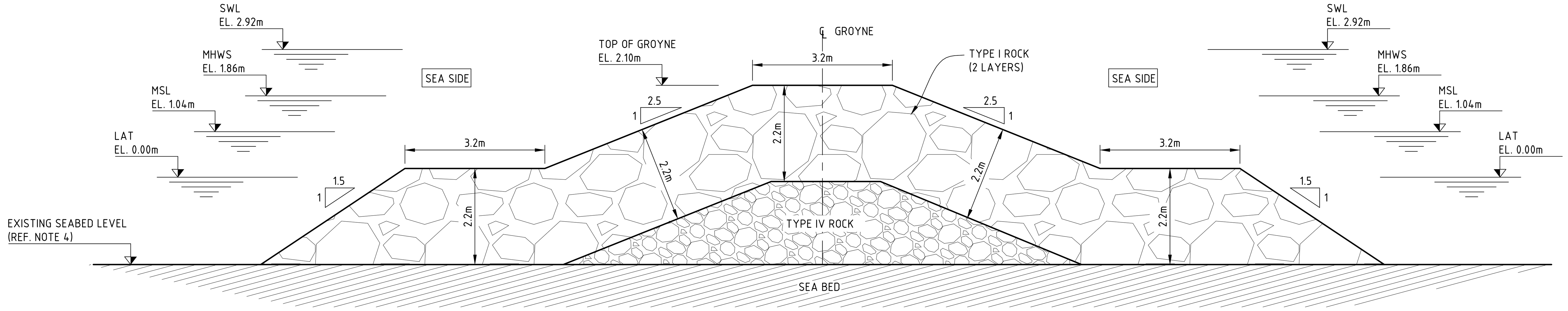

SECTION (C)
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PMT-DGA-1001

NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. ALL ELEVATIONS ARE IN METRES AND RELATIVE TO CHART DATUM (CD).
3. GROYNE BOTTOM LEVEL TO FOLLOW THE EXISTING SEABED LEVEL.
4. THE GROYNE SECTIONS SHALL BE ADOPTED BASED ON THE AVAILABLE DEPTH AS DETAILED BELOW:
   SECTION - A: BETWEEN EXISTING GROUND LEVEL (SEABED) AND 0.00mCD
   SECTION - B: BETWEEN 0.00mCD AND -1.00mCD
   SECTION - C: BETWEEN -1.00mCD AND -2.00mCD
5. REFERENCE DRAWINGS :
   C00729-00-PMT-DGA-1001.

FOR INFORMATION ONLY	✓
PRELIMINARY	
FOR APPROVAL	
FOR TENDER PURPOSES	
FOR CONSTRUCTION	
AS BUILT	

mm 0 1000 2000 3000 4000mm
1:75

REV	DATE	REVISION DESCRIPTION	DRAWN	DESIGNED	REV ENGINEER
A	09/01/2018	FOR INFORMATION ONLY	PERM	SANP	AVRP

CONSULTING ENGINEER
DATE

CLIENT
DATE

0 10 20 30 40 50 60 70 80 90 100
100mm ON ORIGINAL PLAN

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

CLIENT
ST FRANCIS PROPERTY OWNERS
Saving St Francis

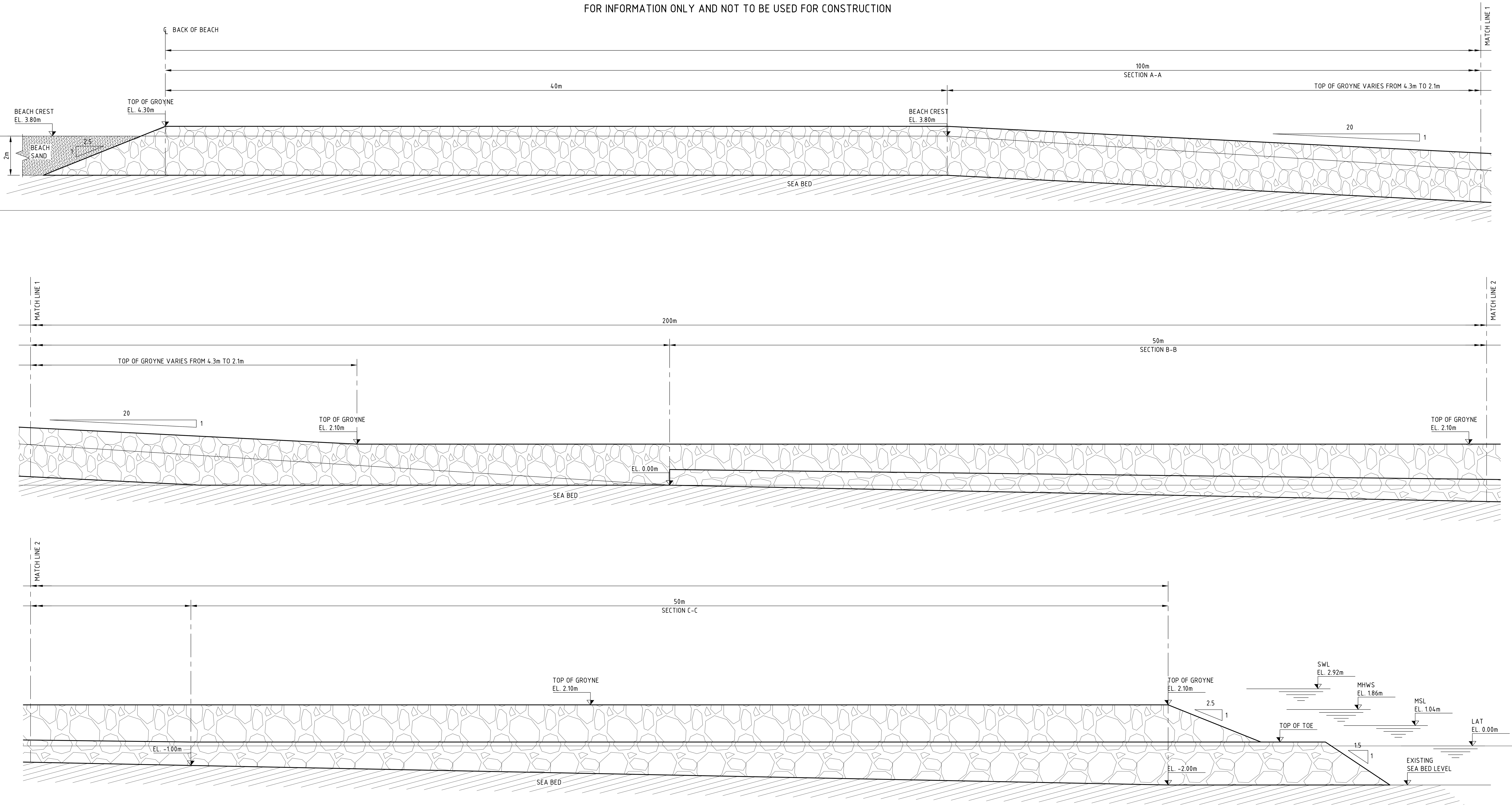
PROJECT
ST. FRANCIS BAY BEACH LONG TERM COASTAL PROTECTION PHASE 2

DRAWING DESCRIPTION
TYPICAL GROYNE CROSS SECTIONS

WorleyParsons
resources & energy
P.O.Box 398
BELLVILLE 7535
TEL:+27 21912 3000
FAX:+27 21912 3222
e-mail: capetown.office@worleyparsons.com

DATE: JAN 2018
SCALE: (ORIGINAL A1) 1:75
DRG No. C00729-00-PMT-DSE-1001
REV. A

FOR INFORMATION ONLY AND NOT TO BE USED FOR CONSTRUCTION



VIEW D
1:100 PMT-DGA-1001

NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. ALL ELEVATIONS ARE IN METRES AND RELATIVE TO CHART DATUM (CD).
3. GROYNE BOTTOM LEVEL TO FOLLOW THE EXISTING SEABED LEVEL.
4. THE GROYNE SECTIONS SHALL BE ADOPTED BASED ON THE AVAILABLE DEPTH AS DETAILED BELOW:
   SECTION - A: BETWEEN EXISTING GROUND LEVEL (SEABED) AND 0.00mCD
   SECTION - B: BETWEEN 0.00mCD AND -1.00mCD
   SECTION - C: BETWEEN -1.00mCD AND -2.00mCD
5. REFERENCE DRAWINGS :
   C00729-00-PMT-DGA-1001.

m 0 1 2 3 4 5 m
1:100

FOR INFORMATION ONLY	✓
PRELIMINARY	
FOR APPROVAL	
FOR TENDER PURPOSES	
FOR CONSTRUCTION	
AS BUILT	

REV	DATE	REVISION DESCRIPTION	DRAWN	DESIGNED	REV ENGINEER
A	09/01/2017	FOR INFORMATION ONLY	PERM	SANP	AVRP

CONSULTING ENGINEER
DATE

CLIENT
DATE

0 10 20 30 40 50 60 70 80 90 100
100mm ON ORIGINAL PLAN

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

CLIENT
ST FRANCIS PROPERTY OWNERS
Saving St Francis

PROJECT
ST. FRANCIS BAY BEACH LONG TERM COASTAL PROTECTION PHASE 2

DRAWING DESCRIPTION
TYPICAL GROYNE LONGITUDINAL ELEVATION

WorleyParsons
resources & energy
P.O.Box 398
BELLVILLE 7535
TEL:+27 21912 3000
FAX:+27 21912 3222
e-mail: capetown.office@worleyparsons.com

DATE: JAN 2018
SCALE: (ORIGINAL A1) 1:100
DRG No. C00729-00-PMT-DSE-1002
REV. A

Appendix B Offshore Hind-cast Analysis

Offshore Wind Data

The wind roses and frequency tables for the three offshore wind locations shown in Figure B 1 are presented in this Appendix.

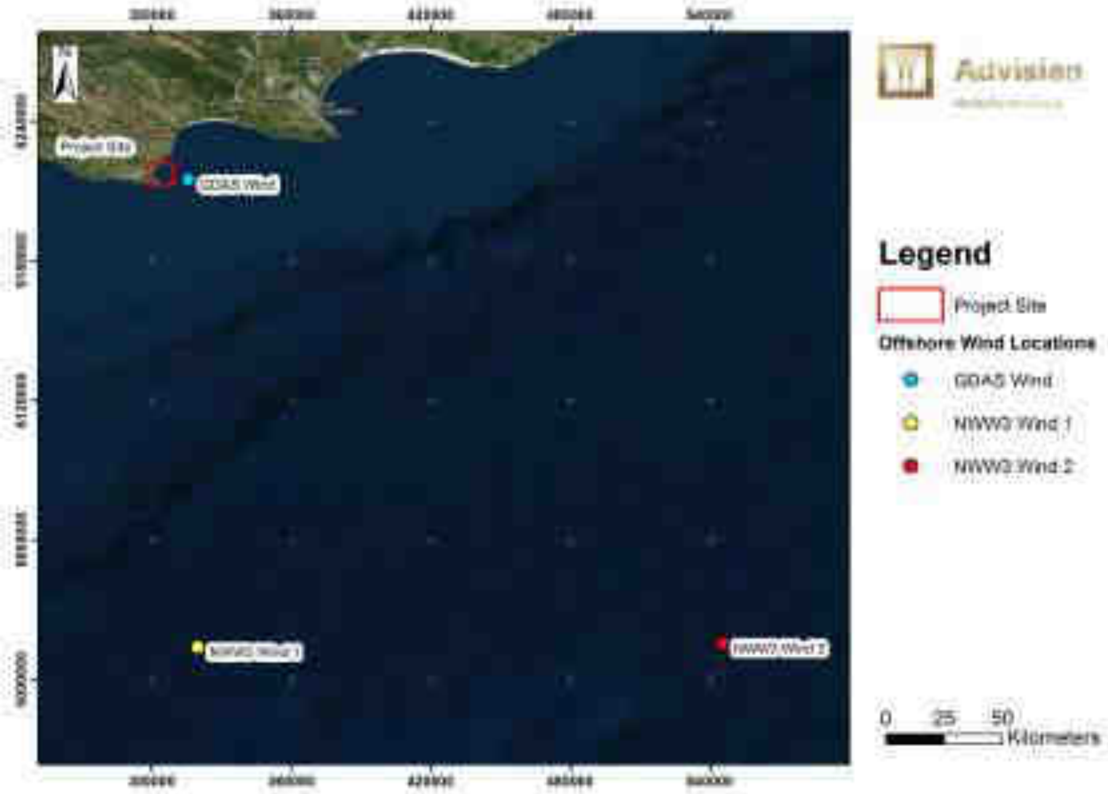


Figure B 1: Offshore Winds Location Map

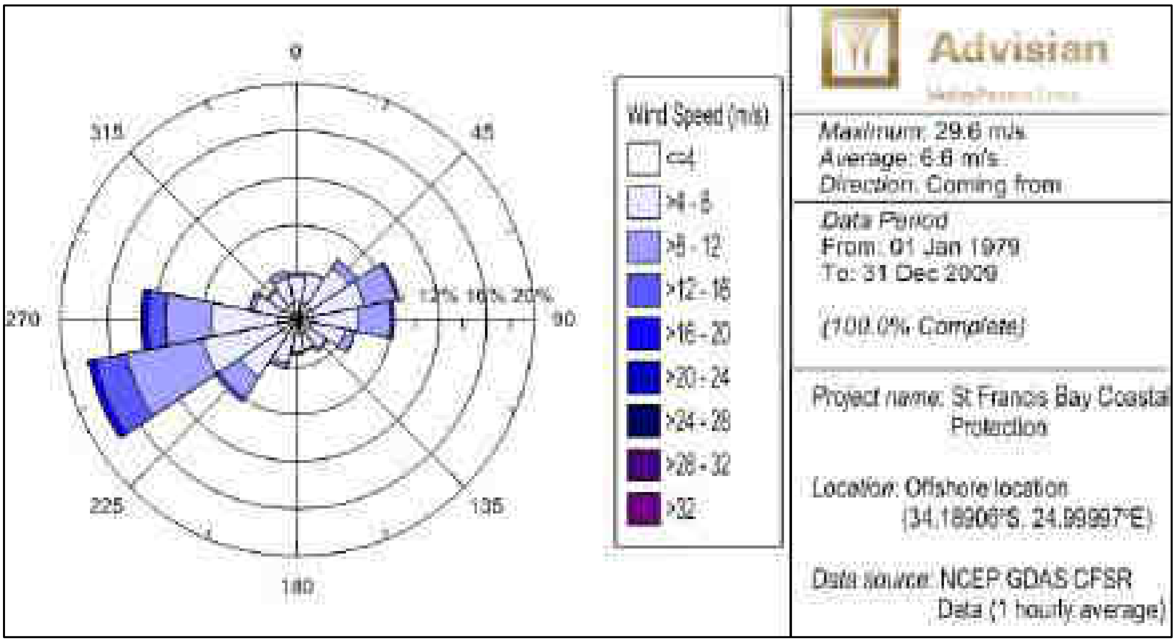


Figure B 2: GDAS Wind - Annual Wind Rose

Table B 1: GDAS Wind – Frequency Table

December		Wind speed, WS (m/s)											
		0	> 0 - 3	> 3 - 6	> 6 - 9	> 9 - 12	> 12 - 15	> 15 - 18	> 18 - 21	> 21 - 24	> 24	All WS	Cum WS
Wind Direction, WD (°N)	N		1.531	2.150	0.233	0	0	0	0	0	0	3.91	3.91
	NNE		1.494	2.505	0.113	0	0	0	0	0	0	4.11	8.03
	NE		1.493	3.808	0.796	0.009	0.000	0	0	0	0	6.11	14.13
	ENE		1.422	4.368	2.708	0.234	0.004	0	0	0	0	8.74	22.87
	E		1.286	3.903	2.663	0.299	0.003	0	0	0	0	8.15	31.02
	ESE		1.276	2.839	0.832	0.043	0.004	0	0	0	0	4.99	36.02
	SE		1.200	1.737	0.189	0.014	0.005	0	0	0	0	3.15	39.16
	SSE		1.213	1.352	0.087	0.011	0.005	0.000	0	0	0	2.67	41.83
	S		1.252	1.478	0.131	0.020	0.003	0	0	0	0	2.88	44.71
	SSW		1.379	2.385	0.385	0.056	0.006	0.000	0	0	0	4.21	48.93
	SW		1.513	4.334	2.075	0.346	0.027	0.001	0	0	0	8.30	57.22
	WSW		1.649	6.431	6.622	2.668	0.577	0.041	0.004	0	0	17.99	75.21
	W		1.659	5.539	3.950	1.530	0.465	0.055	0.007	0.000	0	13.20	88.42
	WNW		1.517	2.192	0.404	0.059	0.016	0.001	0	0	0	4.19	92.61
	NW		1.391	1.532	0.210	0.014	0.001	0	0	0	0	3.15	95.76
	NNW		1.400	2.197	0.640	0.007	0	0	0	0	0	4.24	100.00
	All WD	0.00	22.67	48.75	22.04	5.31	1.12	0.10	0.01	0.00	0.00		
	Cum WD	0.00	22.67	71.43	93.47	98.77	99.89	99.99	100.00	100.00	100.00		

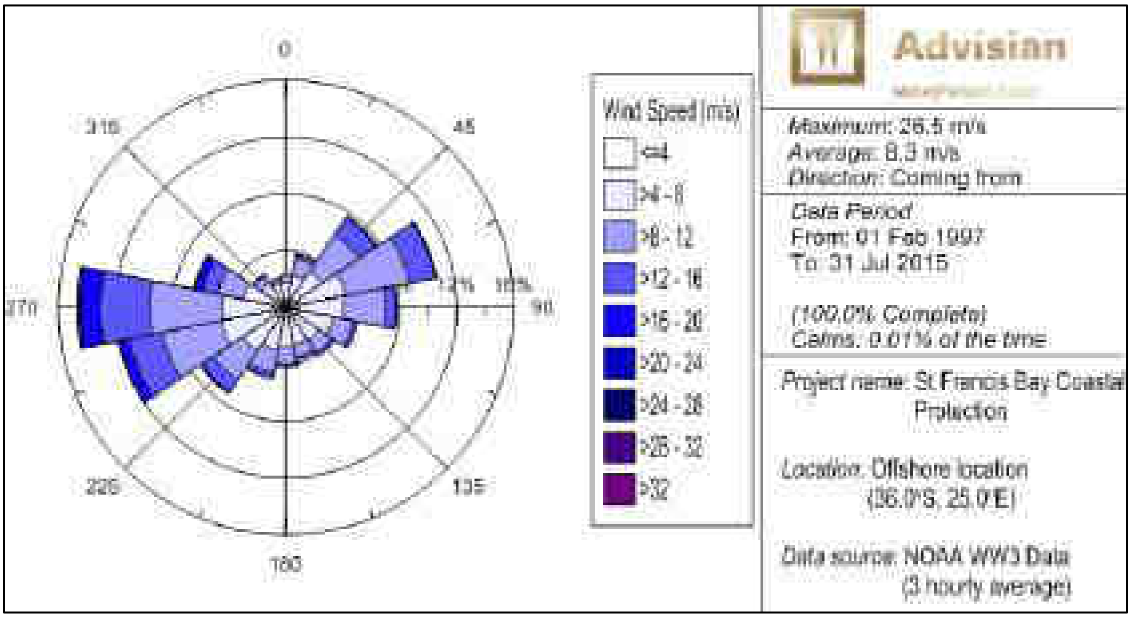


Figure B 3: NWW3 Wind1 - Annual Wind Rose

Table B 2: NWW3 Wind1 – Frequency Table

Annual		Wind speed, WS (m/s)										
		0	> 0 - 4	> 4 - 8	> 8 - 12	> 12 - 16	> 16 - 20	> 20 - 24	> 24 - 28	> 28	All WS	Cum WS
Wind Direction, WD (°N)	N		0.583	1.157	0.498	0.026	0	0	0	0	2.26	2.26
	NNE		0.633	1.693	1.192	0.274	0.015	0.002	0	0	3.81	6.07
	NE		0.711	2.337	3.083	1.477	0.111	0.006	0	0	7.72	13.80
	ENE		0.844	3.453	4.524	1.850	0.115	0.006	0	0	10.79	24.59
	E		0.862	3.187	2.953	0.670	0.087	0.002	0	0	7.76	32.35
	ESE		0.901	2.498	1.419	0.294	0.028	0	0	0	5.14	37.49
	SE		0.823	1.969	1.051	0.229	0.022	0	0	0	4.10	41.58
	SSE		0.781	1.878	0.896	0.155	0.009	0.004	0	0	3.72	45.31
	S		0.792	2.026	1.131	0.207	0.031	0.004	0	0	4.19	49.50
	SSW		0.836	2.226	1.595	0.372	0.050	0.002	0	0	5.08	54.58
	SW		0.903	2.770	2.485	0.936	0.163	0.006	0	0	7.26	61.84
	WSW		0.925	3.742	4.228	2.346	0.670	0.070	0	0	11.98	73.82
	W		0.984	3.484	5.080	3.499	1.384	0.215	0.007	0	14.65	88.48
	WNW		0.809	2.243	1.839	1.088	0.518	0.094	0.002	0	6.59	95.07
	NW		0.753	1.362	0.563	0.115	0.022	0.006	0.004	0	2.82	97.90
	NNW		0.607	1.164	0.313	0.013	0.002	0	0	0	2.10	99.99
	All WD	0.01	12.75	37.19	32.85	13.55	3.23	0.41	0.01	0.00		
	Cum WD	0.01	12.75	49.94	82.79	96.35	99.57	99.99	100.00	100.00		

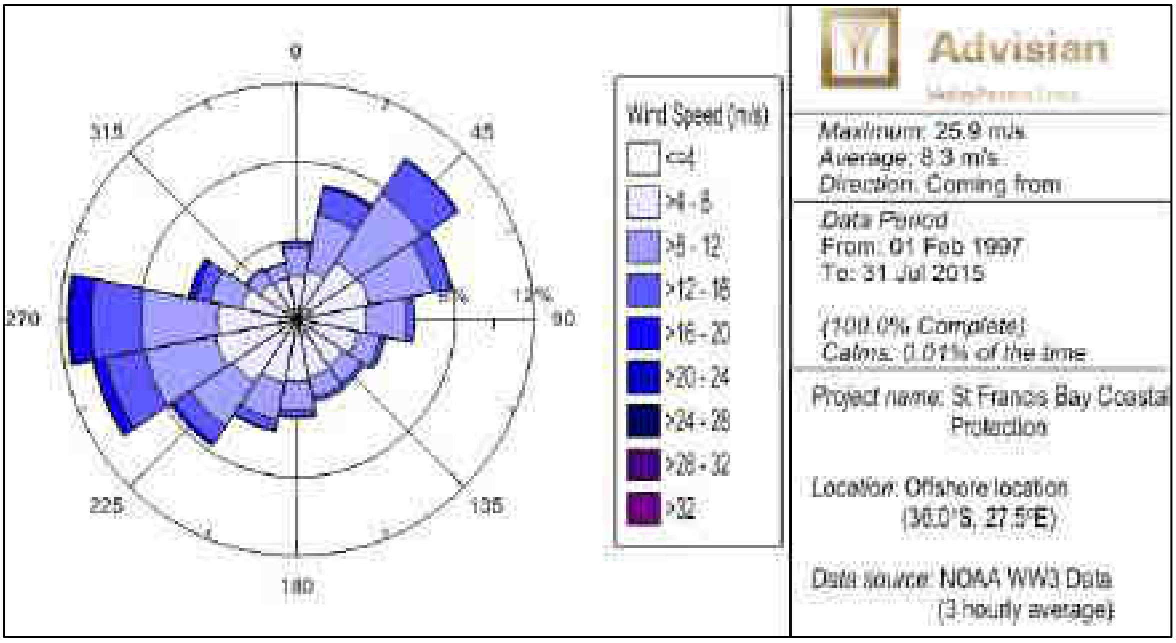


Figure B 4: NWW3 Wind2 - Annual Wind Rose

Table B 3: NWW3 Wind2 – Frequency Table

Annual		Wind speed, WS (m/s)										
		0	> 0 - 4	> 4 - 8	> 8 - 12	> 12 - 16	> 16 - 20	> 20 - 24	> 24 - 28	> 28	All WS	Cum WS
Wind Direction, WD (°N)	N		0.607	1.608	1.456	0.257	0.007	0	0	0	3.94	3.94
	NNE		0.618	1.921	2.852	1.401	0.150	0.002	0	0	6.94	10.88
	NE		0.731	2.803	4.138	2.060	0.126	0	0	0	9.86	20.74
	ENE		0.766	2.983	3.259	0.953	0.050	0	0	0	8.01	28.75
	E		0.851	2.670	2.039	0.370	0.024	0	0	0	5.95	34.70
	ESE		0.825	2.283	1.192	0.255	0.022	0	0	0	4.58	39.28
	SE		0.796	2.048	1.038	0.235	0.026	0	0	0	4.14	43.42
	SSE		0.853	2.126	1.034	0.215	0.017	0	0	0	4.25	47.67
	S		0.803	2.348	1.434	0.348	0.022	0.004	0	0	4.96	52.63
	SSW		0.807	2.457	1.908	0.527	0.070	0.002	0	0	5.77	58.40
	SW		0.972	2.898	2.628	0.986	0.222	0.011	0	0	7.72	66.12
	WSW		0.870	3.355	3.640	2.056	0.561	0.068	0.002	0	10.55	76.67
	W		0.872	3.161	3.866	2.543	1.051	0.122	0.004	0	11.62	88.28
	WNW		0.672	2.169	1.636	0.777	0.287	0.035	0.002	0	5.58	93.86
	NW		0.670	1.569	0.809	0.105	0.015	0	0	0	3.17	97.03
	NNW		0.568	1.564	0.770	0.061	0.002	0	0	0	2.96	99.99
	All WD	0.01	12.28	37.96	33.70	13.15	2.65	0.24	0.01	0.00		
	Cum WD	0.01	12.29	50.25	83.95	97.10	99.75	99.99	100.00	100.00		

Offshore Wave Data

The wind roses and frequency tables for the three offshore wind locations shown in Figure E 5 are presented below.

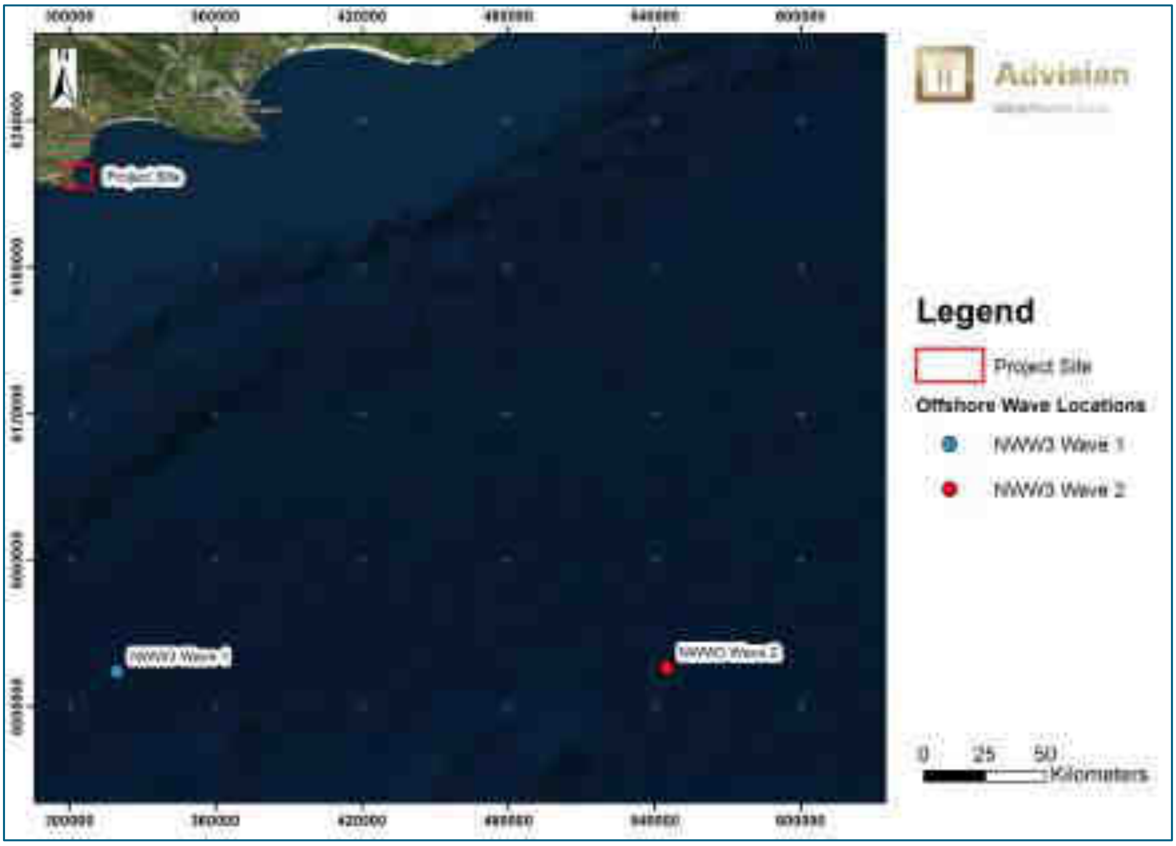


Figure E 5: Location map for offshore waves

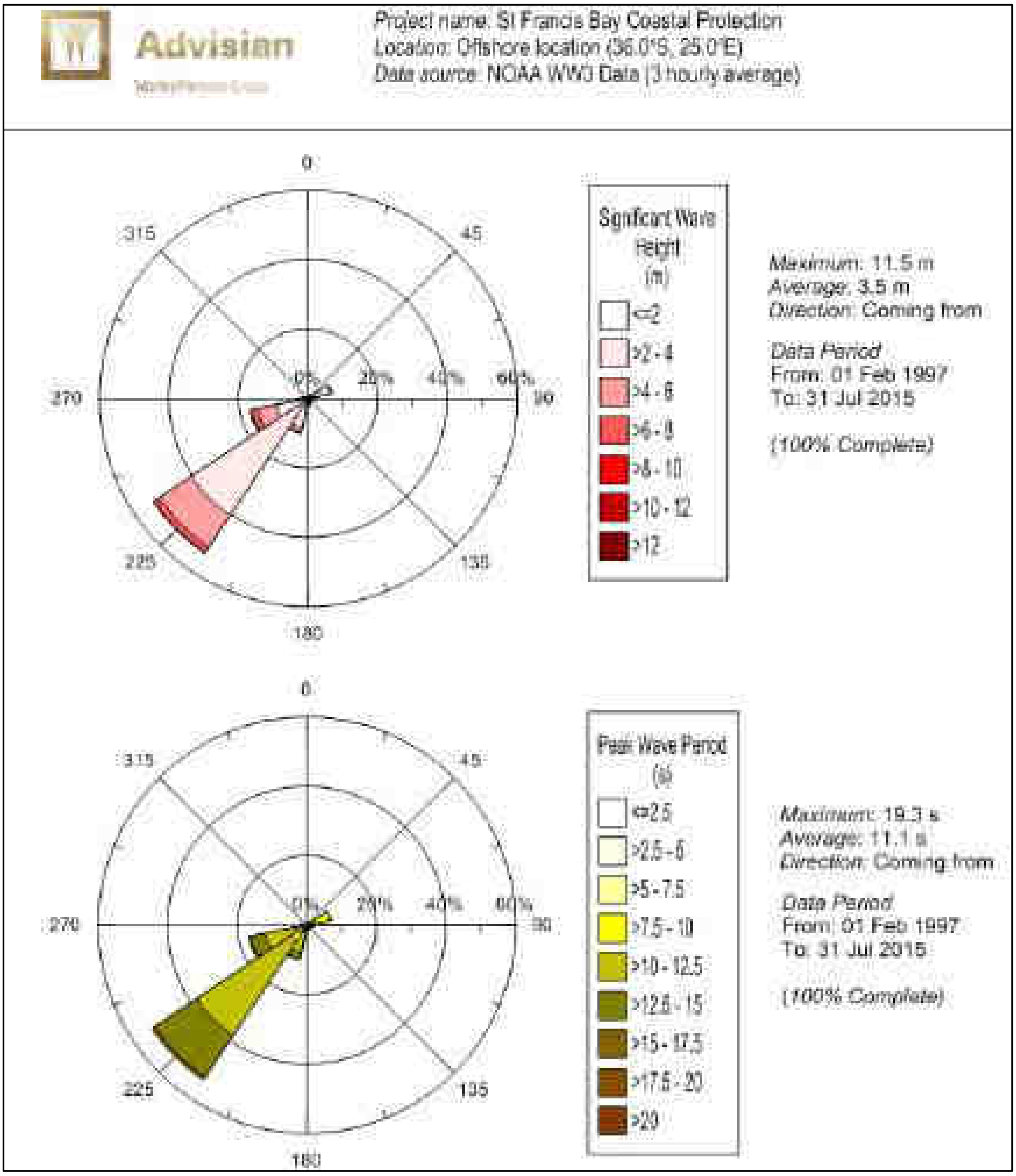


Figure E 6: NWW3 Wave 1 – Annual Wave Rose

Table E 4: NWW3 Wave 1 –Mean Wave Direction (MWD) vs Significant Wave Height Frequency Tables

Annual	Significant Wave Height, H_s (m)														
Mean Wave Direction, MWD (°N, from)	< 1	> 1 - 2	> 2 - 3	> 3 - 4	> 4 - 5	> 5 - 6	> 6 - 7	> 7 - 8	> 8 - 9	> 9 - 10	> 10 - 11	> 11 - 12	> 12	All Hs	Cum Hs
N	0	0	0.007	0.004	0	0.002	0	0	0	0	0	0	0	0.01	0.01
NNE	0	0.004	0.022	0.019	0	0	0	0	0	0	0	0	0	0.04	0.06
NE	0	0.026	0.474	0.694	0.124	0.002	0	0	0	0	0	0	0	1.32	1.38
ENE	0	0.272	3.155	2.994	0.538	0.054	0.015	0	0	0	0	0	0	7.03	8.40
E	0	0.205	1.182	0.761	0.185	0.046	0.011	0.009	0	0	0	0	0	2.40	10.80
ESE	0	0.089	0.622	0.450	0.168	0.039	0	0	0	0	0	0	0	1.37	12.17
SE	0	0.063	0.640	0.376	0.115	0.037	0.007	0	0	0	0	0	0	1.24	13.41
SSE	0	0.115	0.681	0.490	0.157	0.031	0.009	0	0	0	0	0	0	1.48	14.89
S	0	0.124	1.007	0.637	0.231	0.091	0.028	0.015	0	0	0	0	0	2.13	17.03
SSW	0	0.622	4.539	3.453	1.099	0.389	0.131	0.022	0.013	0	0	0	0	10.27	27.29
SW	0	1.939	20.333	18.177	7.802	3.203	1.323	0.476	0.179	0.054	0.013	0.004	0	53.50	80.80
WSW	0	0.520	4.471	4.532	3.181	2.228	1.099	0.637	0.254	0.107	0.057	0.013	0	17.10	97.90
W	0	0.050	0.374	0.674	0.457	0.205	0.105	0.033	0.004	0.004	0	0	0	1.91	99.80
WNW	0	0.007	0.043	0.094	0.022	0.004	0.002	0	0	0	0	0	0	0.17	99.97
NW	0	0.002	0.004	0.009	0	0	0	0	0	0	0	0	0	0.01	99.99
NNW	0	0.002	0.006	0.004	0	0	0	0	0	0	0	0	0	0.01	100.00
All Dir	0.00	4.04	37.56	33.37	14.08	6.33	2.73	1.19	0.45	0.16	0.07	0.02	0.00		
Cum Dir	0.00	4.04	41.60	74.96	89.05	95.38	98.11	99.30	99.75	99.91	99.98	100.00	100.00		

Table E 5: NWW3 Wave 1 –Significant Wave Height vs Wave Peak Period Frequency Tables

Annual	Wave Peak Period, T_P (s)												
Significant Wave Height, Hs (m)	< 2	> 2 - 4	> 4 - 6	> 6 - 8	> 8 - 10	> 10 - 12	> 12 - 14	> 14 - 16	> 16 - 18	> 18 - 20	> 20	All T_P	Cum T_P
< 1	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
> 1 - 2	0	0.004	0.122	0.518	1.801	1.334	0.207	0.039	0.015	0	0	4.04	4.04
> 2 - 3	0	0	0.727	3.317	8.347	18.732	5.378	0.925	0.133	0.006	0	37.57	41.61
> 3 - 4	0	0	0.050	3.485	5.193	12.147	10.474	1.854	0.152	0.017	0	33.37	74.98
> 4 - 5	0	0	0	0.235	2.456	4.583	5.436	1.260	0.111	0.002	0	14.08	89.06
> 5 - 6	0	0	0	0	0.518	2.391	2.539	0.822	0.061	0	0	6.33	95.39
> 6 - 7	0	0	0	0	0.030	1.016	1.266	0.396	0.024	0	0	2.73	98.12
> 7 - 8	0	0	0	0	0	0.276	0.685	0.218	0.013	0	0	1.19	99.32
> 8 - 9	0	0	0	0	0	0.022	0.316	0.111	0	0	0	0.45	99.76
> 9 - 10	0	0	0	0	0	0	0.096	0.067	0.002	0	0	0.16	99.93
> 10 -11	0	0	0	0	0	0	0.026	0.043	0.002	0	0	0.07	100.00
> 11 -12	0	0	0	0	0	0	0.004	0.006	0.007	0	0	0.02	100.02
> 12	0	0	0	0	0	0	0	0	0	0	0	0.00	100.02
All H_s	0.00	0.00	0.90	7.55	18.35	40.50	26.43	5.74	0.52	0.02	0.00		
Cum H_s	0.00	0.00	0.90	8.46	26.80	67.30	93.73	99.47	99.99	100.02	100.02		

Table E 6: NWW3 Wave 1 – Mean Wave Direction (MWD) vs Wave Peak Period Frequency Tables

Annual	Wave Peak Period, T_P (s)												
Mean Wave Direction, MWD (°N, from)	< 2	> 2 - 4	> 4 - 6	> 6 - 8	> 8 - 10	> 10 - 12	> 12 - 14	> 14 - 16	> 16 - 18	> 18 - 20	> 20	All T_P	Cum T_P
N	0	0	0	0.006	0.006	0.002	0	0	0	0	0	0.01	0.01
NNE	0	0	0.017	0.017	0.009	0.002	0	0	0	0	0	0.04	0.06
NE	0	0	0.155	0.875	0.278	0.011	0	0	0	0	0	1.32	1.38
ENE	0	0.002	0.320	3.255	3.266	0.172	0	0.013	0	0	0	7.03	8.40
E	0	0	0.107	0.687	1.301	0.228	0.076	0.002	0	0	0	2.40	10.80
ESE	0	0	0.024	0.309	0.648	0.344	0.043	0	0	0	0	1.37	12.17
SE	0	0	0.017	0.191	0.616	0.366	0.048	0	0	0	0	1.24	13.41
SSE	0	0	0.017	0.141	0.714	0.551	0.048	0.013	0	0	0	1.48	14.89
S	0	0	0.015	0.133	0.859	0.944	0.141	0.041	0	0	0	2.13	17.03
SSW	0	0	0.013	0.194	1.897	5.089	2.374	0.640	0.061	0	0	10.27	27.29
SW	0	0	0.026	0.333	5.294	25.261	18.707	3.594	0.276	0.013	0	53.50	80.80
WSW	0	0	0.046	0.651	2.628	7.182	4.961	1.436	0.183	0.011	0	17.10	97.90
W	0	0	0.118	0.662	0.759	0.339	0.026	0.002	0	0	0	1.91	99.80
WNW	0	0.002	0.024	0.089	0.054	0.004	0	0	0	0	0	0.17	99.97
NW	0	0	0	0.006	0.009	0	0	0	0	0	0	0.01	99.99
NNW	0	0	0	0.006	0.006	0	0	0	0	0	0	0.01	100.00
All Dir	0.00	0.00	0.90	7.55	18.34	40.49	26.42	5.74	0.52	0.02	0.00		
Cum Dir	0.00	0.00	0.90	8.46	26.80	67.29	93.72	99.46	99.98	100.00	100.00		

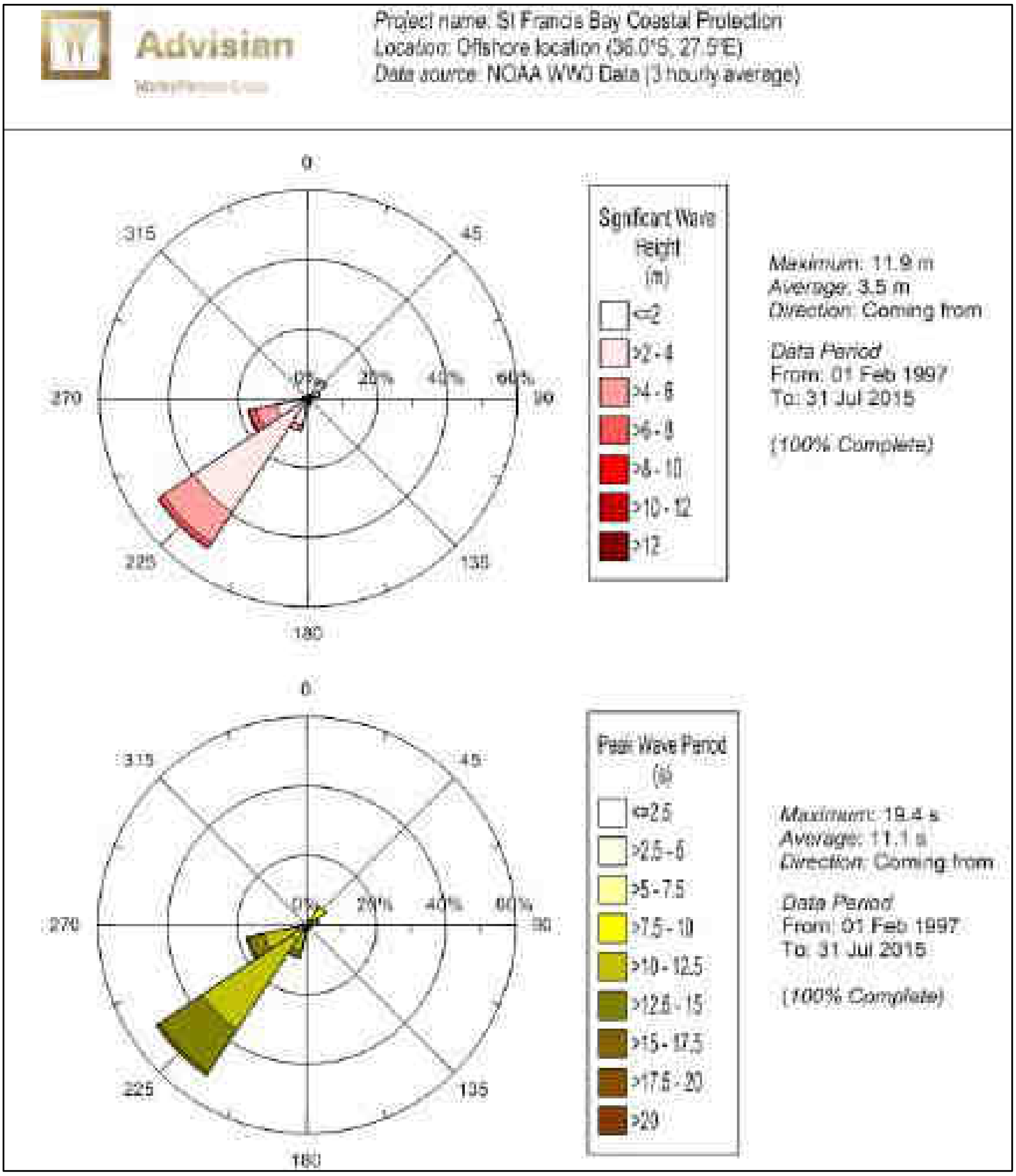


Figure B 7: NWW3 Wave 2 - Annual Wave Rose

Table B 7: NWW3 Wave 2 – Mean Wave Direction (MWD) vs Significant Wave Height Frequency Tables

Annual		Significant Wave Height, H_s (m)														
		< 1	> 1 - 2	> 2 - 3	> 3 - 4	> 4 - 5	> 5 - 6	> 6 - 7	> 7 - 8	> 8 - 9	> 9 - 10	> 10 - 11	> 11 - 12	> 12	All Hs	Cum Hs
Mean Wave Direction, MWD (°N, from)	N	0	0.009	0.063	0.048	0.002	0	0	0	0	0	0	0	0	0.12	0.12
	NNE	0	0.031	0.415	0.755	0.204	0.009	0	0	0	0	0	0	0	1.41	1.54
	NE	0	0.213	2.450	3.050	0.718	0.087	0.009	0	0	0	0	0	0	6.53	8.06
	ENE	0	0.167	1.652	1.338	0.224	0.048	0.007	0	0	0	0	0	0	3.44	11.50
	E	0	0.072	0.724	0.542	0.157	0.011	0.006	0.007	0.011	0	0	0	0	1.53	13.03
	ESE	0	0.056	0.581	0.372	0.148	0.048	0.009	0	0	0	0	0	0	1.21	14.24
	SE	0	0.059	0.579	0.326	0.115	0.056	0.006	0	0	0	0	0	0	1.14	15.38
	SSE	0	0.085	0.594	0.522	0.141	0.028	0.002	0	0	0	0	0	0	1.37	16.75
	S	0	0.137	0.857	0.629	0.287	0.104	0.017	0.004	0.004	0	0	0	0	2.04	18.79
	SSW	0	0.551	4.226	3.283	1.114	0.340	0.115	0.026	0.007	0.004	0	0	0	9.67	28.46
	SW	0	1.721	18.991	18.738	7.713	2.968	1.240	0.433	0.144	0.059	0.015	0.004	0	52.03	80.48
	WSW	0	0.350	4.073	4.867	3.531	2.409	1.271	0.651	0.292	0.131	0.052	0.022	0	17.65	98.13
	W	0	0.031	0.303	0.540	0.350	0.179	0.089	0.028	0.006	0.002	0.004	0	0	1.53	99.67
	WNW	0	0	0.087	0.085	0.028	0.002	0	0	0	0	0	0	0	0.20	99.87
	NW	0	0.007	0.048	0.019	0.004	0	0	0	0	0	0	0	0	0.08	99.95
	NNW	0	0.002	0.022	0.022	0.007	0	0	0	0	0	0	0	0	0.05	100.00
	All Dir	0.00	3.49	35.67	35.14	14.74	6.29	2.77	1.15	0.46	0.20	0.07	0.03	0.00		
	Cum Dir	0.00	3.49	39.16	74.29	89.03	95.32	98.09	99.24	99.71	99.90	99.97	100.00	100.00		

Table B 8: NWW3 Wave 2 – Significant Wave Height vs Wave Peak Period Frequency Tables

Annual		Wave Peak Period, T_P (s)												
		< 2	> 2 - 4	> 4 - 6	> 6 - 8	> 8 - 10	> 10 - 12	> 12 - 14	> 14 - 16	> 16 - 18	> 18 - 20	> 20	All T_P	Cum T_P
Significant Wave Height, Hs (m)	< 1	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
	> 1 - 2	0	0	0.107	0.579	1.447	1.162	0.152	0.039	0.006	0	0	3.49	3.49
	> 2 - 3	0	0	0.605	3.983	7.389	17.771	4.985	0.813	0.122	0.007	0	35.68	39.17
	> 3 - 4	0	0	0.039	3.876	5.471	12.498	11.074	1.962	0.205	0.019	0	35.14	74.31
	> 4 - 5	0	0	0	0.326	2.410	4.629	5.847	1.423	0.106	0.004	0	14.74	89.06
	> 5 - 6	0	0	0	0.004	0.433	2.291	2.625	0.864	0.074	0	0	6.29	95.35
	> 6 - 7	0	0	0	0	0.007	0.924	1.386	0.424	0.030	0	0	2.77	98.12
	> 7 - 8	0	0	0	0	0	0.228	0.698	0.211	0.013	0	0	1.15	99.27
	> 8 - 9	0	0	0	0	0	0.011	0.309	0.144	0	0	0	0.46	99.73
	> 9 - 10	0	0	0	0	0	0	0.107	0.087	0.002	0	0	0.20	99.93
	> 10 -11	0	0	0	0	0	0	0.022	0.044	0.004	0	0	0.07	100.00
	> 11 -12	0	0	0	0	0	0	0.002	0.015	0.009	0	0	0.03	100.03
	> 12	0	0	0	0	0	0	0	0	0	0	0	0.00	100.03
	All H_s	0.00	0.00	0.75	8.77	17.16	39.51	27.21	6.03	0.57	0.03	0.00		
	Cum H_s	0.00	0.00	0.75	9.52	26.68	66.19	93.40	99.43	100.00	100.03	100.03		

Table B 9: NWW3 Wave 2 – Mean Wave Direction (MWD) vs Wave Peak Period Frequency Tables

Annual		Wave Peak Period, T_P (s)												
		< 2	> 2 - 4	> 4 - 6	> 6 - 8	> 8 - 10	> 10 - 12	> 12 - 14	> 14 - 16	> 16 - 18	> 18 - 20	> 20	All T_P	Cum T_P
Mean Wave Direction, MWD (°N, from)	N	0	0	0.019	0.050	0.048	0.006	0	0	0	0	0	0.12	0.12
	NNE	0	0	0.120	0.990	0.302	0.002	0	0	0	0	0	1.41	1.54
	NE	0	0	0.217	3.357	2.879	0.070	0	0.004	0	0	0	6.53	8.06
	ENE	0	0	0.155	1.725	1.405	0.137	0.002	0.013	0	0	0	3.44	11.50
	E	0	0	0.039	0.383	0.688	0.331	0.087	0.002	0	0	0	1.53	13.03
	ESE	0	0	0.013	0.265	0.526	0.368	0.043	0	0	0	0	1.21	14.24
	SE	0	0	0.011	0.183	0.537	0.376	0.033	0	0	0	0	1.14	15.38
	SSE	0	0	0.004	0.154	0.683	0.463	0.063	0.006	0	0	0	1.37	16.75
	S	0	0	0.024	0.137	0.764	0.916	0.152	0.044	0	0	0	2.04	18.79
	SSW	0	0	0.017	0.194	1.839	4.650	2.280	0.622	0.065	0	0	9.67	28.46
	SW	0	0	0.028	0.276	4.306	24.215	19.062	3.810	0.313	0.017	0	52.03	80.48
	WSW	0	0	0.028	0.396	2.444	7.617	5.440	1.519	0.192	0.013	0	17.65	98.13
	W	0	0	0.050	0.483	0.620	0.337	0.039	0.004	0	0	0	1.53	99.67
	WNW	0	0	0.019	0.109	0.067	0.007	0	0	0	0	0	0.20	99.87
	NW	0	0	0.007	0.046	0.020	0.002	0	0.002	0	0	0	0.08	99.95
	NNW	0	0	0.002	0.019	0.026	0.007	0	0	0	0	0	0.05	100.00
	All Dir	0.00	0.00	0.75	8.77	17.15	39.50	27.20	6.03	0.57	0.03	0.00		
	Cum Dir	0.00	0.00	0.75	9.52	26.67	66.18	93.38	99.40	99.97	100.00	100.00		

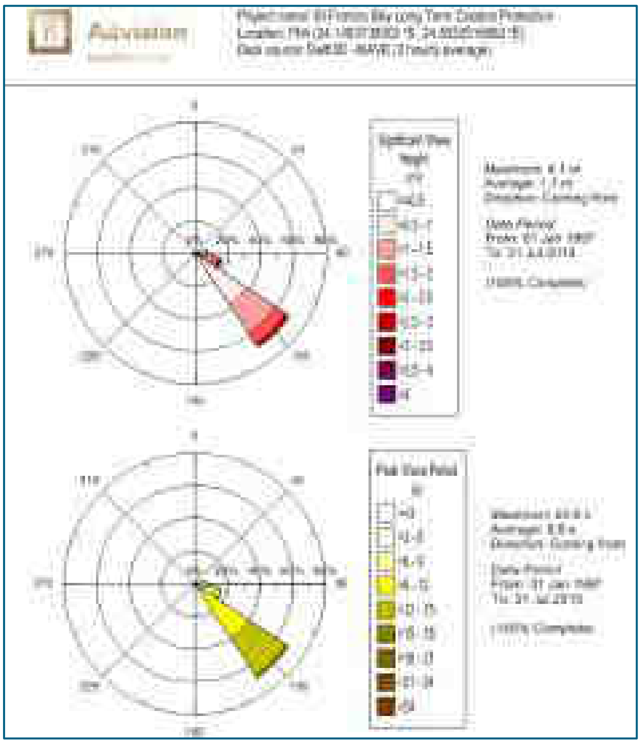
Appendix C Nearshore Wave Analysis

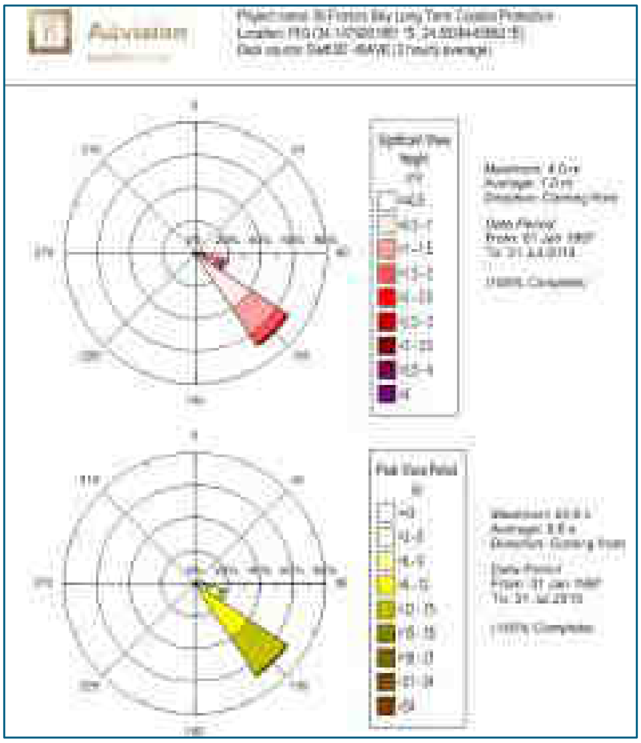
Nearshore Wave Analysis

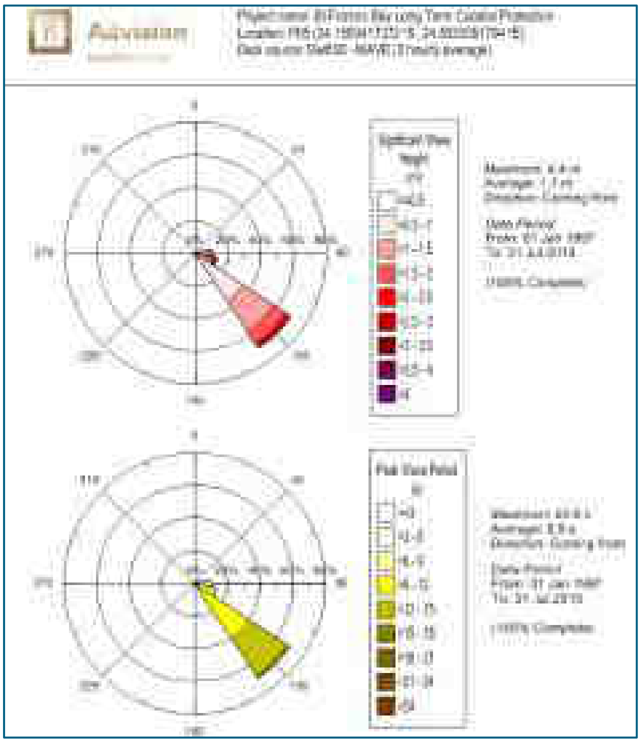
The nearshore wave climate at the locations P03 to P17 (along -10 m CD depth contour) shown in Figure C 1 were utilised in the long-shore sediment transport simulations (UNIBEST).

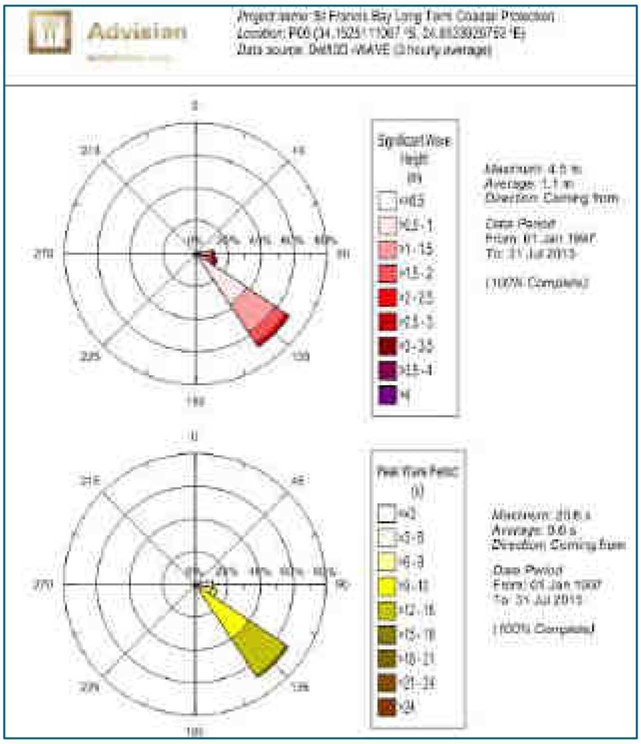
Figure C 1 Nearshore Wave Climate Locations

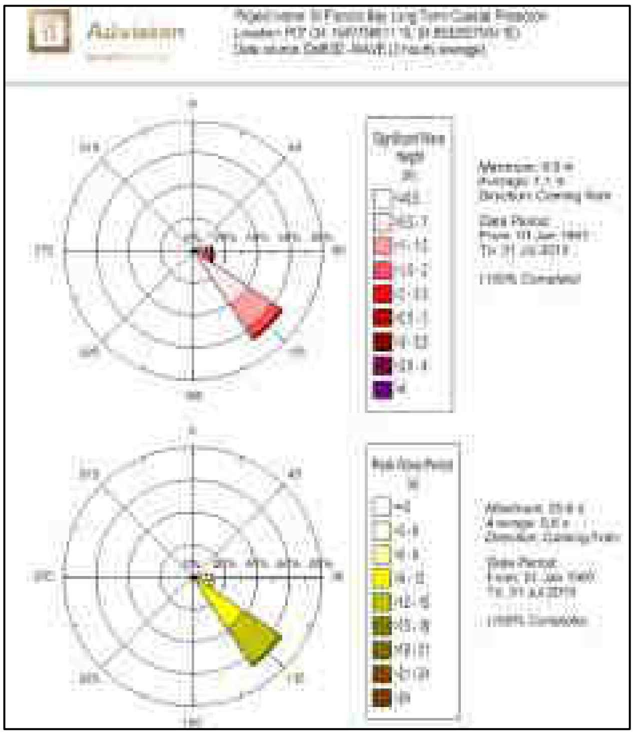
The associated wave roses at each location are presented below.

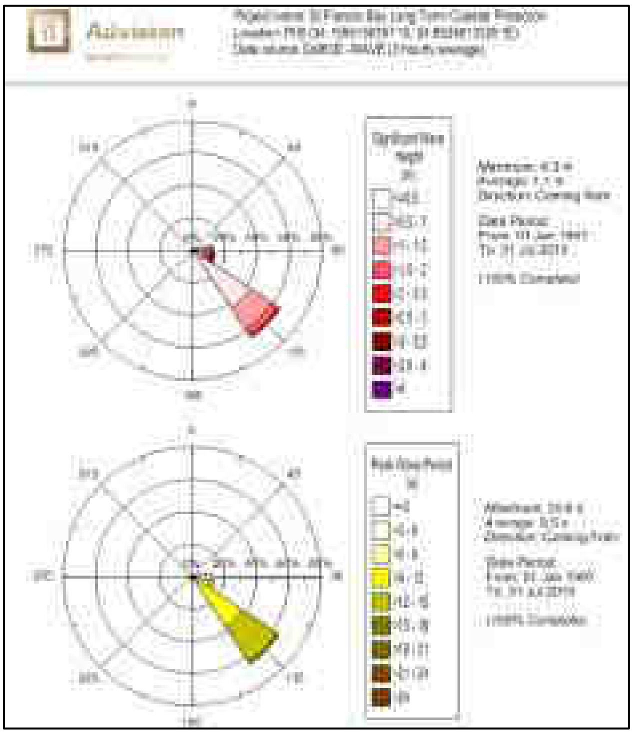


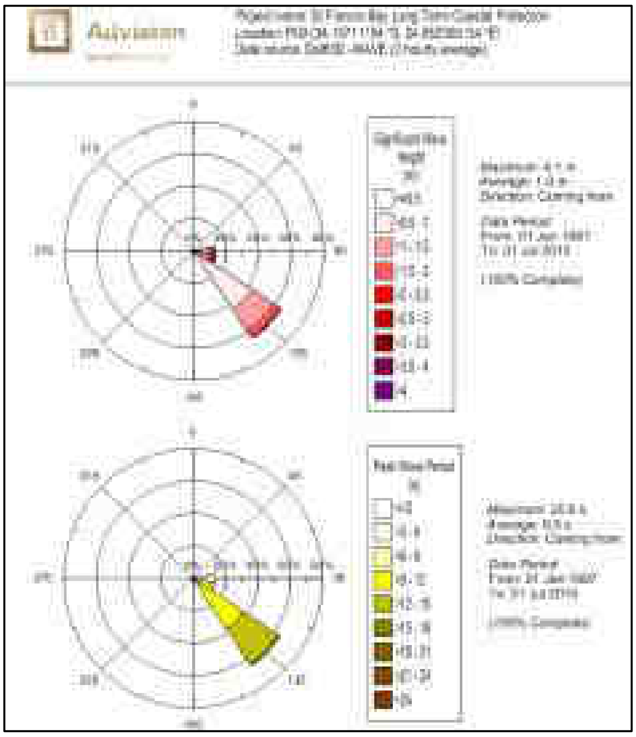


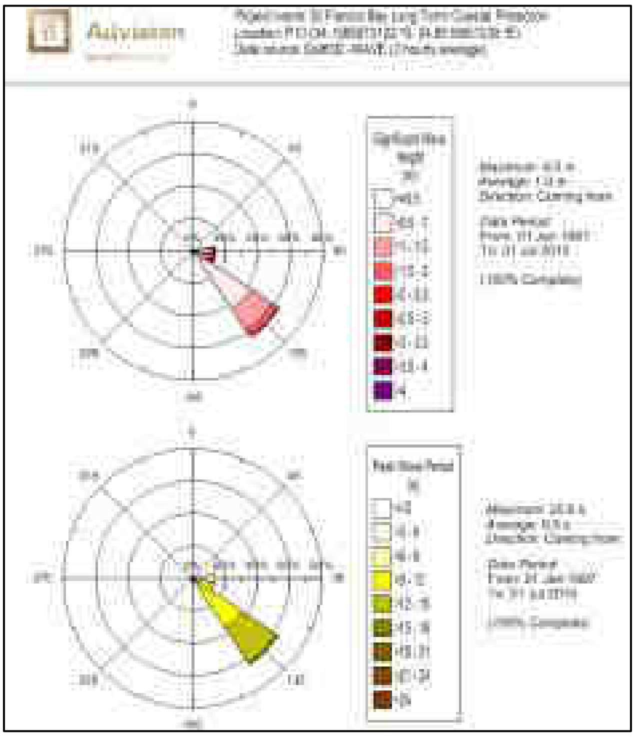


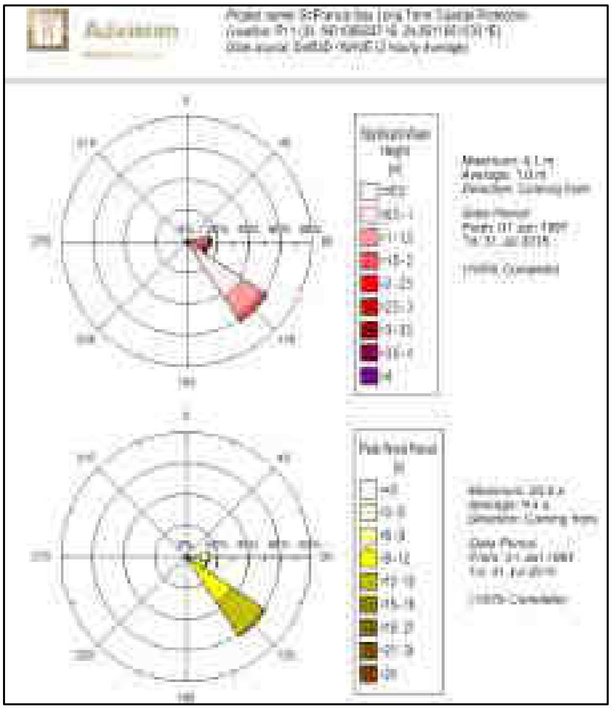

Advisian
Project name: St Francis Bay Long Term Coastal Protection
Data source: DHI MIKE-WAVE (3 hourly average)
Significant Wave Height (m)
Maximum: 4.5 m
Average: 1.1 m
Direction: Coming from
Data Period
From: 01 Jan 1997
To: 31 Jul 2015
(100% Complete)
Peak Wave Period (s)
Direction: Coming from
Data Period
From: 01 Jan 1997
To: 31 Jul 2015
(100% Complete)

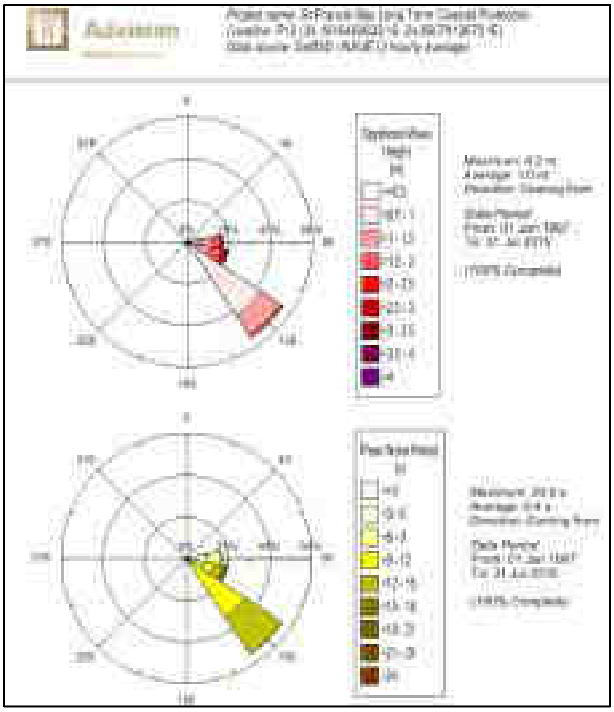


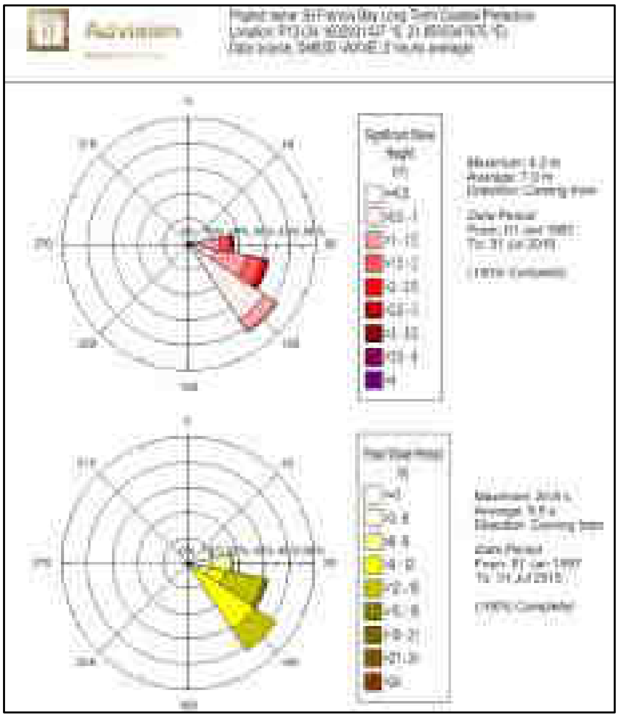


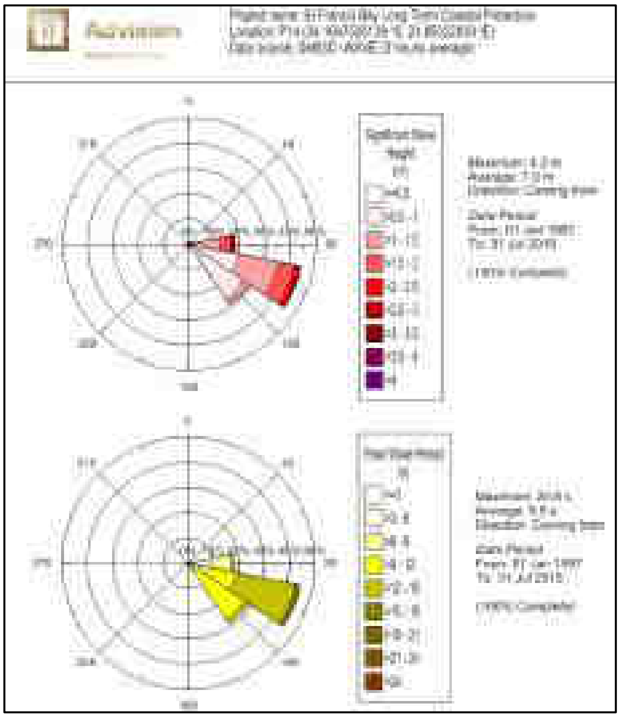


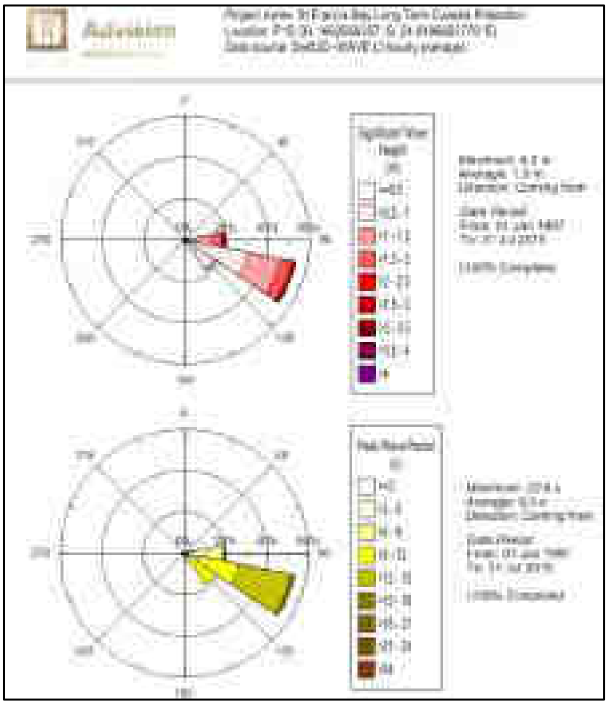


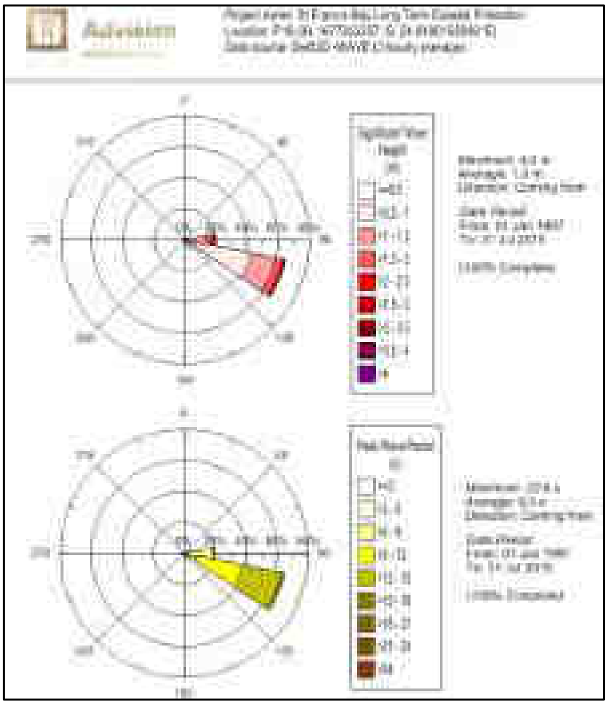


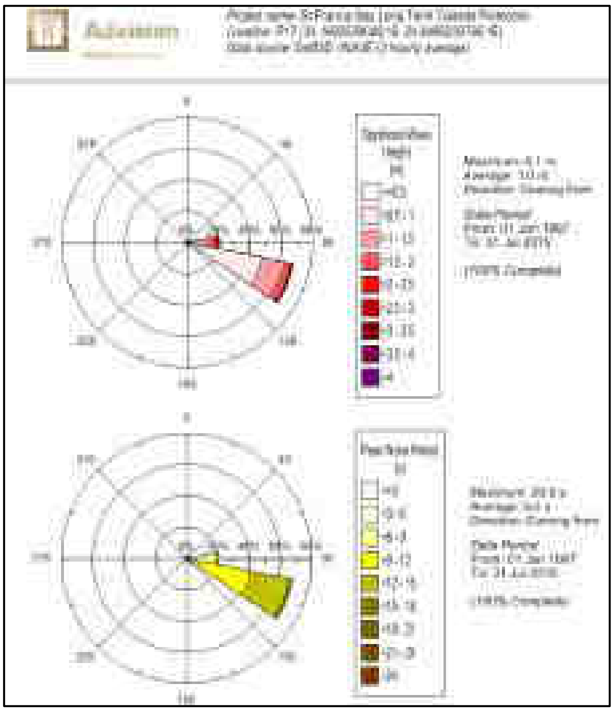












Appendix D UNIBEST Modelling Software

The coastal evolution modelling software used in this study is UNIBEST-CL+. UNIBEST is a software package developed by Deltares capable of simulating longshore and cross-shore processes and related morphodynamics of beach profiles and coastline evolution. It constitutes a powerful coastal engineering tool to be used in coastal erosion control and coastal management.

The UNIBEST software suite consists of three separate modules:

- UNIBEST-TC: Designed for the computation of cross-shore transport and resulting beach changes induced by waves, tidal currents and wind;
- UNIBEST-DE: Designed for the computation of dune erosion during storm conditions; and
- UNIBEST-CL+: Designed for the simulation of coastline changes due to longshore sediment transport gradients. The longshore transports are induced by tide and wave driven longshore currents.

UNIBEST-CL+ consists of two integrated sub-modules:

- The Longshore Transport module (LT-module) is designed to compute tide- and wave-induced longshore currents and sediment transports on an alongshore uniform beach with an arbitrary profile.

  The surf zone dynamics are derived from a built-in random wave propagation and decay model that transforms the offshore wave data to the coast.

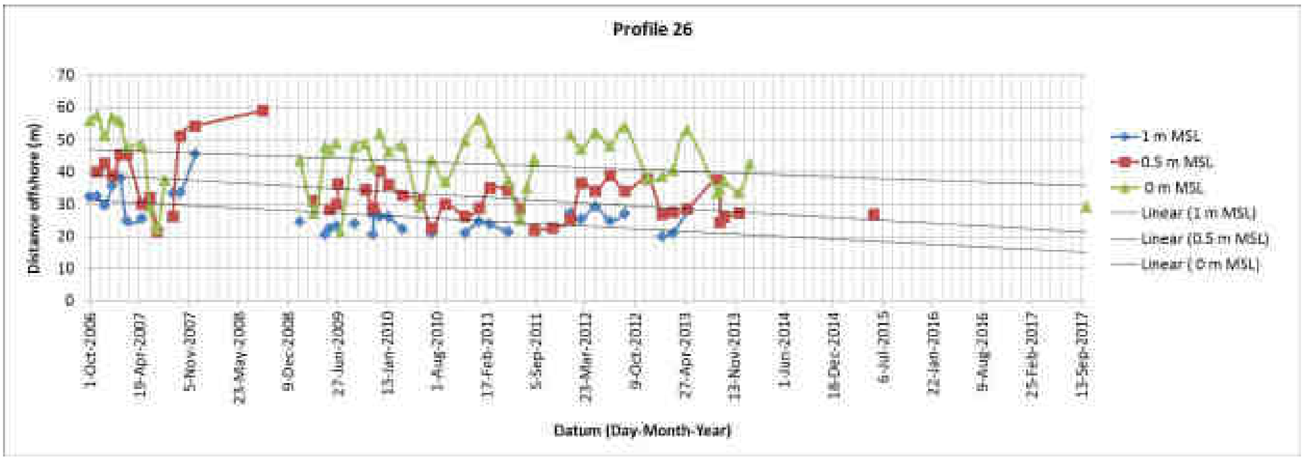
  The computational procedure takes any pre-defined wave climate and tidal regime in order to assess gross and yearly longshore transport, seasonal variation and storm events.
- The Coastline module (CL-module) is designed to simulate the coastline changes due to longshore sediment transport gradients of an alongshore nearly uniform coast on the basis of the single line theory.

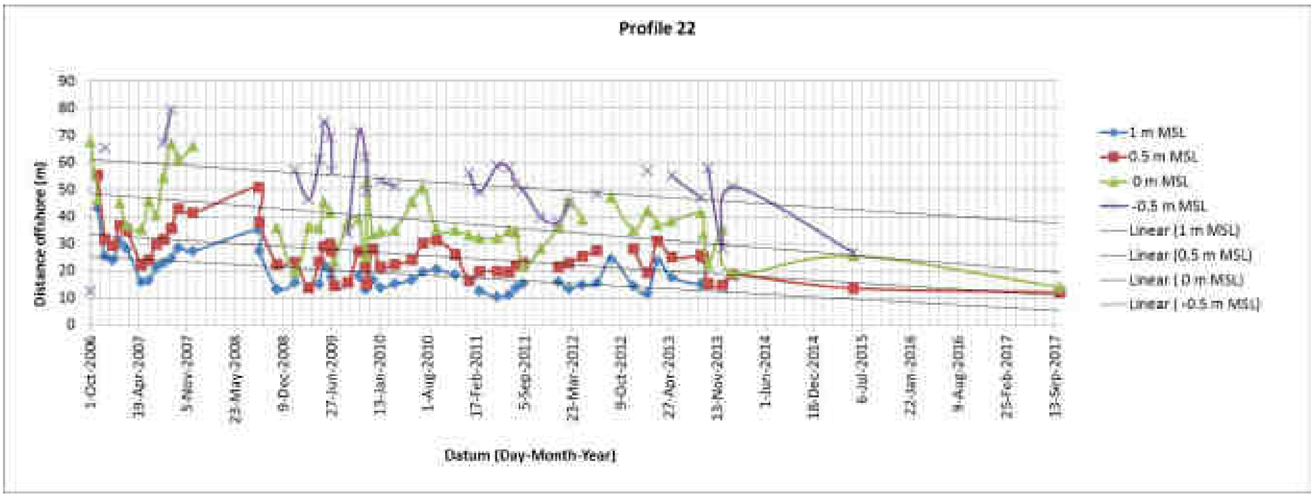
The CL-module is capable of modelling the morphologic effects of various coastal situations:

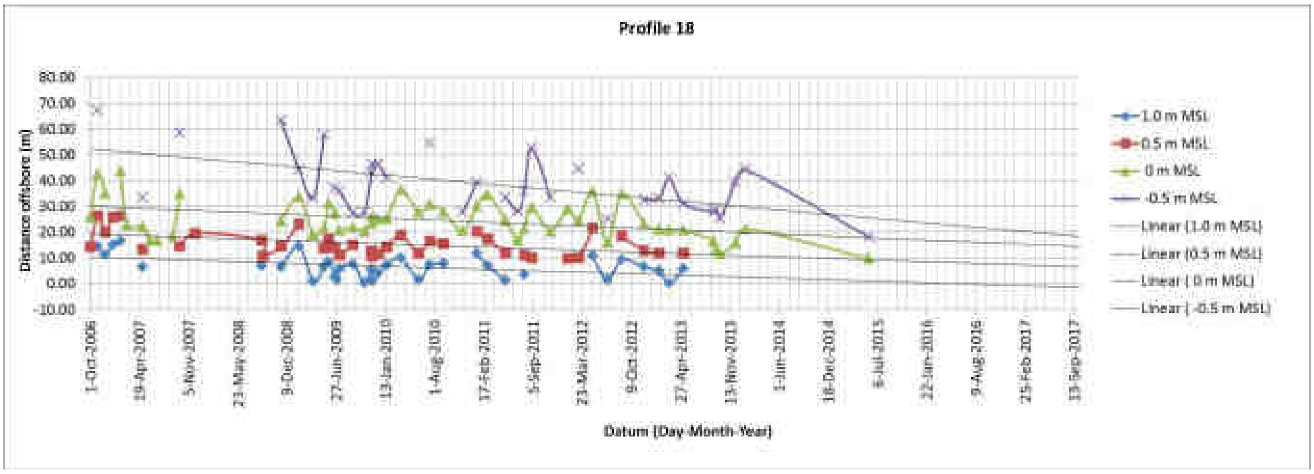
- Sediment sources and sinks;
- Headlands;
- Coastal revetments and sea walls;
- Groynes and breakwaters;
- Offshore breakwaters;
- Artificial sand by-pass; and
- Beach nourishments.

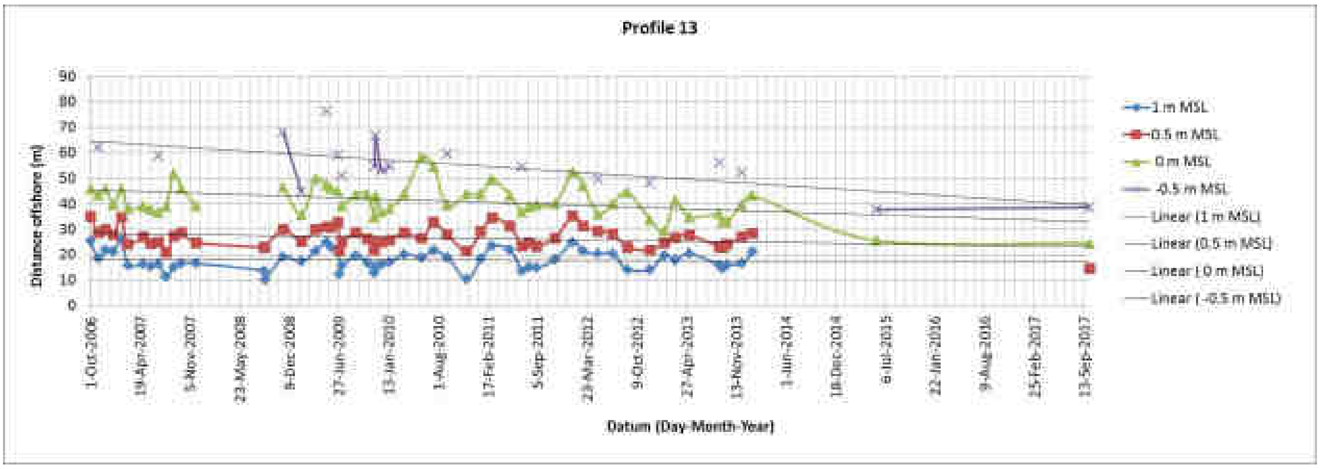
Appendix E Beach Profile Analysis

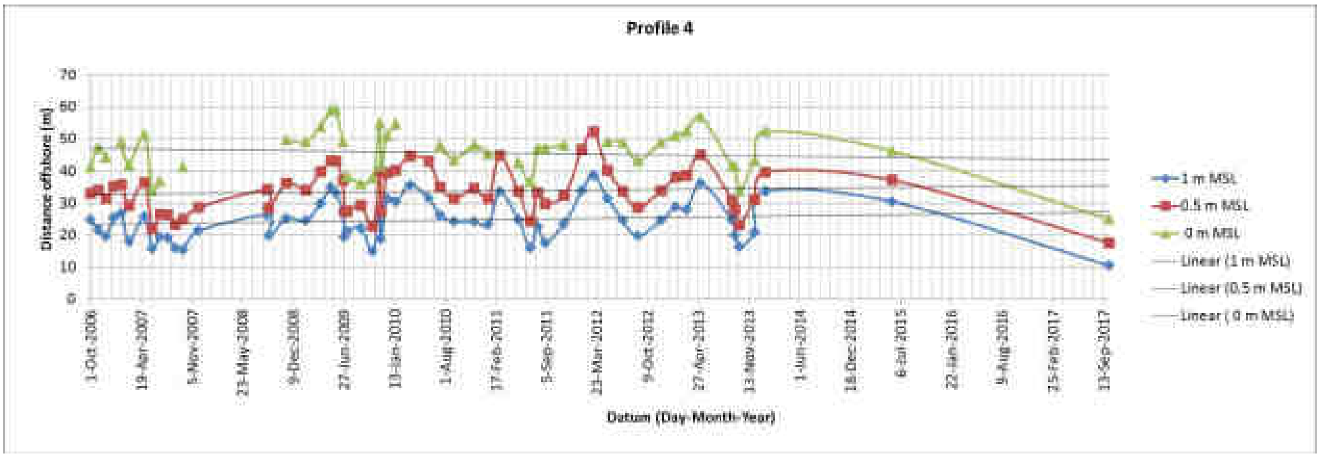
The horizontal movement of the elevation contours over time is presented in this Appendix for profiles nr. 26, 22, 18, 13 and 4 as indicated in the figure below.


Profile 26
Distance offshore (m)
Datum (Day-Month-Year)
1 m MSL
0.5 m MSL
0 m MSL
Linear (1 m MSL)
Linear (0.5 m MSL)
Linear (0 m MSL)


Profile 22
Distance offshore (m)
Datum (Day-Month-Year)
1 m MSL
0.5 m MSL
0 m MSL
-0.5 m MSL
Linear (1 m MSL)
Linear (0.5 m MSL)
Linear (0 m MSL)
Linear (-0.5 m MSL)


Profile 18
Distance offshore (m)
Datum (Day-Month-Year)
1.0 m MSL
0.5 m MSL
0 m MSL
-0.5 m MSL
Linear (1.0 m MSL)
Linear (0.5 m MSL)
Linear (0 m MSL)
Linear (-0.5 m MSL)





For the profiles presented, the average yearly rates of retreat were estimated as shown in the table below. As the survey taken in 2017 indicates significant erosion between 2015 and 2017, likely the result of one or more significant storm events, the rates were estimated with and without the 2017 survey.

It is evident that due to the significant erosion between 2015 and 2017, the average yearly retreat increases and almost reverses the accretion observed in the south (Profile 4).

Table H 1: Average retreat rates with and without 2017 survey

Profile #	Average retreat rate (m/year) for different elevation contours:							
	Surveys from 2006 to 2015				Surveys from 2006 to 2017			
	-0.5 m MSL	0.0 m MSL	0.5 m MSL	1.0 m MSL	-0.5 m MSL	0.0 m MSL	0.5 m MSL	1.0 m MSL
26	n/a	0.7	1.6	1.3	n/a	0.9	1.6	1.5
22	2.1	2.3	2.2	1.7	2.0	2.7	2.0	1.8
18	2.8	1.2	1.1	1.0	2.8	1.2	1.1	1.0
13	1.6	0.6	0.3	0.1	2.1	1.1	0.3	0.1
4	n/a	-0.1 *	-0.7 *	-0.8 *	0.0	0.2	-0.2 *	-0.4 *

Negative values indicate accretion

St. Francis Bay Beach Long-Term Coastal Protection Phase 2

Spit Protection: Preliminary Design Report

04/02/2019

31 Allen Drive
Loevenstein
Cape Town 7530
South Africa

C00729-01-PMT-PRE-0002

www.**advisian**.com

Advisian
WorleyParsons Group

Synopsis

This report documents the preliminary design undertaken as part of the St. Francis Bay Beach Long-Term Coastal Protection Phase 2 project.

Disclaimer

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Project No: C00729-01-PMT-PRE-0002 – St. Francis Bay Beach Long-Term Coastal Protection Phase 2: Spit Protection: Preliminary Design Report

Rev	Description	Author	Review	Advisian Approval	Date
A	Draft Report for Client Review	GR	MC	FS	20/11/18
B	Final Report	GR	MC	FS	04/02/19

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Executive Summary

The sandy beach at St. Francis Bay has suffered from significant erosion events over the past few decades. This has effectively reduced the beach width and impacted on the recreational amenity of the area, as well as threatened backshore infrastructure. The 700 m long unprotected spit area has suffered even more aggressive erosion, with consequent loss of considerable sand material in the dune, and may be subject to a breach if not provided with some level of protection.

Advisian was appointed by the St Francis Property Owners NPC (SFPO) in 2017 for the design and construction supervision of the second phase of the long term coastal protection and sand retention structures for St Francis Bay. Following the submission of the preliminary design report for Phase 2 in February 2018, SFPO expanded Advisian's scope of works to include a preliminary design of revetment structures for the Spit area.

This revetment preliminary design report presents:

- Basis of Design;
- Site Characterisation;
- An analysis of beach profile surveys;
- Cross-shore transport assessment to establish the revetment toe level;
- The preliminary design of a geotextile sand container, rock, and composite revetment option, including a plan layout and cross-sections;
- Alignment of options with the long term coastal protection option of the SFPO;
- The cost estimate and programme for options;
- Recommendation and way forward.

It was found that for the site conditions, a geotextile sand container option would be significantly more expensive than a rock or composite revetment option. It was recommended to either make use of a rock revetment or a composite revetment option.

1 Introduction

1.1 Project Location and Background

St. Francis Bay beach lies on the southern shores of the greater St. Francis Bay, stretching between the Cape St. Francis headland in the south and the Kromme river mouth in the north as shown in Figure 1. The sandy beach at St. Francis Bay has suffered from significant erosion events over the past few decades which can be attributed to the stabilisation of large headland bypass dune-fields during the 1970's and 1980's. This has led to a reduction in sediment supply to the beach which resulted in a rapid retreat of the shoreline. The erosion problem was worsened by the construction of Impofu dam upstream of the Kromme river mouth (completed in 1983) which limited the supply of sediments that would be flushed out during floods and deposited onto the adjacent beaches.

Figure 1: Locality Map – St. Francis Bay

The continued beach erosion has threatened to undermine beach properties and infrastructure, leading to the placement of rock revetments along much of the beach. Where properly maintained these revetment structures have provided some backshore protection but significant beach erosion has been experienced both in front of these structures and along unprotected areas. The unprotected northern most 700 m of the beach, known as the "Spit area", is backed by a narrow sand dune which has experienced significant erosion over recent years (Anderson, 2008). This is a narrow barrier dune and is in danger of being breached, with potentially severe implications for the canal and Marina.

While a steady coastline retreat is noticeable between 2010 and 2015, it was observed that the northern tip of the spit retreated at higher rates between 2015 and 2017. This is shown in Figure 2. (Advisian, 2018)

Figure 2: Spit retreat (Advisian, 2018)

The area under investigation is covered under two phases, namely Phase 1 and Phase 2.

Phase 1 was performed by others and was split into two separate studies. The first of these studies covers revetment protection design for part of the threatened coastline. The second of these studies covers revetment design of the entire portion of threatened coastline (including the portions described above) of which some of the revetment sections have been constructed by means rock protection. Phase 1 did not investigate mitigation of coastal erosion.

Advisian was appointed in 2017 to undertake Phase 2, the Long Term Coastal Protection (which shall further be referred to as LTCP). It focusses on restoration of beach amenity along the coastline. The initial scope of works for Phase 2 excluded revetment type shore protection options and only focussed on measures to mitigate beach erosion. It covered the Spit area and focussed on groyne fields, beach nourishment and offshore breakwaters. The preliminary design report for the LTCP was submitted in February 2018. As part of this report, a shoreline evolution assessment was undertaken of the Spit area and highlighted the need for revetment type protection in the event of a significant storm event taking place prior to implementation of the proposed groyne/ nourishment solution in the LTCP report. In October 2018 SFPO expanded the Phase 2 scope of works to include a preliminary revetment structure design for the Spit area.

1.2 Scope of Work (Revetment Preliminary Design)

A Preliminary Design of a revetment solution along the spit area will be undertaken that will be incorporated within the Advisian Phase 2 coastline stabilisation solution.

The Preliminary Design will consider the protection of approximately 670m by investigating the following three options:

a) Rock revetment option
b) Geotextile sand container (GSC) option;
c) Combination of the above.

The project scope of work is outlined below:

- Preliminary Design Report, which includes:
  - Basis of design and preliminary design;
  - Cost comparison; and
  - High level programme of the three options.
- Preliminary design sketches for (a) a rock revetment option, (b) a geotextile sand container option and (c) a combination of (a) and (b). They include:
  - One general layout which applies for all three options.
  - One cross-section for each of the three options.

In order to achieve the above this report is split into the following chapters:

- Basis of design;
- Site characterisation;
- Storm induced beach erosion;
- Preliminary design;
- Recommendations;
- The way forward.

2 Basis of Design

2.1 Units

SI Units are adopted throughout the drawings, calculations and documentation.

2.2 Chart Datum Reference

All levels in maritime works shall be relative to Chart Datum (CD) which is the Lowest Astronomical Tide (LAT) in all ports in South Africa. For this study CD is 0.836 m below the Mean Sea Level (MSL) or Land Levelling Datum (LLD).

2.3 Coordinate System

The coordinate system used in this study is the UTM, Zone 34H, spheroid WGS84.

2.4 Design Life

The design life of the rock revetment structures is 50 years. A design event with a return period of 100 years has been selected for design of both the rock revetment structures as well as the GSC revetment structures. This event has a probability of occurring or being exceeded at least once of approximately 37% during the structure design life.

Little to no degradation is expected to rock material within a 50 year design life and hence the design can be engineered to meet the design life. In the case of geotextile however the following must be considered:

- Exposed geotextile material may experience degradation due to UV light;
- There is uncertainty in the accuracy of design equations;
- GSC are more prone to vandalism.

These concerns have been documented in literature and are understood by suppliers. These factors therefore make it difficult to establish a medium to long term design life for geotextile based structures. Therefore, no specific design life can be guaranteed.

2.5 Design standards

Marine works and coastal protection have been designed in accordance with the following codes and guidance documents:

2.5.1 Codes:

- BS 6349-1:2000. British Standards for Maritime Structures: Part 1 Code of practice for general criteria.

2.5.2 Best Practice Guidelines

- The Rock Manual: the use of rock in hydraulic engineering (2nd edition), C683, CIRIA. London (CIRIA, CUR, CETMEF, 2007).
- Wave overtopping of sea defences and related structures: Assessment Manual. Environment Agency, UK www.overtopping-manual.com (EurOtop, 2007).
- Coastal Engineering Manual, US Army Corps of Engineers, 2003.
- Geosystems Design Rules and Applications, Deltares, Delft, 2013

3 Site Characterisation

3.1 Beach Profiles

3.1.1 Historic Surveys

Maarschalk & Partners undertook beach profile surveys between 2006 and 2015, and again in 2017. Additional surveys along the spit were undertaken by Allen Nicholson Survey in 2017 and 2018. Table 1 presents the months of the year when surveys were undertaken. The highest frequency of surveys was during 2007 and 2009.

Table 1: Beach Profile Surveys undertaken between 2006 and 2018

Month	Year											
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2017	2018
Jan	✓	✓		✓	✓	✓	✓	✓	✓		✓	
Feb		✓										
Mar		✓		✓	✓	✓	✓	✓		✓		✓
May		✓		✓	✓	✓	✓	✓				
Jun		✓		✓								
July		✓		✓	✓	✓	✓	✓				
Aug		✓	✓	✓		✓	✓					
Sep		✓	✓	✓	✓			✓			✓	
Oct	✓	✓		✓				✓				
Nov	✓		✓	✓	✓	✓	✓					
Dec	✓	✓		✓				✓				

3.1.2 Spit Profile Variations Over Time

Profiles of the Spit's beach taken between 2006 and 2017 were compared to evaluate the fluctuations in the beach profiles over time in the LTCP Report (Advisian, 2018). The approximate short term variation envelopes for the profiles and erosion/ accretion trends were identified.

Based on the standard deviation of the data, the short term horizontal excursion is in the order of 15 m. Linear trend lines fitted through the data points indicate a long term erosion trend of between 10 m and 20 m over 11 years, thus on average about 1.5 to 2 m per year (Advisian, 2018).

The beach profile evaluation between 0 m CD to 3 m CD found that vertical variation in beach level between surveys could reach up to 1.3 m.

Between January 2017 and March 2018 Allen Nicholson undertook three surveys along the Spit. One survey was undertaken prior to a large storm erosion event, one shortly after the event and the third in March 2018. From the surveys it is further evident that the northern part of the Spit (Section 1 – 4) is experiencing continuous erosion while the southern part (Sections 4A - 5) showing signs of recovery. The beach level vertical variation was found to be similar to that mentioned in the LTCP Report (Advisian, 2018) as well as PRDW's (PRDW, March 2015) future erosion assessment which indicated seasonal variation of approximately 1.5m.

Figure 3: Spit Survey Profiles 2017 to 2018 (Source: Allen Nicholson Surveyor).

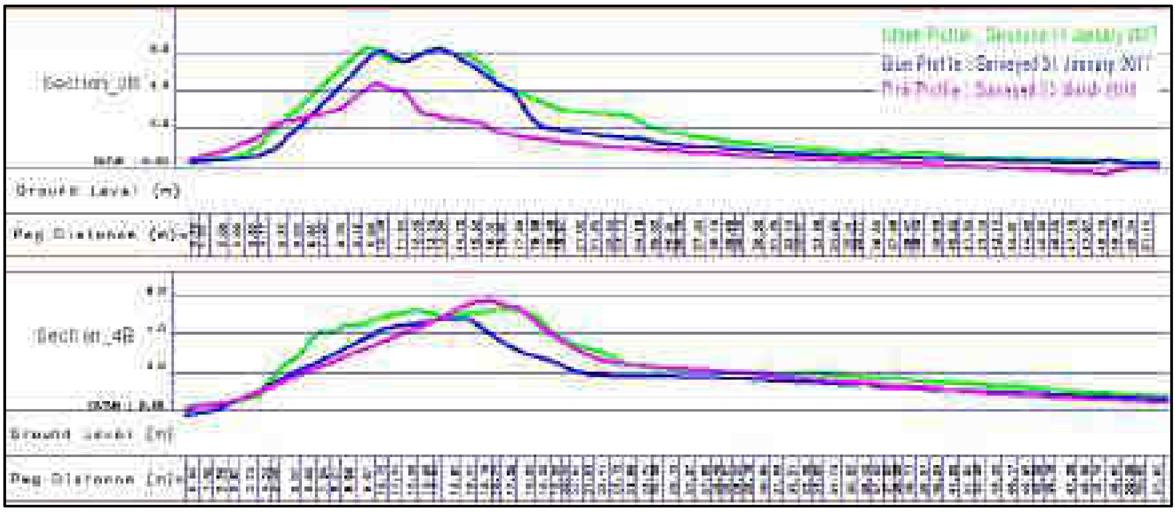

Figure 4: Beach erosion and recovery profiles (Source: Allen Nicholson Surveyor).

3.1.3 Beach profile characteristics

The maximum beach elevation measured along the back of the beach over the last 11 years occurred mostly along the southern and northern stretches of coastline and varied between +2.5 m and +3.5 m MSL (+3.3 to +4.3 m CD).

The slope of the beach above mean sea level was on average between 1 in 15 and 1 in 20.

3.2 Grain Size of Beach Sand

Sediment surveys of the offshore seabed, beach and estuary were undertaken by ASR (2006). It was found that the beach sand and sand in the shallow sub-tidal areas is mostly of similar grain size along the beach. The local bathymetry is also likely to influence the distribution of the sediment in the cross-shore direction, with finer sediments accumulating in the deeper areas according to ASR (2006). According to the (Entech, 2002) sand source report the average median grain size, $D_{50,}$ of the upper beach was found to be 0.18 mm and the lower beach was 0.22 mm.

3.3 Water Levels

3.3.1 Tidal Levels

Tides on the Southern African coasts are regular, semi-diurnal and their range seldom exceeds 2.2m. Tidal planes are provided at the South African ports by the SA Navy Hydrographer (2007). St Francis Bay is situated mid-way between Knysna and Port Elizabeth Port. The tidal planes at Port Elizabeth (Table 2) were adopted for this project.

Table 2: Tidal Levels (in meters CD) of Port Elizabeth (The SA Navy Hydrographer, 2017)

Location	LAT	MLWS	MLWN	ML	MHWN	MHWS	HAT
Port Elizabeth	0	0.21	0.79	1.04	1.29	1.86	2.12

3.3.2 Extreme Water Levels

For the extreme water level, the effects of sea level rise for the 50 year design life of the coastal structures, as well as the storm surge corresponding to the 100 year Average Return Interval (ARI) was superimposed onto the Mean High Water Spring Tide (MHWS). A storm surge analysis and sea level rise projects were undertaken in the Preliminary Design Report (Advisian, 2018). Table 3 provides the extreme water level.

Table 3: Extreme Water Levels

Parameter	Water level including SLR
Tide Level (MHWS)	+1.86 m CD
Storm Surge (1:100)	0.80 m
Sea-level rise	0.26 m
Total Water Level	**+2.92 m CD**

3.3.3 Design Water Levels

Design Still High Water Level was defined based on the combination of tide, surge and sea level rise resulting in +2.92 m above CD (Table 3). Design Still Low Water Level was defined as LAT (0.00 m CD).

4 Storm Induced Beach Erosion

Short term cross-shore erosion is typically the consequence of extreme wave events, where sediment is mostly temporarily (mostly) transported seaward. During calmer conditions, the beach profile typically tends to recover as the sediment is shifted towards the shoreline and deposited on the beach.

The estimated extent of beach recession due to an extreme event was used in the LTCP Phase 2 preliminary design (Advisian, 2018) to determine the minimum beach width required to accommodate such an event without impacting the landside boundary.

Preliminary simulations of storm induced changes to the beach profile were carried out using SBEACH (Simulation of storm induced BEAch CHange) during the Preliminary Design (Advisian, 2018). SBEACH describes the impacts of storms (short-term events) on upper and lower beach profiles.

The typical beach profile and sediment characteristics along St Francis shoreline were utilised to determine the expected beach recession. SBEACH was used to inform the minimum beach width required to maintain a useable beach after a storm event.

The initial beach profile (pre-storm) utilised to estimate short term erosion is shown in Figure 5.

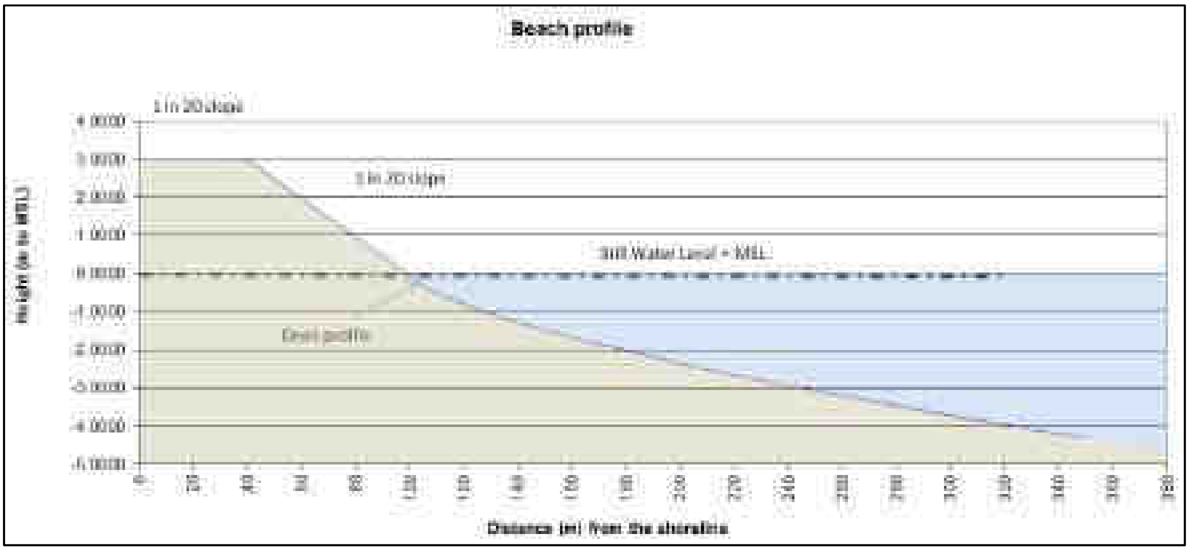

Figure 5: Initial pre-storm profile utilized in SBEACH simulations

The beach profile was based on the existing beach profile characteristics (Section 3.1.3). The highest elevation of the beach profile was adopted as +3 m MSL (+3.8 m CD) with a 1 in 20 slope to MSL (+0.836 m CD). The sub-aqueous section of the profile (below MSL) was assumed to be similar to the equilibrium beach profile based on Dean's equation (Dean, 1991):

4.1 Estimated short term erosion

The estimated cross-shore eroded profiles resulting from the SBEACH model simulations for the 1 year and 100 year ARI, with and without sea level rise (SLR), are presented in Figure 6.

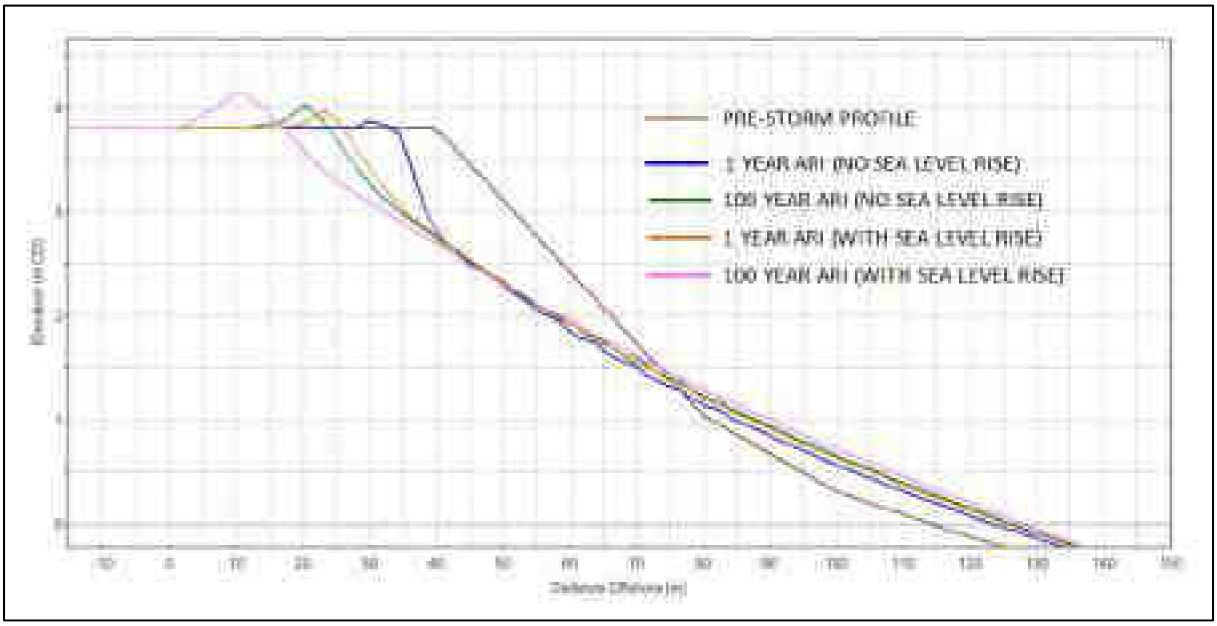

Figure 6: SBEACH storm erosion results (with and without SLR) (Advisian, 2018)

If SLR is not considered, the estimated recession of the beach crest (+3.8 m CD) ranges between 5 and 15 m. However, with SLR over 50 years, the recession increases to between 15 and 25 m with overwash of sediment reaching almost 40 m landward.

5 Preliminary Design

Revetments consist of shore-parallel structures designed to hold the coastline and to protect onshore structures behind them from wave impact, overtopping and erosion damage. As mentioned earlier in this report a study had already been conducted by Advisian to establish beach erosion mitigation measures in the form of a groyne field as well as beach nourishment. In addition, the previous study showed that a revetment will be required at the Spit area if there is a delay in construction of the groyne fields and beach nourishment as the coastline will be subject to erosion during this period. The client has indicated that the construction of the revetment at the Spit will be undertaken during the implementation of the LTCP solution and not prior to it.

This study identified three options to be analysed as potential remedies against wave attack:

- Rock revetment option.
- Geotextile sand container (GSC) option
- Combination of the above

This chapter presents the preliminary design of both the rock revetment and geotextile sand container options as well as a composite revetment section to protect the Spit. The following elements are discussed for each of the three options: incorporation of this design solution into the full Phase 2 LTCP solution (this implies that the revetment design takes cognisance of the groynes and beach nourishment protection solution and they act as one integrated defence system). One typical cross section for each of the options has been developed as well as one general layout plan for reference.

5.1 Incorporation of revetment into overall layout

The revetment solution will be incorporated within Area 1 of the general layout plan, developed during the preliminary design of the LTCP Study (Advisian, 2018) as shown in Figure 7 below. In this manner a single layout is obtained showing the spatial relationship between the groyne fields, beach nourishment and the revetment structures. The revetment will be constructed at the back of the beach along the existing Spit and the beach will be nourished on the ocean side of the revetment thereby extending the beach width by 40 m. The revetment is therefore seen as a last line of defence to prevent the Spit from breaching during consecutive storm events.

Figure 7: General Layout Plan (Advisian, 2018)

It is assumed that the construction sequence of LTCP will commence with the construction of the groynes to reduce the loss of sediment when the beach is nourished. Beach nourishment will then be undertaken by widening the beach by 40 m as recommended in the LTCP Report (Advisian, 2018). Lastly the revetment will be installed to allow for construction in the dry and to allow easy access to the trucks transporting the materials to the Spit. The beach crest level is located at 3.8 m CD (Section 4.1).

5.2 Design Waves

The extreme wave conditions used as input for the design of the revetment were based on depth limited conditions as defined in the CEM and based on (Weggel, 1972).

$$\frac{H_{sb}}{d_b} = b - a\frac{H_{sb}}{gT^2}$$

Where:

H_{sb} : Breaking wave height

d_b : Breaking depth

β : Seabed slope (±2.5°)

$$a = 43.8\left(1 - e^{-19\tan\beta}\right)$$

and

$$b = \frac{1.56}{\left(1 - e^{-19.5\tan\beta}\right)}$$

With the wave calculation it was assumed that the 40 m beach width has eroded away and the beach crest has dropped in level from +3.8 m CD to +2.3 m CD. In order for this erosion to be achieved two 1:100 year events are required such as two 1:100 storm conditions. The wave breaking depth is therefore 0.62 m.

A summary of the design conditions is presented in Table 4.

Table 4: Extreme wave conditions (100 year ARI) based on depth-limited conditions

Seabed Elevation (m CD)	SWL (m CD)	Total water depth (m)	H_{m0b} (m)	T_P (s)
+2.3	2.92	0.62	0.65	11.8

5.3 Revetment Toe Level

The beach profile evaluation undertaken in Section 3.1.2 indicates that the expected beach level variation due to seasonal and storm events could be up to approximately 1.5 m. The toe of the revetment will therefore be placed 1.5 m below the crest level of the beach.

3.8 m CD -1.5 m = 2.3 m CD

It is expected that regular beach maintenance will be undertaken post storm events to prevent the beach level from dropping below the revetment toe level of +2.3 m CD.

5.3.1 Crest Level

Erosion due to waves at the Spit could occur from two mechanisms. The first is when wave overtopping occurs when the beach has been eroded away due to storm events (two 1:100 year events) causing the lowering of the breach crest level and allowing waves to break against the structure. The second mechanism is when the beach crest level is above the design water level causing waves to break on the beach slope and the wave run- up reaching the Spit (revetment is buried). The revetment crest level will be governed by the most conservative of the following two scenarios.

For mechanism 1 it is assumed that the 40 m beach has eroded away and the beach level has dropped to +2.3 m CD.

- *Rock revetment:*

  Using equation 6.6 of the Overtopping Manual and limiting the rate of overtopping to 5 l/s/m results in a revetment crest level of +3.5 m CD (EurOtop, 2016).

- *Geotextile Sand Container Revetment:*

  Using equation 5.13 of the Overtopping Manual and limiting the rate of overtopping to 5 l/s/m results in a revetment crest level of +4.2 m CD (EurOtop, 2016).

For both options, the revetment crest level would fall below or near the same level as the beach crest level and may result in wave run-up passing over the revetment when the beach has not been eroded.

For mechanism 2, the beach crest level of 3.8 m CD is maintained and the beach has a slope of approximately 1:25. The significant wave run-up ($R_{1/3}$) for irregular wave is calculated using the CEM equation II-4-31. Wave run-up is the maximum elevation of wave uprush above the still waver level. The still water level of 2.92 m CD was used (100 year ARI).

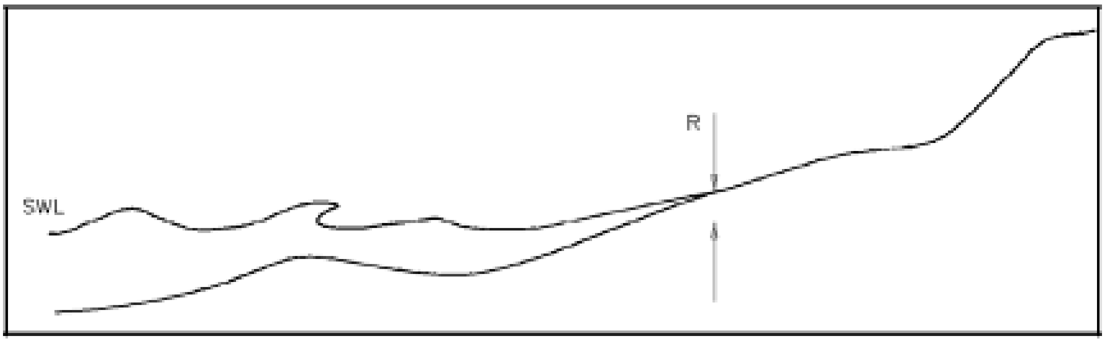

Figure 8: Wave run-up definition

$$\frac{R_{1/3}}{H_o} = 1.38\ \xi_o^{0.70}$$ CEM equation II-4-31

H_0 is the deep water significant wave height, ξ_o is the Surf similarity parameter.

$$\xi_o = \tan\beta \left(\frac{H_o}{L_o}\right)^{-\frac{1}{2}}$$ CEM equation II-4-1

L_o is the deep water wavelength.

For the extreme wave height estimates established in the LTCP Report (Advisian, 2018), the wave run-up levels were calculated and are presented in Table 5 below.

Table 5: Estimated wave run-up level for various Extreme wave height ARIs

ARI (yr)	H_0 (m)	T_P (s)	R_s (m)	R_s Level Reached (m CD)
1	3.6	10.9	2.1	5.0
25	5.2	11.5	2.7	5.7
50	5.6	11.7	2.9	5.8
100	5.9	11.8	3.0	5.9

Table 5 shows that if the revetment is buried below the beach crest level, the wave run-up would pass over the revetment and could run over low lying sections of the dunes along the Spit. This could result in sediment being deposited inside the canal and erosion of the dunes.

The revetment crest will be placed 1 m above the design beach crest level to stop wave run-up and reflect it back towards the sea. The revetment crest level would therefore be at +4.8 m CD. Further refinement of the crest level would be undertaken during the Detailed Design stage.

5.4 Rock Revetment Option

5.4.1 Armour Stability

Armour stability was calculated based on the Van der Meer and Van Gent shallow water equations (CIRIA/CUR/CETMEF, 2007).

The input design parameters for the rock armour stability calculation are listed in Table 6.

Table 6: Rock armour design parameters – Section at 2.3 m CD

Parameter	Abbreviation	Value
Seabed elevation	h	+2.3 m CD
Design High Water Level	DHWL	+2.9 m CD
Significant wave height	H_S	0.65 m
Spectral wave period	$T_{m-1,0}$	10.8 s
Density of sea water	ρ_s	1,025 kg/m^3
Density of rock	ρ_r	2,650 kg/m^3
Number of waves in 6h	N	2104
Damage parameter	S_d	3
Notional permeability	P	0.1
Armour slope	cot α	1V:1.5H
Median rock mass	$\mathbf{W_{50}}$	**238 kg**

The required median rock size is 238 kg. The nearest standard rock grading for the scour protection from the European EN 13383 standard grading requirements in the Rock Manual (CIRIA/CUR/CETMEF, 2007) is 300-1000kg. This deemed to be too large and a non-standard grading in accordance with the Rock Manual is selected as the rock armour.

The rock grading requirements are provided in the table below:

Table 7: Rock Class: EN 13383 Standard Grading Requirements

Class Designation	ELL	NLL	NUL	EUL	M_{em}	
Passing Requirements kg	<2% kg	<10% kg	>70%kg	>97% kg	Lower limit kg	Upper Limit
90-390	37	90	390	630	195	290

Definitions

- ELL: Extreme Lower Limit
- NLL: Nominal Lower Limit
- NUL: Nominal Upper Limit
- EUL: Extreme Upper Limit

The width of the revetment crest is defined as 3 x D_{n50} rocks and toe width was defined as 3 x D_{n50} rocks as per recommendations of (CIRIA/CUR/CETMEF, 2007) and (USACE, 2002).

If the selected rock grading is not locally available, a similar grading may be proposed for approval by the Engineer.

5.4.2 General Layout Plan & Rock Revetment Cross Section

A general layout plan and typical cross section for the rock revetment is shown below and provided in Appendix A. All three revetment option will make reference to the same general layout plan as the same setting out line will be used.

Figure 9: General Layout Plan

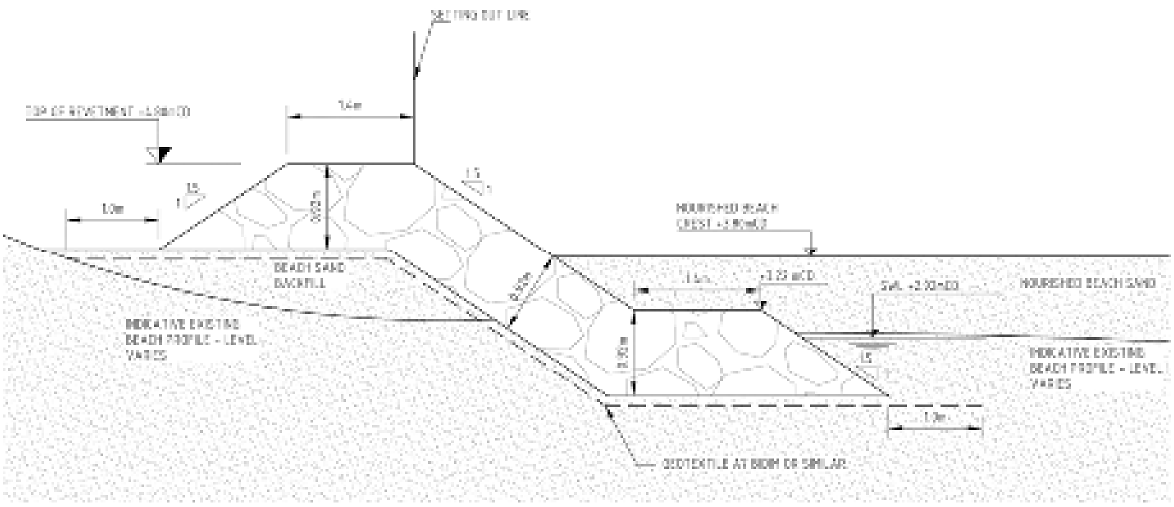

Figure 10: Typical Revetment Section

5.5 Geotextile Sand Container (GSC) Option

GSC stability was calculated using Geosystems Design Rules and Applications, Deltares, Delft, 2013 which is largely based on Pilarczyk's equations for geo-systems.

The input design parameters for the stability calculations are listed in Table 8.

Table 8: GSC design parameters – Section at 2.3 m CD

Parameter	Value	Unit
Sea Water Density (ρ_w):	1024	kg/m^3
Sand Density (ρ_s):	2400	kg/m^3
H_s	0,65	m
T_p	11,80	s
Design Water Level	2,92	mCD
Crest Level	4,80	mCD
Freeboard (Rc)	1,88	m
Lo	217,40	m
Porosity of fill (n)	0,45	-

The required length of the GSC was 1.9 m. for a 1:1 slope.

It must be noted that GSC technology is relatively young and that design guidelines and codes for GSC are still being developed. As such, no generally accepted design equations are currently available for a single layer GSC revetment and therefore there is an inherent risk associated with the use of this type of solution.

5.5.1 GSC Revetment Cross Section

It is generally recommended to apply GSC revetment structures as a double layer section, especially in instances where the revetment will be exposed to a harsh wave environment. A single layer may be considered under the following circumstances:

- Limited exposure to wave action;
- Fairly mild wave climate;
- Buried/ hidden protection;
- Temporary protection.

As the revetment is expected to be buried for most of its use and to reduce the cost of the GSC revetment only a single layer of GSCs will be used. In South Africa, GSCs have to date only been constructed as a double layer system (as confirmed by a manufacturer) due to the previously mentioned performance uncertainties of a single layer system.

If a single layer system will be implemented, it is recommended to undertake physical modelling during the Detailed Design stage to confirm stability of the proposed system. A beach maintenance plan would also need to be implemented to ensure that the design beach profile is maintained.

A typical cross section for the GSC revetment is shown below and provided in Appendix A. The revetment option will be implemented along the same setting out line as indicated in Figure 9 in Section 5.4.2 above.

SFPO have already purchased 120 no. 3PL 7.5m x 2.3m by 0.625m GSC. These containers can be incorporated into the single layer GSC cross section. The 120 GSC will be used within the crest of the revetment while the rest of the revetment will consist of smaller 2.3m x 2.3m x 0.625m containers.

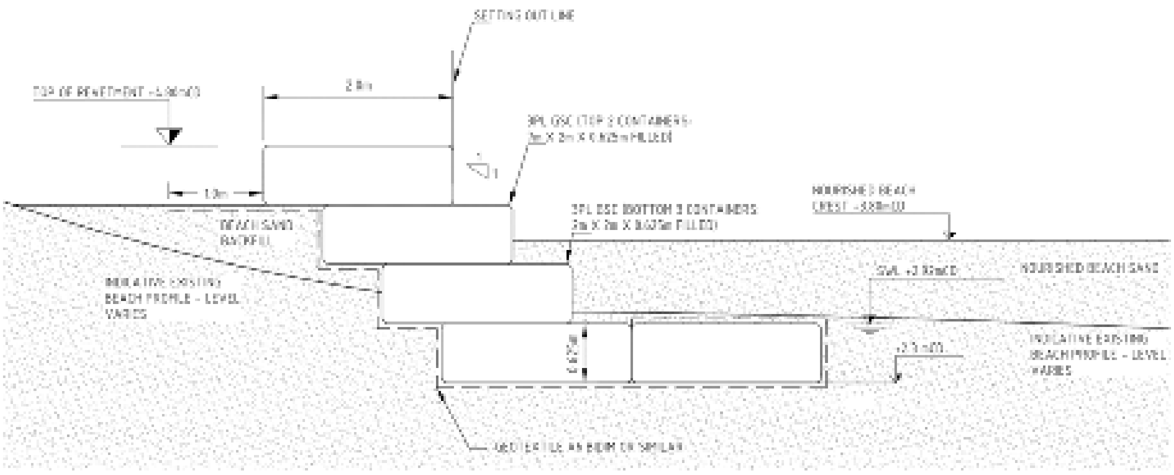

Figure 11: Typical GSC Section

5.6 Composite Revetment Option

SFPO have already purchased 120 no. 3PL 7.5m x 2.3m by 0.55m GSC. These containers could be incorporated into the rock revetment section in the following two ways:

- Firstly (Composite 1) by replacing the rock crest level with 2 GSCs. The expected fill dimensions of the containers are 7m x 2m x 0.625m. The 120 available GSCs would be sufficient to cover 420m of the approximately 670m requiring revetment protection. An additional 72 GSCs would need to be purchased to cover the remaining 250m of the Spit using this composite section. Therefore, for this section the entire length of 670m consists of a section which has a rock toe and slope, while the crest is from GSCs. This includes the client's existing 120 GSCs. Total GSCs needed are 192.

- Secondly (Composite 2), the first 420m of revetment will consists of Composite 1. This includes the client's 120 GSC. The remaining 250m of the length will consists only of rock.

A typical cross section for the composite revetment is shown below and provided in Appendix A.

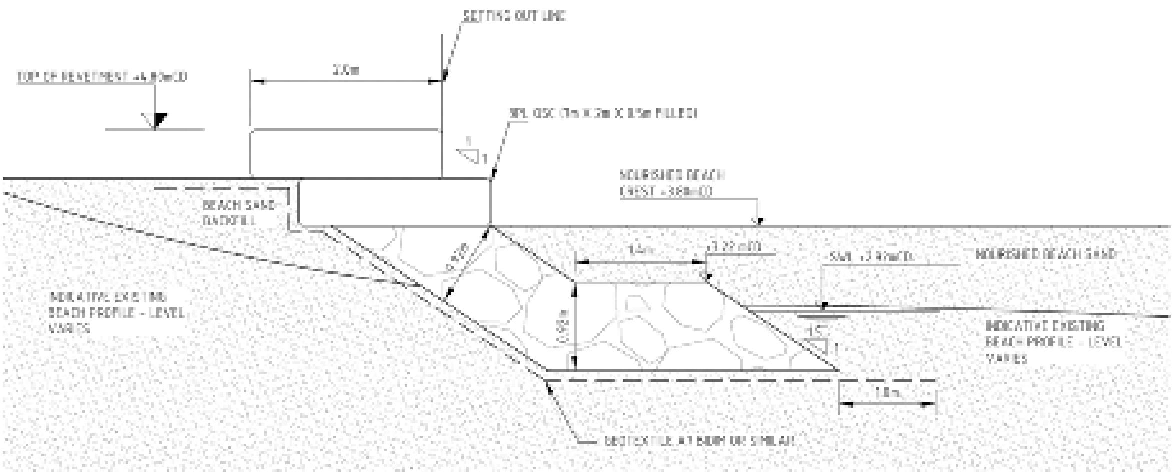

Figure 12: Typical Composite 1 Section

5.7 Estimated Quantities

The approximate quantities of material required for the preliminary design is provided in Table 9 below.

Table 9: Estimated quantities

Option	Rock	GSC	Composite 1	Composite 2
Rock W_{50}=100kg (m^3)	4,300	-	2,550	3,175
Geotextile Filter Layer (m^2)	6,900	6,700	6,850	7,100
GSC (7m x 2m x 0.625m filled) (EA)	-	120	192	120
Sand Containers (2m x 2m x 0.625m filled) (EA)	-	1,255	-	-
Excavation (m^3)	2,050	2850	2,050	2,050
Backfill (m^3)	4,300	3,900	4,500	3,900

5.8 Cost Estimates

The cost estimates are provided in Table 10 for the revetment options. Rock could either be sourced locally near Humansdorp or imported to St Francis from quarries near Port Elizabeth. It is known that the local quarry produces a certain fraction of rock which may be too tabular in shape and which may not be suitable for the marine structures or may require the weight to be adjusted slightly. Further investigations will need to be undertaken to determine the suitability of the rock produced at the quarries. For the cost estimate it was assumed that the rock would be sourced from local quarries.

Costing was based on the following assumptions:

- All rates are exclusive of VAT
- Supply of rock: R 238/t. Rock prices are based on a quotation received in November 2017 from the nearby SupaCrush Quarries, with no guarantee of rock suitability (size, shape and material) for marine construction. These prices have been escalated by 8% to account for inflation.
- P&Gs: 25%
- Contingency: 10%
- It is assumed that there are no additional fees outstanding on the 120 GSCs ordered by the client and no allowance has been made for delivery of these GSCs.

Based on the above assumptions the Total Project Cost for each of the Options are provided below:

Table 10: Estimate of Total Cost

Option	Description	Cost
Rock Revetment	Entire length of 670m consists of rock only	**R5,700,000**
GSC	Entire length of 670m consists of GSC only. This includes the client's existing 120 GSCs.	**R7,000,000**
Composite 1	Entire length of 670m consists of a section which has a rock toe and slope, while the crest is from GSCs. This excludes the cost of the clients already procured 120 GSCs. Total GSCs needed are 192.	**R5,100,000**
Composite 2	250m of the length consists only of rock. The remaining 420m consists of Composite 1. This excludes the cost of the client's already procured 120 GSCs.	**R5,000,000**

5.9 Construction Duration

The approximate construction duration for the various options are provided in the Table 11 below. The groyne construction and beach nourishment would need to be undertaken concurrently.

Table 11: Estimated Construction Duration

Option	Lead time (months)	Mobilisation (months)	Revetment Construction (months)	Demobilisation (months)	Total Construction Duration (months)
Rock Revetment	1	0.5	3	0.5	**5**
GSC Revetment	2	1	4	0.5	**7.5**
Composite	2	1	4	0.5	**7.5**
Note: Lead time and mobilisation may overlap with groyne construction and beach nourishment of the LTCP solution.					

5.10 Advantages and Disadvantages of Options

A summary of the advantages/disadvantages for each option described in the previous sections are presented in Table 12.

Table 12: Summary of advantages/disadvantages for each option

OPTION	ADVANTAGES	DISADVANTAGES
1. Rock revetment solution	▪ Guaranteed design life ▪ Shorter construction duration ▪ More environmentally friendly ▪ Proven to work efficiently along St Francis Bay when properly designed and maintained.	▪ Less aesthetically attractive ▪ More construction vehicles required on beach
2. Geotextile sand container revetment	▪ Soft solution (no hard structures) ▪ More aesthetically attractive ▪ Easily disassembled ▪ Less construction vehicles required on beach ▪ Procured GSCs are available for use	▪ No design life guaranteed and tends to be short term solution in harsher wave conditions. ▪ Highest cost ▪ Longer construction duration ▪ More complex constructability ▪ More maintenance required ▪ Vulnerable to vandalism
3. Composite	▪ More aesthetically attractive ▪ Procured GSCs are available for use ▪ Lowest cost	▪ Longer construction duration ▪ More maintenance required ▪ Vulnerable to vandalism

6 Conclusions and Recommendations

The following conclusions are drawn from the above study:

Costing in order of cheap to expensive are as follows:

Cost (cheapest to most expensive	Option
1	**Composite 2:** 250m of the length consists only of rock. The remaining 420m consists of GSCs only. This includes the client's 120 GSCs.
2	**Composite 1:** Entire length of 670m consists of a section which has a rock toe and slope, while the crest is from GSCs. This includes the client's existing 120 GSCs. Total GSCs needed are 192.
3	**Rock revetment only**
4	**Single layer GSC**

- The proposed single layer GSC revetment is more expensive than a rock or composite revetment and may require physical modelling to confirm the that a single layer of containers could be utilised.
- GSC technology is relatively young and design guidelines and codes for GSC are still being developed. As such, no generally accepted design equations are currently available for single layer GSC revetments and therefore there is an inherent risk associated with the use of this technology. While there are cases of GSCs being used for 20+ years of coastal protection, there are still uncertainties regarding the design life.
- St Francis Bay currently uses approximately 2km of rock revetment to protect infrastructure, properties and part of the spit. While some sections have partially collapsed at St Francis, when designed properly and maintained, rock revetments are a proven cost-effective solution however it may be aesthetically less pleasing to the community.
- A composite revetment may look more appealing however it will require more maintenance than a rock revetment.
- The Composite 1 option will have a more uniform appearance (more aesthetically attractive appearance) than the Composite 2 option.

Based on the cost comparison it is recommended that either the rock revetment or one of the composite revetment options be selected by SFPO.

7 The Way Forward

As this report forms part of the larger Phase 2 study, the following is suggested:

1) The client is to review the report and provide his comments with regards to any preferences from an EIA perspective, legal, cost, social etc.
2) It is understood that portions of this report will be used for the EIA. It is therefore important that the record of decision be made available to Advisian for design development.
3) Detailed design of revetment;
4) Update beach nourishment design based on sand source investigation (to be undertaken by SFPO);
5) Produce detailed design drawings.

The following additional studies and investigations will be required to complete the detailed design and/or prior to the construction of the preferred solution which is not part of the current study:

a) Suitability study of rock sources;

b) Sand source investigation;

c) Environmental Impact Assessment.

8 References

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Appendix A Drawings

FOR INFORMATION ONLY AND NOT TO BE USED FOR CONSTRUCTION

GENERAL ARRANGEMENT

1:1000

LEGENDS:

- PREDICTED SHORELINE
- ROCK REVETMENT

NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. ALL ELEVATIONS ARE IN METRES AND RELATIVE TO CHART DATUM (CD).
3. THE PREDICTED SHORELINE IS INDICATIVE ONLY AND MAY VARY SIGNIFICANTLY.
4. FOR GROYNE TYPICAL DETAILS REFER TO DWG C00729-00-PMT-DSE-1001
5. FOR ROCK REVETMENT TYPICAL DETAILS REFER TO DWG C00729-00-PMT-DSE-2001

m 0 10 20 30 40 50 m

1:1000

FOR INFORMATION ONLY	✓
PRELIMINARY	
FOR APPROVAL	
FOR TENDER PURPOSES	
FOR CONSTRUCTION	
AS BUILT	

REV	DATE	REVISION DESCRIPTION	DRAWN	DESIGNED	REV ENGINEER
A	09/01/2018	FOR INFORMATION ONLY	GR	GR	FS

CONSULTING ENGINEER ______

DATE ______

CLIENT ______

DATE ______

0 10 20 30 40 50 60 70 80 90 100

100mm ON ORIGINAL PLAN

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

CLIENT

ST FRANCIS PROPERTY OWNERS

PROJECT

ST. FRANCIS BAY BEACH LONG TERM COASTAL PROTECTION PHASE 2

DRAWING DESCRIPTION

GENERAL LAYOUT PLAN ROCK REVETMENT

WorleyParsons
P.O.Box 398
BELLVILLE 7535
TEL:+27 21912 3000
FAX:+27 21912 3222
e-mail: capetown.office@worleyparsons.com

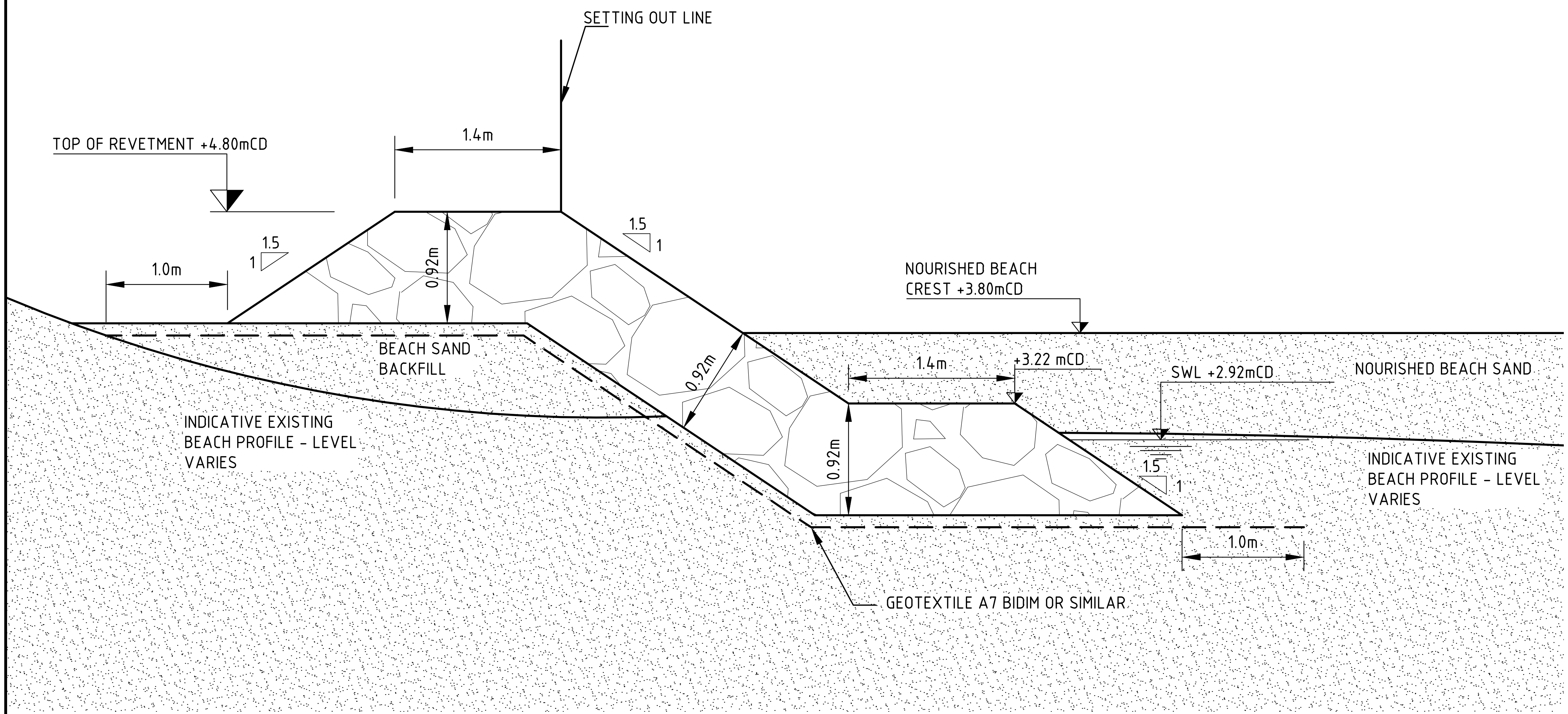
DATE: NOV 2018

SCALE: (ORIGINAL A1) 1:1000

DRG No. C00729-00-PMT-DAL-2001

REV. A

FOR INFORMATION ONLY AND NOT TO BE USED FOR CONSTRUCTION



NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. ALL ELEVATIONS ARE IN METRES AND RELATIVE TO CHART DATUM (CD).
3. REFERENCE DRAWINGS :
   C00729-00-PMT-DGA-2001.

ROCK CLASS	GRADING	W50 (kg)
ARMOUR ROCK	W=90-390 kg	238

FOR INFORMATION ONLY	✓
PRELIMINARY	
FOR APPROVAL	
FOR TENDER PURPOSES	
FOR CONSTRUCTION	
AS BUILT	

mm 0 500 1000 mm
1:20

REV	DATE	REVISION DESCRIPTION	DRAWN	DESIGNED	REV ENGINEER
A	20/11/2018	FOR INFORMATION ONLY	GR	GR	FS

CONSULTING ENGINEER
DATE
CLIENT
DATE

0 10 20 30 40 50 60 70 80 90 100
100mm ON ORIGINAL PLAN

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

CLIENT
ST FRANCIS PROPERTY OWNERS

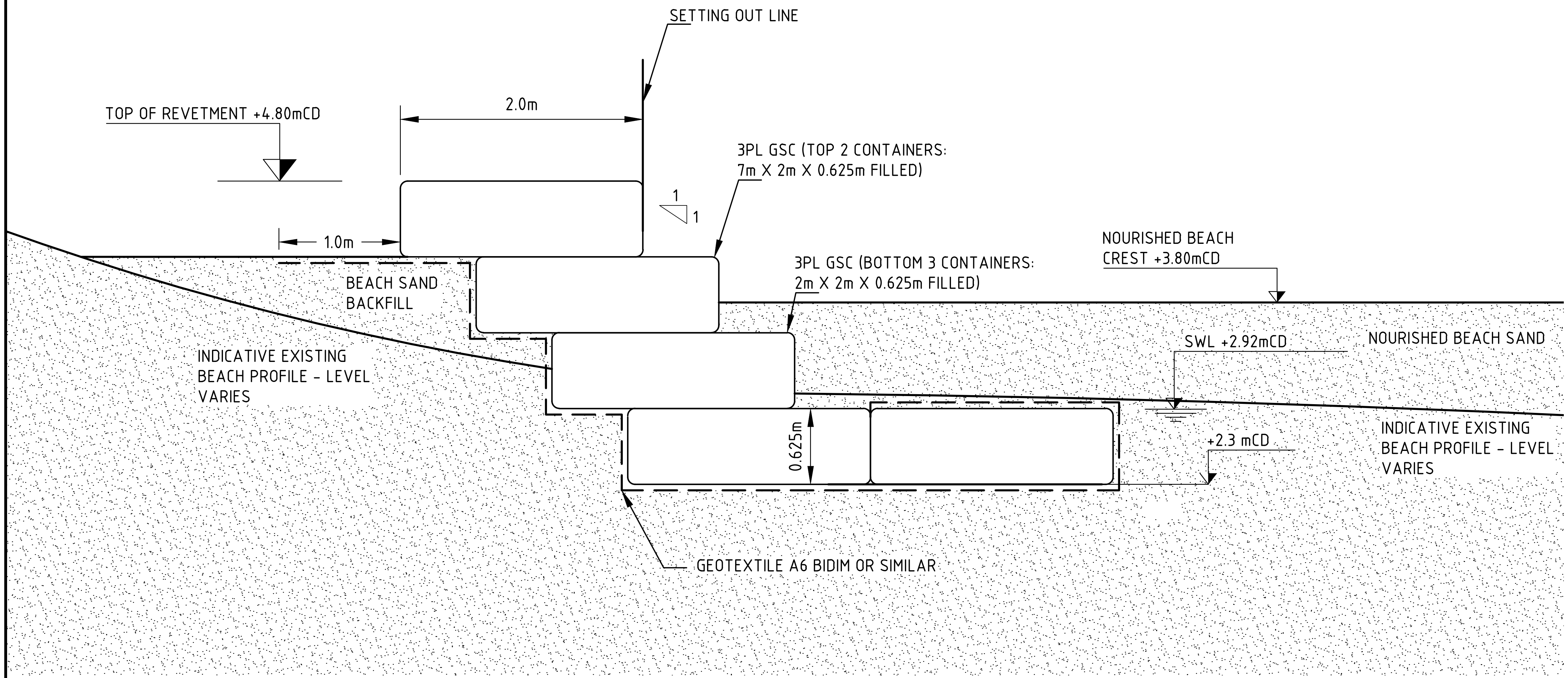
PROJECT
ST. FRANCIS BAY BEACH LONG TERM COASTAL PROTECTION PHASE 2

DRAWING DESCRIPTION
TYPICAL ROCK REVETMENT CROSS SECTION

WorleyParsons
P.O.Box 398
BELLVILLE 7535
TEL:+27 21912 3000
FAX:+27 21912 3222
e-mail: capetown.office@worleyparsons.com

DATE: NOV 2018
SCALE: (ORIGINAL A1) 1:20
DRG No. C00729-00-PMT-DSE-2001
REV. A

FOR INFORMATION ONLY AND NOT TO BE USED FOR CONSTRUCTION



NOTES:

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2. ALL ELEVATIONS ARE IN METRES AND RELATIVE TO CHART DATUM (CD).
3. REFERENCE DRAWINGS :
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mm 0 500 1000 mm
1:20

FOR INFORMATION ONLY	✓
PRELIMINARY	
FOR APPROVAL	
FOR TENDER PURPOSES	
FOR CONSTRUCTION	
AS BUILT	

REV	DATE	REVISION DESCRIPTION	DRAWN	DESIGNED	REV ENGINEER
A	20/11/2018	FOR INFORMATION ONLY	GR	GR	FS

CONSULTING ENGINEER
DATE

CLIENT
DATE

0 10 20 30 40 50 60 70 80 90 100
100mm ON ORIGINAL PLAN

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

CLIENT
ST FRANCIS PROPERTY OWNERS

PROJECT
ST. FRANCIS BAY BEACH LONG TERM COASTAL PROTECTION PHASE 2

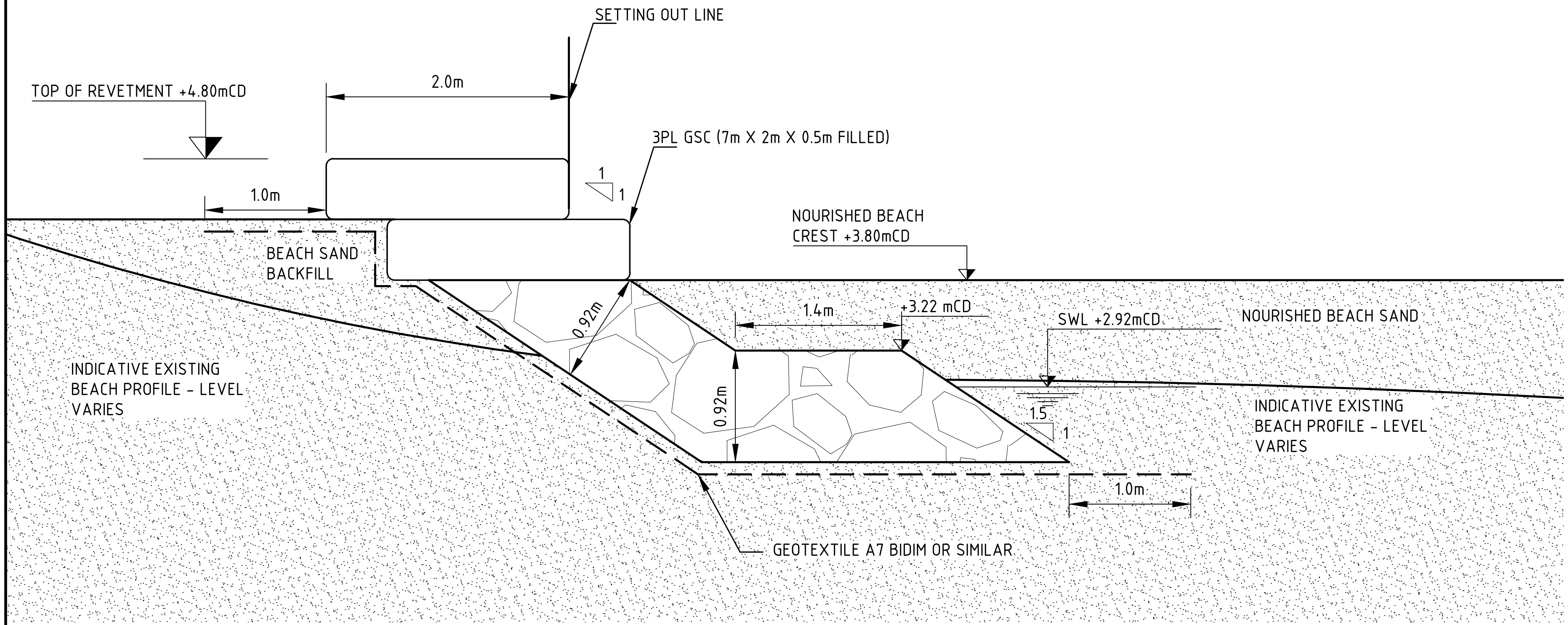
DRAWING DESCRIPTION
GSC REVETMENT CROSS SECTION

WorleyParsons
P.O.Box 398
BELLVILLE 7535
TEL:+27 21912 3000
FAX:+27 21912 3222
e-mail: capetown.office@worleyparsons.com

DATE	SCALE: (ORIGINAL A1)
NOV 2018	1:20

DRG No.	REV.
C00729-00-PMT-DSE-2002	A

FOR INFORMATION ONLY AND NOT TO BE USED FOR CONSTRUCTION



NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. ALL ELEVATIONS ARE IN METRES AND RELATIVE TO CHART DATUM (CD).
3. REFERENCE DRAWINGS :
   C00729-00-PMT-DGA-2001.

ROCK CLASS	GRADING	W50 (kg)
ARMOUR ROCK	W=90-390 kg	238

mm 0 500 1000 mm

1:20

FOR INFORMATION ONLY	✓
PRELIMINARY	
FOR APPROVAL	
FOR TENDER PURPOSES	
FOR CONSTRUCTION	
AS BUILT	

REV	DATE	REVISION DESCRIPTION	DRAWN	DESIGNED	REV ENGINEER
A	20/11/2018	FOR INFORMATION ONLY	GR	GR	FS

CONSULTING ENGINEER

DATE

CLIENT

DATE

0 10 20 30 40 50 60 70 80 90 100

100mm ON ORIGINAL PLAN

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

CLIENT

ST FRANCIS PROPERTY OWNERS

PROJECT

ST. FRANCIS BAY BEACH LONG TERM COASTAL PROTECTION PHASE 2

DRAWING DESCRIPTION

COMPOSITE REVETMENT CROSS SECTION

WorleyParsons
P.O.Box 398
BELLVILLE 7535
TEL:+27 21912 3000
FAX:+27 21912 3222
e-mail: capetown.office@worleyparsons.com

DATE: NOV 2018

SCALE: (ORIGINAL A1) 1:20

DRG No. C00729-00-PMT-DSE-2003

REV. A

APPENDIX G – HERITAGE AND ARCHAEOLOGICAL SPECIALIST REPORT

ST FRANCIS PROPERTY OWNERS NPC: PROPOSED ST FRANCIS BAY COASTAL PROTECTION PROJECT, ST FRANCIS, KOUGA MUNICIPALITY, EASTERN CAPE PROVINCE

Archaeological Impact Assessment

Prepared for: **St Francis Property Owners NPC**

Prepared by: **Exigo Sustainability**

Email info@exigo3.com
Tel +27 012 751 2160
Fax +27 086 607 2406

Postnet Suite 74,
Private Bag X07,
Arcadia, 0007

Vat nr: 4910184854
Registration nr: 2006/011434/07

Innovation in Sustainability

www.exigo3.com

ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF AREAS DEMARACTED FOR REHABILITATION FOR THE ST FRANCIS BAY COASTAL PROTECTION PROJECT, ST FRANCIS, KOUGA MUNICIPALITY, EASTERN CAPE PROVINCE

Conducted for:

St Francis Property Owners NPC
CES

Compiled by:
Nelius Kruger (BA, BA Hons. Archaeology Pret.)

Reviewed by:
Gregory Shaw (CES)

DOCUMENT DISTRIBUTION LIST

Name	Institution
Deon Pienaar	St Francis Property Owners NPC
Gregory Shaw	CES

DOCUMENT HISTORY

Date	Version	Status
25 November 2019	1.0	Draft
9 December 2019	2.0	Final Draft
20 March 2020	3.0	Final
30 November 2020	3.0	Final

DECLARATION

I, Nelius Le Roux Kruger, declare that –

- I act as the independent specialist;
- I am conducting any work and activity relating to the proposed St Francis Bay Coastal Protection Project in an objective manner, even if this results in views and findings that are not favourable to the client;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have the required expertise in conducting the specialist report and I will comply with legislation, including the relevant Heritage Legislation (National Heritage Resources Act no. 25 of 1999, Human Tissue Act 65 of 1983 as amended, Removal of Graves and Dead Bodies Ordinance no. 7 of 1925, Excavations Ordinance no. 12 of 1980), the Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment (SAHRA, AMAFA and the CRM section of ASAPA), regulations and any guidelines that have relevance to the proposed activity;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this declaration are true and correct.

____

Signature of specialist
Company: Exigo Sustainability
Date: 30 November 2020

EXECUTIVE SUMMARY

This report details the results of an Archaeological Impact Assessment (AIA) study subject to an Environmental Impact Assessment (EIA) process for the proposed St Francis Bay Coastal Protection Project in St Francis in the Kouga Municipality, Eastern Cape Province. The project entails the proposed rehabilitation of the St Francis Bay frontage over a linear area of approximately **2.7km**. The report includes background information on the area's archaeology, its representation in Southern Africa, and the history of the larger area under investigation, survey methodology and results as well as heritage legislation and conservation policies. A copy of the report will be supplied to the South African Heritage Resources Agency (SAHRA / EC-PHRA) and recommendations contained in this document will be reviewed.

Project Title	St Francis Bay Coastal Protection Project
General Project Location	S34.159684° E24.834225°
1:50 000 Map Sheet	3424BB
Farm Portion / Parcel	Goed Geloof 745
Magisterial District / Municipal Area	Kouga Municipality
Province	Eastern Cape Province

The history of Eastern Cape is reflected in a rich archaeological landscape. The province is well known for its contribution to Stone Age research and various South African archaeological cultures have derived their names from cave sites in the larger Port Elizabeth landscape such as Klasies River, Albany, Wilton and Howiesons Poort. Significantly, the intensive utilization of marine resources by San hunter-gatherers (dating from as old as 6 000 years ago), Khoekhoe pastoralists and KhoiSan (dating from the past 1 800 years in the region), manifests in the archaeological record through hundreds of shell middens (large piles of marine shell) dating to the terminal Pleistocene and Holocene that litter coastal areas along the Eastern Cape and specifically St Francis Bay. River mouths and estuaries were popular areas for hunter-gatherers and pastoralists to live because of the wide variety of food resources within easy walking distance, i.e. shellfish along the beach, fish in the estuary and game in the nearby hills. Later, Bantu-speaking tribes moved into this area from other parts of Southern Africa and settled here. White farmers, settling in the area since the middle of the 19th century, divided up the landscape into a number of farms, which even today form the framework for agricultural, urban, residential and other forms of development. Binneman (2009) indicates that the coastline south of Port Elizabeth once housed large numbers of archaeological sites but many of these important archaeological features have been destroyed by the development of the coastal towns and many were covered with dune sand and vegetation. The St Francis landscape has been developed extensively during the last decades where large portions of land have been transformed for agriculture and urbanization. In addition, coastal erosion, development and previous rehabilitation projects have transformed much of the coastal dunes in the project area. Cognizance should be taken of archaeological material that might be present in surface and sub-surface deposits. The following recommendations are made based on general observations in the proposed St Francis Bay Coastal Protection Project in terms of heritage resources management.

In terms of terrestrial archaeology, the following should be noted:

- The archeological site survey did not locate any archaeological sites or material in the project area of the St Francis Bay Coastal Protection Project area and it is highly likely that heritage sites may have been lost due to coastal erosion, through coastal development or during previous ocean front rehabilitation projects where by extensive revetments were constructed in recent years. It should be noted that the “Community Garden” and the “Two Harbour Walk” situated to the south of the project area near Harbour Road could hold meaning and significance to local residents and potential impact to these receptors should be addressed during the Public Participation process for the project.
- Considering the localised nature of heritage remains, the general monitoring of the development progress is recommended for all stages of the project. Here, all construction activities must be monitored by an archaeologist/heritage practitioner or alternatively a person must be specially trained, for example the ECO, to conduct the monitoring**.** Construction managers / foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately.
- It is essential that cognisance be taken of the larger archaeological landscape of the area in order to avoid the destruction of previously undetected heritage sites. It should be stated that it is likely that undetected archaeological remains might occur elsewhere in the project landscape in subsurface despots, along pristine coast dune-veld, near water sources and drainage lines and fountains which would often have attracted human activity in the past. Also, since Stone Age material seems to originate from below present soil surfaces in eroded areas, the larger landscape should be regarded as potentially sensitive in terms of possible subsurface deposits. As Palaeontological remains occur where bedrock has been exposed, all geological features should be regarded as sensitive.

In terms of Marine and Underwater Cultural Heritage (MUCH), a number of ships are known to have wrecked along the coastline of Cape St Francis and the Kromme River mouth - four vessels in particular are listed as being wrecked in St Francis Bay and of note is the wrecking site of the Lady Head (1859) in an unspecified location in the mouth of the Kromme River. A Maritime and Underwater Cultural Heritage Impact Assessment (MUCHIA) was considered as a large part of the proposed development and particularly sand sourcing and beach replenishment are proposed to occur below the high-water mark. However, the MUCH Unit of SAHRA granted exemption from MUCHIA cognisant of the fact that target areas for dredging occur largely to the riverside delta of the Kromme River estuary and areas within the river system to the west. In addition, the beach infrastructure (i.e. groyne) is expected to be constructed on top of the existing beach sand and level without the need for excavation. The revetment at the spit will be installed on a nourished beach level, which will be approximately 1 metre higher than the existing beach level. Therefore, no intervention in submerged items and artefacts are anticipated. The exemption was granted on the following conditions:

- A 100m buffer around the river mouth should be implemented. This is demarcated around the high-water line and around the coastal rock outcrop which encompasses the relative location of the Lady Head shipwreck shipwreck. This buffer includes the beach and coastal dune strips around the river mouth which could potentially hold the washed-up remains of wreckage, artefacts as well as possible survivor camp remnants. However, since the estuary and inland river canal south-west of the river mouth have been subjected to historical alteration and more recent riparian rehabilitation, it is recommended that this area be excluded from the 100m buffer. Rather a 50m buffer observed from the highwater mark to include the beachfront and adjoining dune strip east of the dividing spit at the estuary.

- The exclusion for development of a portion of dredging target area P1 which falls within this proposed buffer zone is recommended. The extent of this proposed exclusion area is approximately **1.1ha**.
- Bi-weekly monitoring by an informed and trained Environmental Control Office (ECO) of the dredging of target areas P1 and S1 and the placing of the groyne and revetment should be conducted in order to detect possible wreck remains and remains of survivor camps at the earliest opportunity. The ECO should ensure that identified dredging areas are not deviated from and that the exclusion of the portion of target area P1 in the conservation buffer be maintained at all times. The ECO should carefully monitor the placing of the groyne and ensure that sub-surface beach deposits are not impacted on by the activity.
- A suitably qualified MUCH specialist should be appointed during initial stages of the development in order to provide training to the assigned project ECO and contractors involved in the project activities on site. Training should cover the MUCH sensitivity of the area and heritage Chance Find procedures for the site.
- The ECO should report to the SAHRA MUCH Unit on a weekly basis, on the dredging progress and site status of target areas P1 and S1 for the duration of activities in these target areas.
- A Chance Find procedure that outlines what will happen if previously undetected heritage resources, particularly maritime archaeological resources, are encountered during dredging activities should be compiled and implemented. The Chance Find procedure should include some or all of the following measures:
    a. If any heritage resources and particularly maritime heritage resources (remains of the wreck, related artefacts, possible survivor camp remnants) are encountered, dredging activities should immediately be suspended and the SAHRA MUCH Unit should be notified;
    b. If any heritage resources and particularly maritime heritage resources is encountered, the controlled and systematic recovery of the resources should be done by means of rescue excavations. The recovery of heritage resources should be executed by a suitably qualified MUCH specialist;
    c. Any rescue excavations, artefact recovery or sampling must be done after a permit has been issued by SAHRA under Section 35 of the NHRA (Act 25 of 1999) to the qualified MUCH specialist;
    d. The recovery work should be conducted in such a way as to augment the research of shipwrecks along the Cape St Francis coastline;
    e. A close out report on MUCH rescue work must be submitted to SAHRA by the specialist.

These recommendations should be included within the Environmental Management Programme (EMPr) for the proposed project.

NOTATIONS AND TERMS/TERMINOLOGY

Absolute dating: Absolute dating provides specific dates or range of dates expressed in years.

Archaeological record: The archaeological record minimally includes all the material remains documented by archaeologists. More comprehensive definitions also include the record of culture history and everything written about the past by archaeologists.

Artefact: Entities whose characteristics result or partially result from human activity. The shape and other characteristics of the artefact are not altered by removal of the surroundings in which they are discovered. In the Southern African context examples of artefacts include potsherds, iron objects, stone tools, beads and hut remains.

Assemblage: A group of artefacts recurring together at a particular time and place, and representing the sum of human activities.

Context: An artefact's context usually consists of its immediate *matrix*, its *provenience* and its *association* with other artefacts. When found in *primary context*, the original artefact or structure was undisturbed by natural or human factors until excavation and if in *secondary context,* disturbance or displacement by later ecological action or human activities occurred.

Cultural Heritage Resource: The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

Cultural landscape: A cultural landscape refers to a distinctive geographic area with cultural significance.

Cultural Resource Management (CRM): A system of measures for safeguarding the archaeological heritage of a given area, generally applied within the framework of legislation designed to safeguard the past.

Feature: Non-portable artefacts, in other words artefacts that cannot be removed from their surroundings without destroying or altering their original form. Hearths, roads, and storage pits are examples of archaeological features

Impact: A description of the effect of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time and space.

Lithic: Stone tools or waste from stone tool manufacturing found on archaeological sites.

Matrix: The material in which an artefact is situated (sediments such as sand, ashy soil, mud, water, etcetera). The matrix may be of natural origin or human-made.

Midden: Refuse that accumulates in a concentrated heap.
Microlith: A small stone tool, typically knapped of flint or chert, usually about three centimetres long or less.
Monolith: A geological feature such as a large rock, consisting of a single massive stone or rock, or a single piece of rock placed as, or within, a monument or site.

Phase 1 CRM Assessment: An Impact Assessment which identifies archaeological and heritage sites, assesses their significance and comments on the impact of a given development on the sites. Recommendations for site mitigation or conservation are also made during this phase.

Phase 2 CRM Study: In-depth studies which could include major archaeological excavations, detailed site surveys and mapping / plans of sites, including historical / architectural structures and features. Alternatively, the sampling of sites by collecting material, small test pit excavations or auger sampling is required. Mitigation / Rescue involves planning the protection of significant sites or sampling through excavation or collection (in terms of a permit) at sites that may be lost as a result of a given development.

Phase 3 CRM Measure: A Heritage Site Management Plan (for heritage conservation), is required in rare cases where the site is so important that development will not be allowed and sometimes developers are encouraged to enhance the value of the sites retained on their properties with appropriate interpretive material or displays.

Provenience: Provenience is the three-dimensional (horizontal and vertical) position in which artefacts are found. Fundamental to ascertaining the provenience of an artefact is *association,* the co-occurrence of an artefact with other archaeological remains; and *superposition,* the principle whereby artefacts in lower levels of a matrix were deposited before the artefacts found in the layers above them, and are therefore older.

Random Sampling: A probabilistic sampling strategy whereby randomly selected sample blocks in an area are surveyed. These are fixed by drawing coordinates of the sample blocks from a table of random numbers.

Scoping Assessment: The process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addressed in an impact assessment. The main purpose is to focus the impact assessment on a manageable number of important questions on which decision making is expected to focus and to ensure that only key issues and reasonable alternatives are examined. The outcome of the scoping process is a Scoping Report that includes issues raised during the scoping process, appropriate responses and, where required, terms of reference for specialist involvement.

Site (Archaeological): A distinct spatial clustering of artefacts, features, structures, and organic and environmental remains, as the residue of human activity. These include surface sites, caves and rock shelters, larger open-air sites, sealed sites (deposits) and river deposits. Common functions of archaeological sites include living or habitation sites, kill sites, ceremonial sites, burial sites, trading, quarry, and art sites,

Stratigraphy: This principle examines and describes the observable layers of sediments and the arrangement of strata in deposits

Systematic Sampling: A probabilistic sampling strategy whereby a grid of sample blocks is set up over the survey area and each of these blocks is equally spaced and searched.

Trigger: A particular characteristic of either the receiving environment or the proposed project which indicates that there is likely to be an *issue* and/or potentially significant *impact* associated with that proposed development that may require specialist input. Legal requirements of existing and future legislation may also trigger the need for specialist involvement.

LIST OF ABBREVIATIONS

Abbreviation	Description
ASAPA	Association for South African Professional Archaeologists
AIA	Archaeological Impact Assessment
BP	Before Present
BCE	Before Common Era
BGG	Burial Grounds and Graves
CRM	Culture Resources Management
EIA	Early Iron Age (also Early Farmer Period)
EIA	Environmental Impact Assessment
EFP	Early Farmer Period (also Early Iron Age)
ESA	Earlier Stone Age
GIS	Geographic Information Systems
HIA	Heritage Impact Assessment
ICOMOS	International Council on Monuments and Sites
K2/Map	K2/Mapungubwe Period
LFP	Later Farmer Period (also Later Iron Age)
LIA	Later Iron Age (also Later Farmer Period)
LSA	Later Stone Age
MIA	Middle Iron Age (also Early later Farmer Period)
MRA	Mining Right Area
MSA	Middle Stone Age
NHRA	National Heritage Resources Act No.25 of 1999, Section 35
PFS	Pre-Feasibility Study
PHRA	Provincial Heritage Resources Authorities
SAFA	Society for Africanist Archaeologists
SAHRA	South African Heritage Resources Association
YCE	Years before Common Era (Present)

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LIST OF FIGURES

1 BACKGROUND

1.1 Scope and Motivation

Exigo Sustainability (Pty) Ltd (Exigo) was commissioned by the St Francis Property Owners NPC and CES to conduct an Archaeological Impact Assessment (AIA) study for the proposed St Francis Bay Coastal Protection Project in the Eastern Cape Province. The rationale of the AIA was to determine the potential presence of heritage resources such as archaeological and historical sites and features, graves and places of religious and cultural significance in the project area; to consider the impact of the proposed project on such heritage resources, and to submit appropriate recommendations with regard to the cultural resources management measures that may be required at affected sites / features.

1.2 Project Direction

Exigo's expertise ensures that all projects be conducted to the highest international ethical and professional standards. As archaeological specialist for Exigo Sustainability, Mr Neels Kruger acted as field director for the project; responsible for the assimilation of all information, the compilation of the final consolidated AIA report and recommendations in terms of heritage resources on the demarcated project areas. Mr Kruger is an accredited archaeologist and Culture Resources Management (CRM) practitioner with the Association of South African Professional Archaeologists (ASAPA), a member of the Society for Africanist Archaeologists (SAFA) and the Pan African Archaeological Association (PAA) as well as a Master's Degree candidate in archaeology at the University of Pretoria.

1.3 Project Brief

The St Francis Bay beach has lost a considerable amount of sand material and the existing dune area across the frontage as a result of significant erosion events occurring over the past few decades. This has resulted in existing infrastructure becoming more vulnerable to loss and damage, should more significant erosion events take place. The effects of the erosion of the beach (in both width and depth of sediment) has been realised across the full frontage, stretching from the car park at the end of Nevil Rd in the south to the Kromme Estuary mouth in the north. Approximately 700 m of the frontage, referred to as "the spit" is particularly vulnerable, as it is currently unprotected and that should a breach occur, there would be significant risk to existing infrastructure (e.g. houses, roads and canals) which are located behind the spit. The St Francis Property Owners Non-Profit Company (SFPO NPC), on behalf of the Kouga Local Municipality, has proposed the implementation of a coastal protection scheme for St Francis Bay beach. The coastal protection scheme will include sand material sourcing from the Kromme River (and any other viable sources), beach nourishment of St Francis Bay beach and the development of coastal structures to retard the erosion of St Francis Bay beach. The implementation of beach nourishment together with the development of 5 short stub groynes (i.e. a low solid barrier built into the sea) was considered to be the most suitable option for long-term coastal protections. To prevent the sea from breaking through the St Francis Bay beach spit during a strong storm surge event, revetment structures have been proposed as an additional coastal protection measure to be implemented.

The revetment structures will extend for approximately 620m along the length of the beach spit. A stretch of coastal dunes and beach of approximately **2700m** extending from Nevil Rd to the Kromme River mouth forms the project area.

Figure 1-1: Aerial image indicating the proposed St Francis Bay Coastal Protection Project area.

Figure 1-2: Aerial map detailing the extent of proposed dredging areas in the Kromme River for the proposed St Francis Bay Coastal Protection Project.

1.4 Terms of Reference

Heritage specialist input into the Environmental Impact Assessment (EIA) process is essential to ensure that, through the management of change, developments still conserve our heritage resources. It is also a legal requirement for certain development categories which may have an impact on heritage resources. Thus, EIAs should always include an assessment of heritage resources. The heritage component of the EIA is provided for in the **National Environmental Management Act, (Act 107 of 1998)** and endorsed by section 38 of the **National Heritage Resources Act (NHRA - Act 25 of 1999)**. In addition, the NHRA protects all structures and features older than 60 years, archaeological sites and material and graves as well as burial sites. The objective of this legislation is to ensure that developers implement measures to limit the potentially negative effects that the development could have on heritage resources. Based hereon, this project functioned according to the following **terms of reference for** heritage specialist input**:**

- Provide a description of archaeological or historical sites and features, graves and places of religious and cultural value and the built environment;
- Provide a cultural context and provenience for archaeological artefacts, structures (including graves) and settlements in the project area and in the surrounding landscape by means of a detailed desktop background study and review of existing heritage information;
- Assess the nature and degree of significance of such resources within the area and establish possible heritage conservation buffers;
- Assess any possible developmental impacts, present and future, on potential archaeological and historical remains within the larger landscape;
- Propose and provide possible heritage management measures for following phases of legally compliant heritage mitigation and management.
- Liaise and consult with EC-PHRA with regards to the site investigation, recommendations pertaining to possible management and mitigation measures as well as the final decision (ROD) for the project heritage landscape.

1.5 CRM: Legislation, Conservation and Heritage Management

The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

1.5.1 Legislation regarding archaeology and heritage sites

The South African Heritage Resources Agency (SAHRA) and its provincial offices aim to conserve and control the management, research, alteration and destruction of cultural resources of South Africa. It is therefore vitally important to adhere to heritage resource legislation at all times.

a. National Heritage Resources Act No 25 of 1999, section 35

According to the National Heritage Resources Act No 25 of 1999 (section 35) the following features are protected as cultural heritage resources:

a. Archaeological artefacts, structures and sites older than 100 years

b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography

c. Objects of decorative and visual arts

d. Military objects, structures and sites older than 75 years

e. Historical objects, structures and sites older than 60 years

f. Proclaimed heritage sites

g. Grave yards and graves older than 60 years

h. Meteorites and fossils

i. Objects, structures and sites of scientific or technological value.

In addition, the national estate includes the following:

a. Places, buildings, structures and equipment of cultural significance

b. Places to which oral traditions are attached or which are associated with living heritage

c. Historical settlements and townscapes

d. Landscapes and features of cultural significance

e. Geological sites of scientific or cultural importance

f. Archaeological and paleontological sites

g. Graves and burial grounds

h. Sites of significance relating to the history of slavery

i. Movable objects (e.g. archaeological, paleontological, meteorites, geological specimens, military, ethnographic, books etc.)

With regards to activities and work on archaeological and heritage sites this Act states that:

"No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit by the relevant provincial heritage resources authority." (34. [1] 1999:58)

and

"No person may, without a permit issued by the responsible heritage resources authority-

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites. (35. [4] 1999:58)."

and

"No person may, without a permit issued by SAHRA or a provincial heritage resources agency-

(a) *destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;*

(b) *destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority;*

(c) *bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) and excavation equipment, or any equipment which assists in the detection or recovery of metals (36. [3] 1999:60)."*

b. Human Tissue Act of 1983 and Ordinance on the Removal of Graves and Dead Bodies of 1925

Graves and burial grounds are commonly divided into the following subsets:

a. ancestral graves
b. royal graves and graves of traditional leaders
c. graves of victims of conflict
d. graves designated by the Minister
e. historical graves and cemeteries
f. human remains

Graves 60 years or older are heritage resources and fall under the jurisdiction of both the National Heritage Resources Act and the Human Tissues Act of 1983. However, graves younger than 60 years are specifically protected by the Human Tissues Act (Act 65 of 1983) and Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws. Such burial places also fall under the jurisdiction of the National Department of Health and the Provincial Health Departments.

c. National Heritage Resources Act No 25 of 1999, section 35

This act (Act 107 of 1998) states that a survey and evaluation of cultural resources must be done in areas where development projects, that will change the face of the environment, will be undertaken. The impact of the development on these resources should be determined and proposals for the mitigation thereof are made. Environmental management should also take the cultural and social needs of people into account. Any disturbance of landscapes and sites that constitute the nation's cultural heritage should be avoided as far as possible and where this is not possible the disturbance should be minimized and remedied.

1.5.2 Background to HIA and AIA Studies

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are 'generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. Heritage sites are frequently threatened by development projects and both the environmental and heritage legislation require impact assessments (HIAs & AIAs) that identify all heritage resources in areas to be developed. Particularly, these assessments are required to make recommendations for protection or mitigation of the impact of the sites. HIAs and AIAs should be done by qualified professionals with adequate knowledge to (a) identify all heritage resources including archaeological and palaeontological sites that might occur in areas of developed and (b) make recommendations for protection or mitigation of the impact on the sites.

A detailed guideline of statutory terms and requirements is supplied in Addendum 1.

2 REGIONAL CONTEXT

2.1 Area Location

The proposed St Francis Bay Coastal Protection Project is located along the frontage of St Francis in the Kouga Municipality, Eastern Cape Province. Humansdorp is situated more or less 15km north of the project area and Port Elizabeth is 75km to the north-east. The project footprints appear on 1:50 000 map sheets **3424BB** (see Figure 2-1).

A key geographical point for the project locations is:

- **S34.159684° E24.834225°**

2.2 Area Description: Receiving Environment

The St Francis region is situated along the Eastern Cape coastal grasslands. The ecological landscape is defined as a combination of mixed grasslands and forest / scrub forest, typically dominated by mixed grassveld and forests at differing altitudes. The annual rainfall ranges between 1150 to over 1300mm per annum. The geology of the larger region is constituted by mudstones and sandstones of the Beaufort group and towards the coast, shales, mudstones and sandstones of the Ecca group, with exposures of dolerite intrusions mostly in the higher lying areas, are found. Soils in the area are moderate to deep and vary between sandy loams in the upper half to clayey loam in the downstream half. The town is situated within expanding rural residential areas and surface disturbances are prevalent in the study area. The Kromme Estuary mouth forms the northern periphery of the town.

2.3 Site Description

The project area subject to this assessment is situated along the frontage of the town of St Francis. The stretch of coastline subject to this assessment extends from the Kromme River to Harbour Road over an area consisting of both private properties and land belonging to the Kouga Municipality. At present, much of the coastline along the highwater mark is protected by extensive rock revetments. In places, these revetments as well as roads and sand embankments along the frontage have been eroded by recent storms and tidal activity. As such, very little of the original coastal dune environment remains in the project area and the only relatively intact coastline occurs towards the Kromme estuary.

Figure 2-1: 1:50 00 Map representation of the location of the proposed St Francis Bay Coastal Protection Project (sheet 3424BB).

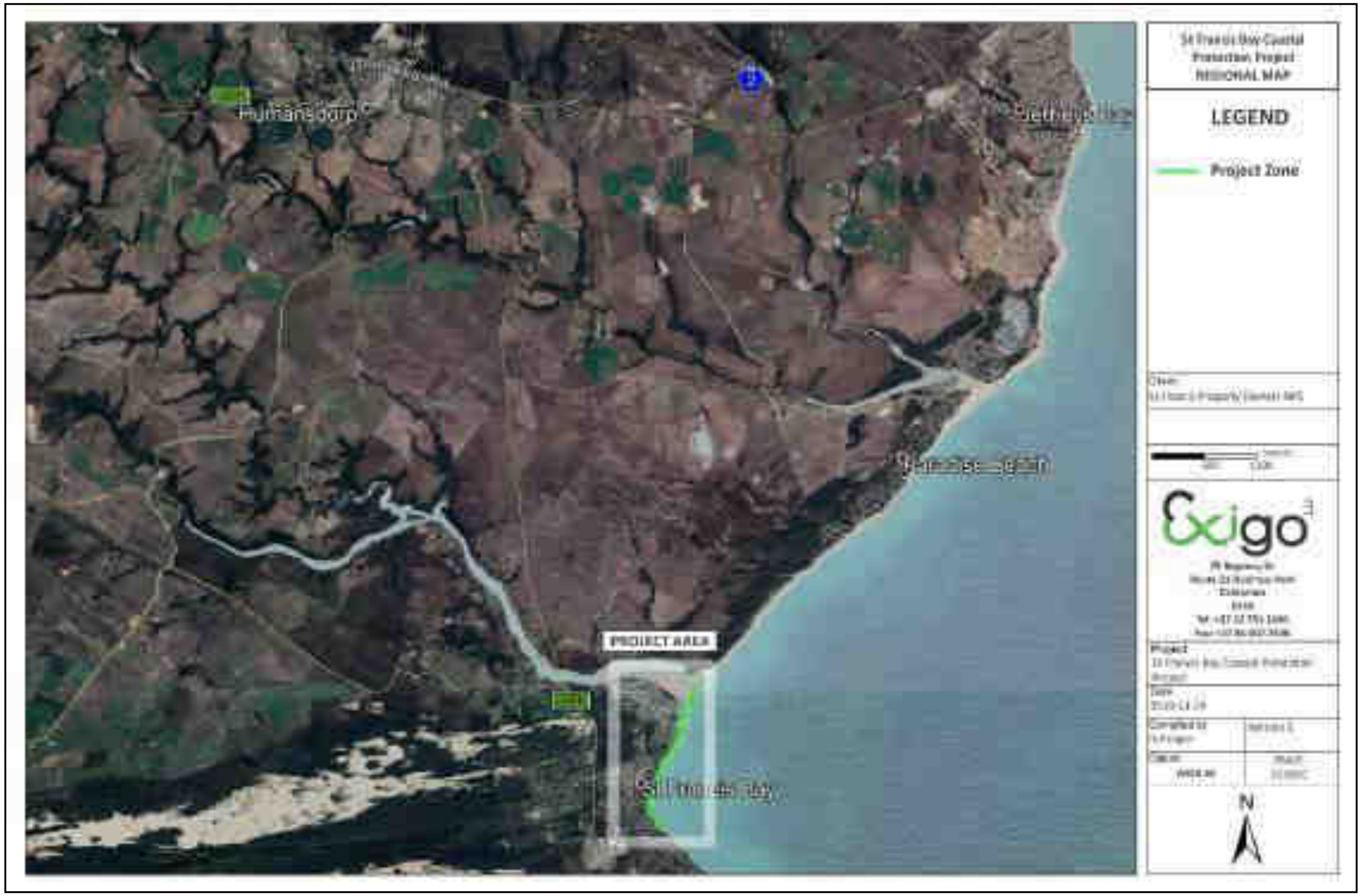

Figure 2-2: Aerial map providing a regional context for the proposed St Francis Bay Coastal Protection Project.

3 METHOD OF ENQUIRY

3.1 Sources of Information

Data from detailed desktop, aerial and field studies were employed in order to sample surface areas systematically and to ensure a high probability of heritage site recording.

3.1.1 Desktop Study

The larger landscape of Eastern Cape has been well documented in terms of its archaeology and history. A desktop study was prepared in order to contextualize the proposed project within a larger historical milieu. The study drew on available academic papers and research articles, unpublished archival databases to give a comprehensive representation of known sites in the larger project region and to establish a baseline of the landscape's heritage. A number of commercially driven Heritage Assessments have been conducted in the region around the project area and these include:

- Binneman, J.N.F. 1985. Research along the south eastern Cape coast. In: Hall, S.L. & Binneman, J.N.F. Guide to archaeological sites in the eastern and north eastern Cape. pp. 117-134. Grahamstown: Albany Museum.
- Binneman, J.N.F. 1996. The symbolic construction of communities during the Holocene Later Stone Age in the south-eastern Cape. Unpublished D.Phil. thesis: University of the Witwatersrand.
- Binneman, J.N.F. 2001. An introduction to a Later Stone Age coastal research project along the south-eastern Cape coast. Southern African Field Archaeology 10:75-87.
- Binneman, J.N.F. 2005. Archaeological research along the south-eastern Cape coast part1: open-air shell middens Southern African Field Archaeology 13 & 14:49-77.
- Binneman, J. 2005. Phase 1 archaeological and living heritage impact assessments on the farm Kabeljaus River 339, Jeffrey's Bay. Prepared for Africa Geo-Environmental Services (Pty) Ltd. Arcadia.
- Binneman, J. 2006. Phase 1 archaeological heritage impact assessment for the proposed Kouga development of portions of the farms Kabeljauws River No. 322 and Papiesfontein No. 319 in Jeffreys Bay, Kouga Municipality, District of Humansdorp, Eastern Cape. Prepared for CEN Integrated Environmental Management Unit, Port Elizabeth.
- Binneman, J.N.F. 2007. Archaeological research along the south-eastern Cape coast part2, caves and shelters: Kabeljous River Shelter 1 and associated stone tool industries Southern African Field Archaeology 15 & 16:57-74.
- Binneman, J. 2008. Phase 1 archaeological heritage impact assessment for the proposed "St Francis Coastal Reserve" on portions of the remainder of the farm New Papiesfontein No. 320, Kouga Municipality, District of Humansdorp, Eastern Cape. Prepared for: Envirovision Consulting, Pretoria.
- Binneman, J. 2009. A Phase 1: Archaeological Heritage Impact Assessment of the proposed Cob Creek Estate development on portion 21 of the Farm Kabeljauws River No. 321, Jeffreys Bay, Kouga Municipality, Eastern Cape.
- Binneman, J. 1996. The symbolic construction of communities during the Holocene Later Stone Age in the south-eastern Cape. Unpublished D.Phil. thesis: University of the Witwatersrand.
- Binneman, J. 2001. An introduction to a Later Stone Age coastal research project along the south-eastern Cape coast. Southern African Field Archaeology 10:75-87.
- Binneman, J. 2005. Archaeological research along the south-eastern Cape coast part1: open-air shell middens Southern African Field Archaeology 13 & 14:49-77.
- Binneman, J. 2007. Archaeological research along the south-eastern Cape coast part2, caves

and shelters: Kabeljous River Shelter 1 and associated stone tool industries Southern African Field Archaeology 15 & 16:57-74.

- Binneman, J. 2008. A Phase 1 Archaeological Impact Assessment (AIA) of the proposed development on Portion 78 of the Farm Ongegund. Vryheid No. 746 (Rocky Coast Farm), Cape St Francis, Kouga Municipality, Eastern Cape Province.
- Binneman, J. 2014. A Phase 1 Archaeological Impact Assessment (AIA) of the proposed storm water management system developments on Portion 62 of the farm Ongegunde Vryheid No. 746, St Francis Bay, Kouga Local Municipality, Eastern Cape Province.
- Deacon, H. J. & Wurz, S. 1996. Klasies River Main Site, Cave 2: a Howiesons Poort occurrence. In: Pwiti, G. & Soper, R., eds, Aspects of African Archaeology. Harare: University of Zimbabwe Publications, pp. 213–8.
- Nilssen, P. 2003. Phase 1 Archaeological Impact Assessment for the proposed St Francis Golf Estate, St Francis Bay, Kouga Municipality, Eastern Cape Province
- Webley, L. 2006. Phase 1: Archaeological Impact Assessment along the St Francis bay beach. Albany Museum

3.1.2 Aerial Survey

Aerial photography is often employed to locate and study archaeological sites, particularly where larger scale area surveys are performed. This method was applied to assist the foot site surveys where depressions, variation in vegetation, soil marks and landmarks were examined (refer to Section 5.1). Historical aerial photos obtained during the archival search were scrutinized and features that were regarded as important in terms of heritage value were identified and if they were located within the boundaries of the project area they were physically visited in an effort to determine whether they still exist and in order to assess their current condition and significance. By superimposing high frequency aerial photographs with images generated with Google Earth as well as historical aerial imagery, potential sensitive areas were subsequently identified, geo-referenced and transferred to a handheld GPS device. These areas served as reference points from where further vehicular and foot surveys were carried out (Section 5.2).

3.1.3 Mapping of sites

Historical and current maps of the project area were examined. By merging data obtained from the desktop study and the aerial survey, sites and areas of possible heritage potential were plotted on these maps of the larger St Francis area using GIS software. These maps were then superimposed on high definition aerial representations in order to graphically demonstrate the geographical locations and distribution of potentially sensitive landscapes. Historical and more recent maps indicate the appearance of suburban areas during the mid-1950's in the project area (refer to Section 5.1.)

3.1.4 Field Survey

Archaeological survey implies the systematic procedure of the identification of archaeological sites. An archaeological survey of the project alignments, routes and impact areas was conducted in November 2019. The process encompassed a systematic field survey in accordance with standard archaeological practice by which heritage resources are observed and documented. In order to sample surface areas systematically and to ensure a high probability of site recording, the beachfront was systematically surveyed on foot. GPS reference points identified during the aerial survey were also visited and random spot checks were made (see detail in previous section). Using a Garmin Montana GPS objects and structures of archaeological / heritage value were recorded and photographed with a Samsung Digital camera. Real time aerial orientation, by means of a mobile Google Earth application was also employed to investigate possible disturbed areas during the survey.

3.1.5 Access

The project areas subject to this assessment are accessed via roads connecting to a number of parking areas and lookout points on the frontage. Access control is not applied to the areas relevant to this assessment and no restrictions were encountered during the site visit.

3.1.6 Visibility

The surrounding vegetation in the project area is mostly comprised out of coastal vegetational and pioneering species, scattered trees and bushes. The general visibility at the time of the AIA survey (November 2019) ranged from high in transformed areas, to low in more overgrown zones. In single cases during the survey sub-surface inspection was possible. Where applied, this revealed no archaeological deposits.

Figure 3-1: View of extensive rock revetments along the coast line.

Figure 3-2: View of residential houses and vegetated coastal dunes along rock revetments.

Figure 3-3: View of vegetated coastal dunes in the project area.

Figure 3-4: Erosion is evident along much of the remaining coastal dunes in the area.

Figure 3-5: View of stones and shells along coast dunes in the project area, these are probably not attributed to human activity.

Figure 3-6: View of the Kromme River estuary.

Figure 3-7: View of residential houses and vegetated coastal dunes along rock revetments.

Figure 3-8: View farther rock revetments and concrete reinforcements along the St Francis beach frontage.

Figure 3-9: View of vegetated coastal dunes.

Figure 3-10: The project area, looking north across St Francis.

Figure 3-11: View of a small boat launch pad directly south of the project area.

Figure 3-12: The St Francis Community garden is situated south of the project area.

Figure 3-13: The Two Harbour Walk is situated south of the project area.

3.1.7 Summary: Limitations and Constraints

The foot site survey for the St Francis Bay Coastal Protection Project AIA primarily focused around the coastal dunes and other areas of potential heritage sensitivity. The following constraints were encountered:

- **Visibility:** Visibility proved to be a minor constraint in areas with denser surface cover, as well as portions where vegetation is more pristine.

It should be noted that, even though it might be assumed that survey findings are representative of the heritage landscape of the project area, it should be stated that the possibility exists that individual sites could be missed due to the localised nature of some heritage remains as well as the possible presence of sub-surface archaeology. Therefore, maintaining due cognisance of the integrity and accuracy of the archaeological survey, it should be stated that the heritage resources identified during the study do not necessarily represent all the heritage resources present in the project area. The subterranean nature of some archaeological sites, dense vegetation cover and visibility constraints sometimes distort heritage representations and any additional heritage resources located during consequent development phases must be reported to the Heritage Resources Authority or an archaeological specialist.

3.2 Impact Assessment

For consistency among specialists, impact assessment ratings by Exigo Specialist are generally done using the Plomp[1] impact assessment matrix scale supplied by Exigo. According to this matrix scale, each heritage receptor in the study area is given an impact assessment (See Section 6).

4 ARCHAEO-HISTORICAL CONTEXT

4.1 The archaeology of Southern Africa

Archaeology in Southern Africa is typically divided into two main fields of study, the **Stone Age** and the **Iron Age** or **Farmer Period**. The following table provides a concise outline of the chronological sequence of periods, events, cultural groups and material expressions in Southern African pre-history and history.

Table 1 Chronological Periods across Southern Africa

Period	Epoch	Associated cultural groups	Typical Material Expressions
Early Stone Age 2.5m – 250 000 YCE	Pleistocene	Early Hominins: *Australopithecines* *Homo habilis* *Homo erectus*	Typically large stone tools such as hand axes, choppers and cleavers.
Middle Stone Age 250 000 – 25 000 YCE	Pleistocene	First *Homo sapiens* species	Typically smaller stone tools such as scrapers, blades and points.
Late Stone Age 20 000 BC – present	Pleistocene / Holocene	*Homo sapiens sapiens* including San people	Typically small to minute stone tools such as arrow heads, points and bladelets.
Early Iron Age / Early Farmer Period 300 – 900 AD **(commonly restricted to the interior and north-east coastal areas of Southern Africa)**	Holocene	First Bantu-speaking groups	Typically distinct ceramics, bead ware, iron objects, grinding stones.
Middle Iron Age (Mapungubwe / K2) / early Later Farmer Period 900 – 1350 AD **(commonly restricted to the interior and north-east coastal areas of Southern Africa)**	Holocene	Bantu-speaking groups, ancestors of present-day groups	Typically distinct ceramics, bead ware and iron / gold / copper objects, trade goods and grinding stones.
Late Iron Age / Later Farmer Period 1400 AD -1850 AD **(commonly restricted to the interior and north-east coastal areas of Southern Africa)**	Holocene	Various Bantu-speaking groups including Venda, Thonga, Sotho-Tswana and Zulu	Distinct ceramics, grinding stones, iron objects, trade objects, remains of iron smelting activities including iron smelting furnace, iron slag and residue as well as iron ore.
Historical / Colonial Period ±1850 AD – present	Holocene	Various Bantu-speaking groups as well as European farmers, settlers and explorers	Remains of historical structures e.g. homesteads, missionary schools etc. as well as, glass, porcelain, metal and ceramics.

4.2 Discussion: The St Francis Area: Specific Themes.

The history of Eastern Cape is reflected in a rich archaeological landscape. The province is well known for its contribution to Stone Age research and various South African archaeological cultures have derived their

[1] Plomp, H.,2004

names from cave sites in the larger Port Elizabeth landscape such as Klasies River, Albany, Wilton and Howiesons Poort. Significantly, the intensive utilization of marine resources by San hunter-gatherers (dating from as old as 6 000 years ago), Khoekhoe pastoralists and KhoiSan (dating from the past 1 800 years in the region), manifests in the archaeological record through hundreds of shell middens (large piles of marine shell) dating to the terminal Pleistocene and Holocene that litter coastal areas along the Eastern Cape and specifically St Francis Bay. As such, places like the Kabeljous River estuary and, specifically the Kabeljous River Shelters were popular areas for hunter-gatherers and pastoralists to live because of the wide variety of food resources within easy walking distance, i.e. shellfish along the beach, fish in the estuary and game in the nearby hills. Later, Bantu-speaking tribes moved into this area from other parts of Southern Africa and settled here. White farmers, settling in the area since the middle of the 19th century, divided up the landscape into a number of farms, which even today form the framework for agricultural, residential and other forms of development. Binneman (2009) indicates that the coastline south of Port Elizabeth once housed large numbers of archaeological sites including the remains of indigenous people. Unfortunately, many of these important archaeological features have been destroyed by the development of the coastal towns and many were covered with dune sand and vegetation.

4.2.1 Early History and the Stone Ages

The Earlier Stone Age, from between 1.5 million and 250 000 years ago, refers to the earliest that *Homo sapiens sapiens'* predecessors began making stone tools. The earliest stone tool industry was referred to as the Olduwan Industry, originating from stone artefacts recorded at Olduvai Gorge, Tanzania. The Acheulian Industry, the predominant Southern African Early Stone Age Industry, which replaced the Olduwan Industry approximately 1.5 million years ago, is attested to in diverse environments and over wide geographical areas. The hallmark of the Acheulian Industry is its large cutting tools (LCTs or bifaces), primarily handaxes and cleavers. The most well-known Early Stone Age site in Southern Africa is Amanzi Springs, situated about 10km north-east of Uitenhage, near Port Elizabeth (Deacon 1970). In a series of spring deposits, a large number of stone tools were found in situ to a depth of 3-4m. Wood and seed material preserved remarkably very well within the spring deposits, and possibly date to between 800 000 to 250 000 years old. Large stone ESA tools are often found associated with gravels which capped the hill slopes in the region, and on the calcrete floors exposed in the dune systems along the coast towards Cape St Francis (Laidler 1947; Deacon & Geleijnse 1988; Binneman 2001, 2005).

The Middle Stone Age (MSA) spans a period from 250 000-30 000 years ago and focuses on the emergence of modern humans through the change in technology, behaviour, physical appearance, art and symbolism. The large handaxes and cleavers were replaced by smaller stone artefacts called the MSA flake and blade industries. Surface scatters of these flake and blade industries occur widespread across Southern Africa. The majority of MSA sites occur on flood plains and sometimes in caves and rock shelters. Sites usually consist of large concentrations of knapped stone flakes such as scrapers, points and blades and associated manufacturing debris. Some of the world's oldest remains of anatomically modern humans (some 110 000 years old) come from the Klasies River complex of caves about 35 kilometers west of St Francis Bay. The archaeological deposits at these caves date to 120 000 years old and also represent the oldest evidence for the exploitation of marine food resources by people in the region (Singer & Wymer 1982; Rightmire & Deacon 1991; Deacon 1992, 1993, 2001; Deacon, H. J & Shuurman, R. 1992). Although humans were already anatomically modern by 110 000 years ago, they were not yet exhibiting 'modern behaviour' and only developed into culturally modern behaving humans between 80 000 and 70 000 years ago. This occurred during cultural phases known as the Still Bay and Howieson's Poort time periods/stone tool traditions. The Howison's Poort is well represented at Klasies River Cave 2 and in the dunes near Oyster Bay (Deacon & Wurz 1996; Wurz 1999; Carrion et al. 2000).

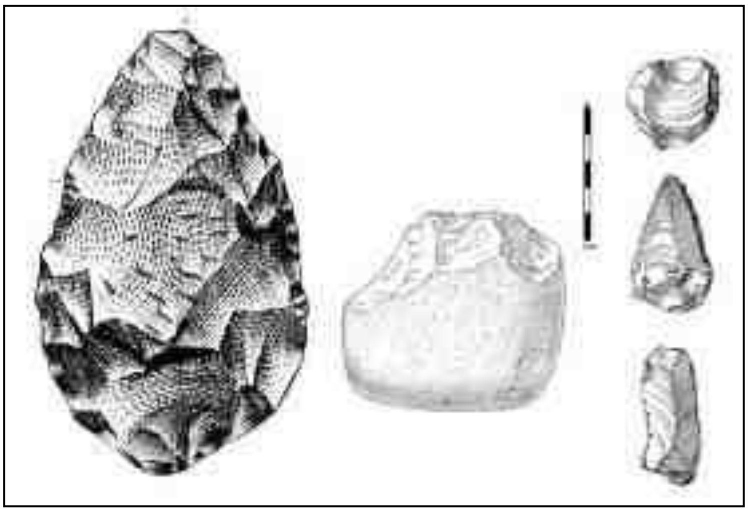

Figure 4-1: Typical ESA handaxe (left) and cleaver (center). To the right is a MSA scraper (right, top), point (right, middle) and blade (right, bottom).

The Later Stone Age (LSA) spans the period from about 20 000 years ago until the colonial era, although some communities continue making stone tools today. The period between 30 000 and 20 000 years ago is referred to as the transition from the MSA to LSA; although there is a lack of crucial sites and evidence that represent this change. The LSA is marked by a series of technological innovations, new tools and artefacts, the development of economic, political and social systems, and core symbolic beliefs and rituals. The stone toolkits changed over time according to time-specific needs and raw material availability, from smaller microlithic Robberg, Wilton Industries and in between, the larger Albany/Oakhurst and the Kabeljous Industries. Bored stones used as part of digging sticks, grooved stones for sharpening and grinding and stone tools fixed to handles with mastic also become more common. Fishing equipment such as hooks, gorges and sinkers also appear within archaeological excavations. Most importantly bows and arrows revolutionized the hunting economy. It was only within the last 2000 years that earthenware pottery was introduced. Before then tortoiseshell bowls were used for cooking and ostrich eggshell (OES) flasks were used for storing water. Sites dating to the LSA are better preserved in rock shelters, although open sites with scatters of mainly stone tools can occur. Well-protected deposits in shelters allow for stable conditions that result in the preservation of organic materials such as wood, bone, hearths, ostrich eggshell beads and even bedding material.

4.2.2 Pastoralism in the Eastern Cape

Khoekhoe pastoralists or herders entered southern Africa about 2000 years ago, with domestic animals such as fat-tailed sheep and goats, travelling through the south towards the coast. Hunter-gatherer and herder sites occur widely in the Eastern Cape. It is sometimes difficult to distinguish between hunter-gatherer and herder sites, because the former may have acquired stock through theft or herder clientship and the latter largely relied on hunting and gathering to supplement pastoral resources. Both groups collected shellfish and used other food sources from the sea, and both groups hunted and gathered plant food. Their economic systems were directed by the accumulation of wealth in domestic stock numbers and their political make-up was more hierarchical than that of the hunter-gatherers. Often, these archaeological sites are found close to the banks of large streams and rivers. Excavations at sites indicate that shellfish and marine animals, and in particular seals, specifically formed a major part of their diet. The intensive utilization of shellfish manifests in the archaeological record through hundreds of shell middens (large piles of marine shell) dating to the terminal Pleistocene and Holocene that litter the coastal areas of southern Africa. These were campsites of San, Khoekhoe and Bantu-speakers who lived along the immediate coast. Human remains are frequently found in the middens, mixed with shell, other food remains and cultural material.

Similarly, the most common archaeological sites found in the St Francis Bay area are shell middens (Binneman 1996, 2001, 2005; Rudner 1968). They are relatively large piles of marine shell and are popularly referred to as 'strandloper middens'. In general, these shell middens date from the past 6 000 years. They are found mainly opposite rocky coasts, but also occur along sandy beaches if there was a large enough source of white mussels. These concentrations of shell represent the campsites of San hunter-gatherers (dating from as much as 6 000 years ago), Khoekhoe pastoralists and KhoiSan (dating from the past 1 800 years in the region) peoples who lived along the immediate coast and collected marine foods on a daily basis. The Khoekhoe people were the first food producers in South Africa and introduced domesticated animals (sheep, goat and cattle) and ceramic vessels to southern Africa as early as 2 000 years ago. The oldest sheep remains recovered from the middens near the Kabeljous River Mouth were radiocarbon dated to 1 560 years old - the oldest date for the presence of sheep in the Eastern Cape (Binneman 1996, 2001) (see further detail in Section 5.1).

Figure 4-2: A large shell midden off the coast of southern Africa

Furthermore, the Cape St Francis region contains remnants of ancient landscapes with associated fossilized remains of animals that died around waterholes. Such remains are important to inform scientists about ancient and altered environments and ecosystems.

4.2.3 Iron Age / Farmer Period

The beginnings of the Iron Age (Farmer Period) in southern Africa are associated with the arrival of a new Bantu speaking population group at around the third century AD. These newcomers introduced a new way of life into areas that were occupied by Later Stone Age hunter-gatherers and Khoekhoe herders. Distinctive features of the Iron Age are a settled village life, food production (agriculture and animal husbandry), metallurgy (the mining, smelting and working of iron, copper and gold) and the manufacture of pottery. Iron Age farming communities generally preferred to occupy river valleys within the eastern half of southern Africa owing to the summer-rainfall climate that was conducive for growing millet and sorghum.Even though much research has been conducted on the Iron Age (IA) across southern Africa, only a small portion has focused on the Eastern Cape. A few important Eastern Cape Early Iron Age Sites (EIA) sites include Kulubele situated in the Kei River Valley near Khomga (Binneman 1996), Ntsitsana situated in the interior Transkei, 70 km west of the coast, along the Mzimvubu River (Prins & Granger 1993), and Canasta Place situated on the west bank of the Buffalo River (Nogwaza 1994). Previous investigations into the EIA in the Transkei and Ciskei include work at Buffalo River Mouth (Wells 1934; Laidler 1935), at Chalumna River Mouth (Derricourt 1977) and additional research by Feely (1987) and Prins (1989).

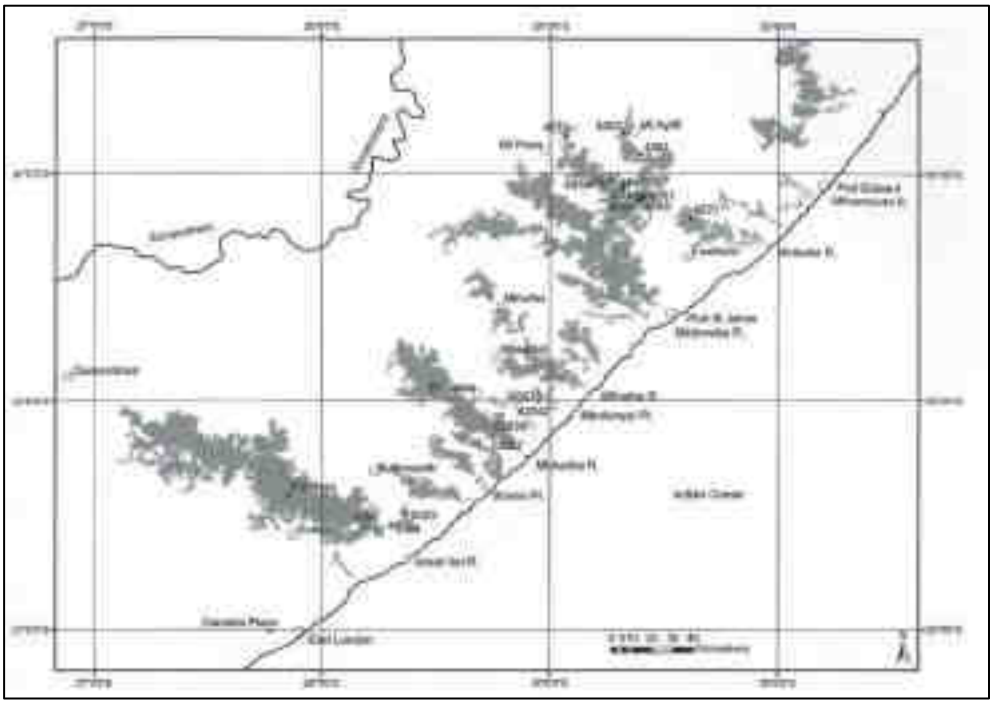

Figure 4-3: Early Iron Age farmer period sites in the Eastern Cape around Mthahta (after Feely & Bell-Cross 2011).

The first EIA farming communities during the first millennium AD preferred to occupy river valleys within the eastern half of southern Africa owing to the summer-rainfall climate that was conducive for growing millet and sorghum. The closest documented and well-researched Early Iron Age site, to Elliot is located within the Great Kei River Valley. The site is situated some 200 m below the plateau and 60 km inland from the coast, within the borders of the Transkei, approximately 100 km up the coast towards Durban. There has in the past been some speculation that Early Iron Age populations may have spread well south of the Transkei into the Ciskei, possibly up to the Great Fish River (Binneman et al. 1992), however, no further research has been undertaken to confirm these statements. A closer Early Iron Age site has been documented to the south of East London (Cronin 1982). Thicker and decorated pottery sherds, kraals, possible remains of domesticated animals, upper and lower grindstones and storage pits are associated for identifying EIA sites. The sites are generally large settlements, but the archaeological visibility may in most cases be difficult owing to the organic nature of the homesteads. Metal and iron implements are also associated with EIA communities.

The Later Iron Age (LIA) is not only distinguished from the EIA by greater regional diversity of pottery styles but is also marked by extensive stone wall settlements. LIA sites in the Eastern Cape Province occur adjacent to the major rivers in low lying river valleys but also along ridge crests above the 800m contour. The LIA in the project area can be ascribed to the Mpondomise, Thembu, and Xhosa tribal clusters or their immediate predecessors (Feely 1987). It is also possible that some stone walled sites, especially those incorporating shelters or caves, were constructed by hybrid San/Nguni groups. Trade played a major role in the economy of LIA societies. Goods were traded locally and over long distances. The main trade goods included metal, salt, grain, cattle and thatch. This led to the establishment of economically driven centres and the growth of trade wealth. Keeping of domestic animals, metal work and the cultivation of crops continued with a change in the organisation of economic activities (Maggs, 1989; Huffman 2007). Hilltop settlements are mainly associated with LIA settlement patterns that occurred during the second millennium AD. Later Iron Age settlements have been formally recorded by the Albany Museum and cover a relatively extended area in comparison with the Early Iron Age settlement patterns. With the exception of the Tembu, stone buildings which characterizes the Iron Age sites of Sotho areas, is absent in the Transkei and Ciskei, and a pattern of some mobility without, it is presumed, a stone working technology of significance, makes the allocation of sites a major problem (Derricourt 1973).

Contact with the Cape Colony initially stimulated an already flexible and dynamic characteristic of the Cape Nguni political economy. When trade opportunities developed in the late 18th century, the Xhosa would exchange cattle (and permission for and guidance in hunting elephants) in return for copper, iron, beads (Peires 1981:95); they would then exchange these goods at a profit for cattle with their African neighbours to the east, bringing about a kind of speculation in cattle.

4.2.4 Later History: Colonial Period

The Eastern Cape region is typically viewed by historians as a frontier zone. This area was the meeting place between an aggressively expanding colonial frontier and the southernmost distribution of black Bantu-speaking farming communities in Africa (Huffman 2007). It is well known in the historical literature for the nine frontier wars that were fought here between the settlers of the Cape colony and the Xhosa nation between 1779 and 1879 (see below). Whereas white colonial settlement expanded north and eastwards from Table Bay, in modern Cape Town, some 350 years ago Bantu-speaking agro pastoralists, the predecessors of the Xhosa nation, inhabited areas to the east of the Sundays river already since 1300 years ago (Binneman et al 1992). For many centuries their movement further west and south were hindered by a climatic frontier that prevented these small-scale subsistence farmers from cultivating summer-rainfall crops, such as millet and sorghum, their main source of food. Adding to climatic constraints, the first Bantu speaking pioneers encountered other indigenous population groups in these more marginal areas as did colonial agents many centuries later. These were the Khoisan - the direct descendants of the first modern people to have emerged in Africa some 200 000 years ago. These people had from the time of van Riebeeck become popularly known as the San or Bushmen and Khoekhoe or Hottentots. Whereas the Khoekhoe typically lived closer to the coastal areas where they could find adequate grazing for their cattle and sheep the San hunter-gatherers lived further inland in areas not favoured by either Khoekhoe pastoralists or Bantu-speaking agropastoralists. Nevertheless, the Eastern Cape became the contact zone between these different cultures both in the historical and prehistoric past. By the closing decades of the 18th century, South Africa had fallen into two broad regions: west and east. Colonial settlement dominated the west, including the winter rainfall region around the Cape of Good Hope, the coastal hinterland northward toward the present-day border with Namibia, and the dry lands of the interior. Trekboers moved into, and occupied Khoekhoe and remnant hunter-gatherer land. Indigenous farmers controlled both the coastal and valley lowlands and the Highveld of the interior in the east, where summer rainfall and good grazing made mixed farming economies possible A large group of British settlers arrived in the eastern Cape in 1820; this, together with a high European birth rate and wasteful land usage, produced an acute land shortage, which was alleviated only when the British acquired more land through massive military intervention against Africans on the eastern frontier. Until the 1840s the British vision of the colony did not include African citizens and most of these groups were expelled across the Great Fish River, the unilaterally proclaimed eastern border of the colony. The first step in this process included attacks in 1811–12 by the British army on the Xhosa groups, the Gqunukhwebe and Ndlambe. An attack by the Rharhabe-Xhosa on Graham’s Town in 1819 provided the pretext for the annexation of more African territory, to the Keiskamma River. Various Rharhabe-Xhosa groups were driven from their lands throughout the early 1830s. They counterattacked in December 1834, and Governor Benjamin D’Urban ordered a major invasion the following year, during which thousands of

Rharhabe-Xhosa died. The British crossed the Great Kei River and ravaged territory of the Gcaleka-Xhosa as well; the Gcaleka chief, Hintsa, invited to hold discussions with British military officials, was held hostage and died trying to escape. The British colonial secretary, Lord Glenelg, who disapproved of D'Urban's policy, halted the seizure of all African land east of the Great Kei. D'Urban's initial attempt to rule conquered Africans with European magistrates and soldiers was overturned by Glenelg; instead, for a time, Africans east of the Keiskamma retained their autonomy and dealt with the colony through diplomatic agents However, after further fighting with the Rharhabe-Xhosa on the eastern frontier in 1846, Governor Colonel Harry Smith finally annexed, over the next two years, not only the region between the Great Fish and the Great Kei rivers (establishing British Kaffraria) but also a large area between the Orange and Vaal rivers, thus establishing the Orange River Sovereignty. These moves provoked further warfare in 1851–53 with the Xhosa (joined once more by many Khoe), with a few British politicians ineffectively trying to influence events. Between 1811 and 1858 colonial aggression deprived Africans of most of their land between the Sundays and Great Kei rivers and produced poverty and despair. From the mid-1850s British magistrates held political power in British Kaffraria, destroying the power of the Xhosa chiefs. Following a severe lung sickness epidemic among their cattle in 1854–56 the Xhosa killed many of their remaining cattle and in 1857–58 grew few crops in response to a millenarian prophecy that this would cause their ancestors to rise from the dead and destroy the whites. Many thousands of Xhosa starved to death, and large numbers of survivors were driven into the Cape Colony to work. British Kaffraria fused with the Cape Colony in 1865, and thousands of Africans newly defined as Fingo resettled east of the Great Kei, thereby creating Fingoland.

4.2.5 Later History: St Francis Bay

Manuel de Perestrelo, a Portuguese explorer weighed anchor in a sheltered bay in 1575. He was struck with the natural beauty of what he saw and named it Bahia de Sao Francisca after the Patron Saint of Sailors, St Francis of Assissi. As legend has it, the landward side reminded him of the beautiful cloisters of the 14th Century Gothic monastery of St Francisca, at his hometown of Santareme. Little did he know that over 400 years later a unique village of great beauty would develop right here. In 1954 a new adventurer, Leighton Hulett, paid £1 750 for the farm Goedgeloof and moved here from KwaZulu Natal with his young family. The land was harsh and not suitable for farming so in 1958, to supplement their income, he established a rough fishing camp for visitors. As time passed several more people, mainly from Port Elizabeth and Uitenhage, bought land from Hulett and built holiday homes. After he exchanged a house and plot in the village for a further 179 hectares of swampy land alongside the Kromme River, he dredged a canal system, making St Francis the first marina in Southern Africa. He insisted on rigid control of building designs, allowing only homes with white walls and high-pitched black thatch roofs. In 1976, when the Humansdorp Divisional Council became the controlling authority, they entrenched these controls in the local bylaws. The building codes of Santareme stipulate red tiled roofs, creating a unique Mediterranean theme. Port St Francis is the only privately-owned working harbour in South Africa and home to a squid, hake and pilchard fleet. Construction was finished in 1997, when Port Island was inaugurated into South Africa as newly proclaimed land (soil from the basin of the new harbour was used to create this piece of land). Private yachts and deep-sea fishing boats have access to the ocean from the recreational bay (http://www.stfrancistourism.co.za/area/st-francis-bay).

4.2.6 Marine Underwater Cultural Heritage

A number of ships were wrecked along the coastline of Cape St Francis and the Kromme River mouth. The locations of these wrecks are indicated on Figure 3 in Addendum 2 and a list of wrecks are included in Addendum 1 (also refer to Kruger, 2020). There are four vessels listed as being wrecked in St Francis Bay but of note is the wrecking site of the Lady Head (1859) which is recorded as being in the mouth of the Kromme River

St Francis Bay Shipwreck Register				
Wreck Name	**Type**	**Date of Sinking**	**Location Reference (General)**	**Situation (if known)**
Lady Head	Cargo	1859	Submerged rocks just off the mouth of the *Kromme River*	Grounded
Cape Recife	Cargo	1929	Seal Point	Partially submerged
Queen of the West	Barque	1850	West of Cape St Francis	Sank
The Hope	Steamer	1840	East of Huisklip	
Lyngenfjord	Cargo	1938	Near Tzitzikama Point	Partially submerged
Panaghlia		1938	Near Tzitzikama Point	Partially submerged
Suffolk	Steamer	1900	Near Tzitzikama Point	Grounded
HMS Osprey	Sloop Warship	1867	10 miles West from Seal Point Lighthouse	Beached
Nederlandsche Vlag		1870	St Francis Bay	Grounded
ELiza and Alice	Barque	1870	Mosterts Hoek	Partially submerged
Berwick	Barque	1827	Seal Point	
Auguste	Barque	1858	Cape St Francis	
Milford		1875	Cape St Francis	
British Duke		1880	Oyster Bay, near Cape St Francis	Grounded
Derby	Barque	1895	6 miles East of Cape St Francis	Grounded
Meng Yaw 366	Cargo	1989	Brakkeduine	
L'Agile	Barque	1850	20 miles West of St Francis bay	Grounded
Queen of the West	Barque	1850	West of Cape St Francis	Sank
Spy	Barque	1851	St Francis Bay	Grounded
La Guste	Barque	1858		
Bosphorus	Steamer	1867	Cape St Francis	
Jason	Barque	1869	St Francis Bay	
Niagara	Barque	1870	Oyster Bay, near Cape St Francis	Grounded
Mitford		1875	Cape St Francis	
Freeman Clarke		1883	Cape St Francis	
Suffolk	Steamer	1900	Near Tzitzikama Point	
Cromatyshire		1901	west of Seal Point	
President Reitz	Freighter	1947	Seal Point	Lost
Sikelela	Fishing vessel	2014	St Francis Bay	Submerged
Barcelona	Motor Vessel	1973	Cape St Francis	Wrecked
Bokkeveld	Motor Vessel	1978	Cape St Francis	Foundered
Leif	Sailing Vessel	1895	Cape St Francis	Grounded
Mabel Young	Sailing Vessel	1879	St Francis Bay	Wrecked
Micmac	Sailing Vessel	1879	Cape St Francis	Grounded, Refloated
Nepaul		1862	Cape St Francis	Abandoned
Opkyk	Motor Vessel	1996	Cape St Francis	
Pigot	Sailing Vessel	1785	Cape St Francis	
Rona	Sailing Vessel	1883	Cape St Francis	Foundered
Santa Artemis	Motor Vessel	1972	Port St Francis	Foundered
Southern Reaper	Motor Vessel	2001	St Francis Bay	Wrecked
Stork	Steamer	1940	Cape St Francis	Grounded
Susan Crisp	Sailing Vessel	1851	Cape St Francis	Grounded

Figure 5-4: Map indicating the distribution of ship wrecks along the Cape St Francis coastline.

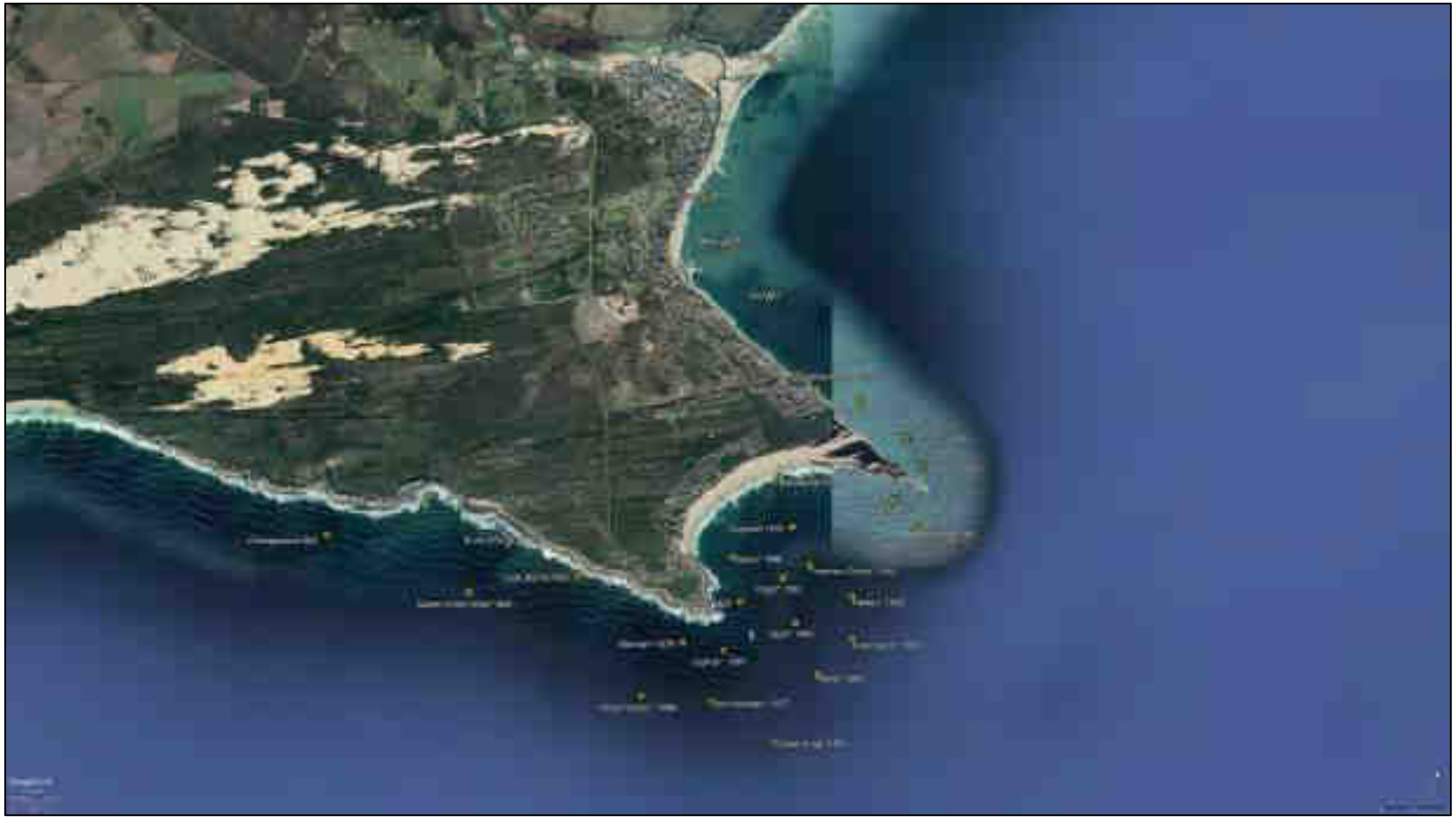

Figure 5-4: Detail map indicating the distribution of ship wrecks along the Cape St Francis coastline.

5 RESULTS: ARCHAEOLOGICAL SURVEY

5.1 The Off-Site Desktop Survey

The history and archaeology of the larger Eastern Cape Province and its coastal areas have seen a number of systematic archaeological research projects indicating the occurrence of Herder coastal sites, shell middens and also Colonial remnants. The archaeology of the Cape St Francis area in particular was studied by Dr J Binneman (Albany Museum) during the 1980s and detailed information is available in his PhD dissertation (Binneman 1996). According to Binneman, coastal shell middens are divided into three groups that are most common in the St Francis area:

1. Shell middens without pottery and with large quartzite implements, are classified as the Kabeljous Industry (first identified at a site on the Kabeljous River near Jeffreys Bay). This industry dates to between 3000 and 1800 years before present (BP).
2. A second group of shell middens, also without pottery, but with microlithic tools, is called the Wilton Industry. These date to between 5180 and 1900 BP.
3. Binneman excavated an open-air shell-midden in a deflation hollow in the Sand River Dune Fields that was named Goedgeloof (after the adjoining farm) (refer to Figure 5-3 and Figure 5-4). This pastoralist site represents the oldest dates for sheep and pottery in the Eastern Cape. The pottery has been dated to 1770 BP (AD 180) and the sheep to 1560 BP (AD 390). Interestingly, the most common shellfish utilized by these peoples was pencil bait (*Solen capensis*) and these were almost certainly collected from the Kromme River estuary which has the highest population of pencil bait in the Eastern Cape. The site of Goedgeloof is located some 5km from the St Francis Bay coast showing that the occupants of the site were traveling considerable distances to collect their food. In addition to middens, a number of graves were found in the Sand River Dune Field area adjacent to the proposed site for the St Frances Golf Estate. The burials generally represent Khoisan individuals who are frequently buried in a flexed (fetal) position. They may be buried with grave goods such as grindstones or ostrich eggshell bead necklaces. Of importance is the discovery of the remains of a Negroid individual just north of the Kromme River some years ago. This individual was buried some 700 years ago and this is the earliest Negroid found this far south on the South African coast.

Historical aerial imagery of this particular region is limited but archive maps of areas subject to this assessment indicate a landscape which has been transformed over the past decades by human activity relating urbanization and human settlement. A careful analysis of historical sources, historical aerial imagery and archive maps reveals the following:

- An HIA conducted in in 2006[2] for initial rehabilitation plans on the St Francis Bay beach, indicated that the larger St Francis Bay coast is rich in notably marine archaeological resources.
- Areas subject to this assessment have been altered extensively by recent and historical urbanization, presumably during the latter part of the 20th century.
- Man-made structures or Built Environment features occur along the frontage in the project area by at least 1970.

[2] **Webley, L. 2006. PHASE 1: ARCHAEOLOGICAL IMPACT ASSESSMENT ALONG THE ST FRANCIS BAY BEACH. Albany Museum**

Figure 5-1: A historical aerial image dating to 1951 indicating the project area (green line) in the historical landscape. The current status quo of the landscape is indicated on the right.

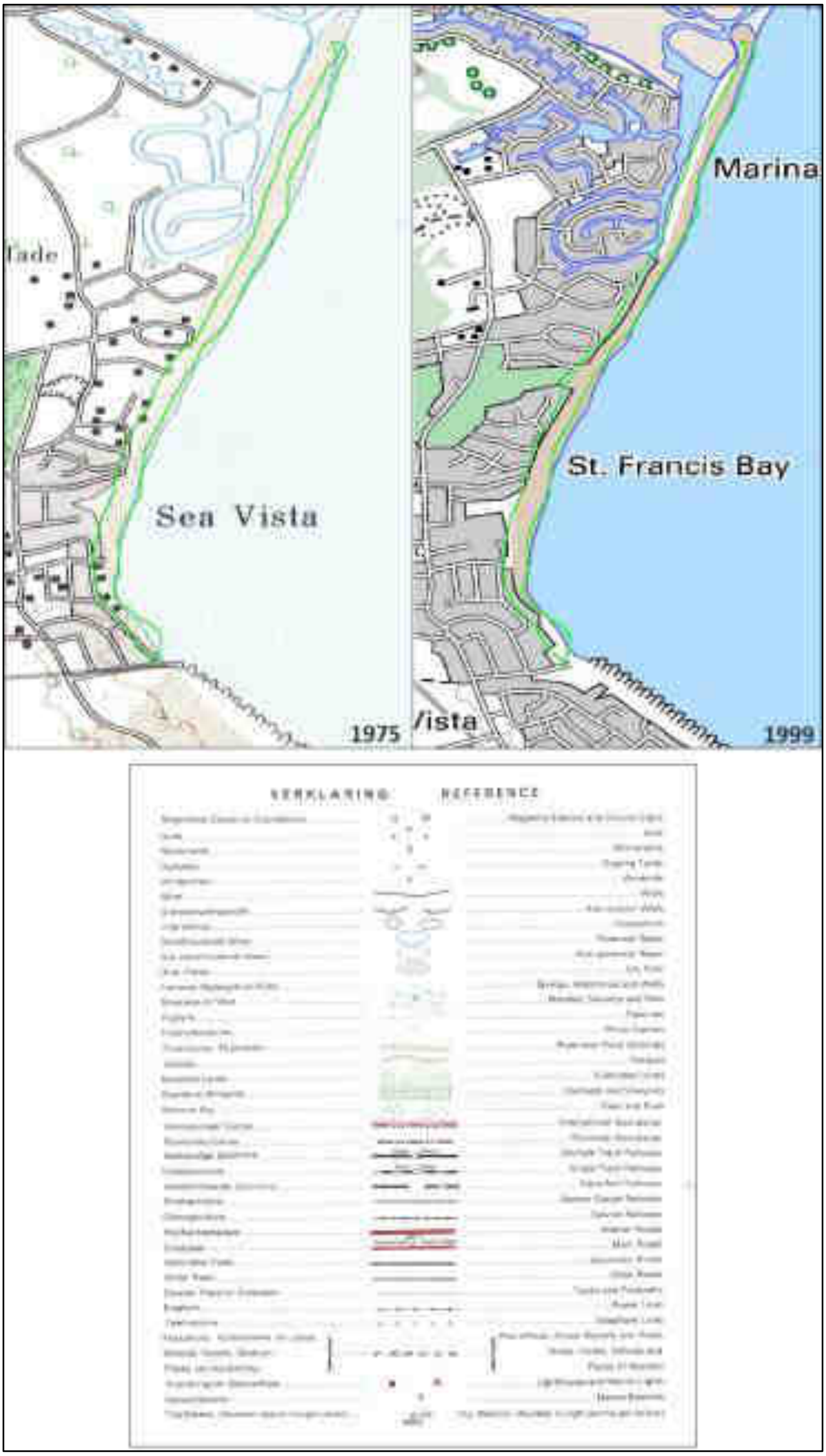

Figure 5-2: Historical topographic maps of the project area dating to 1975 (left) and 1998 (right).

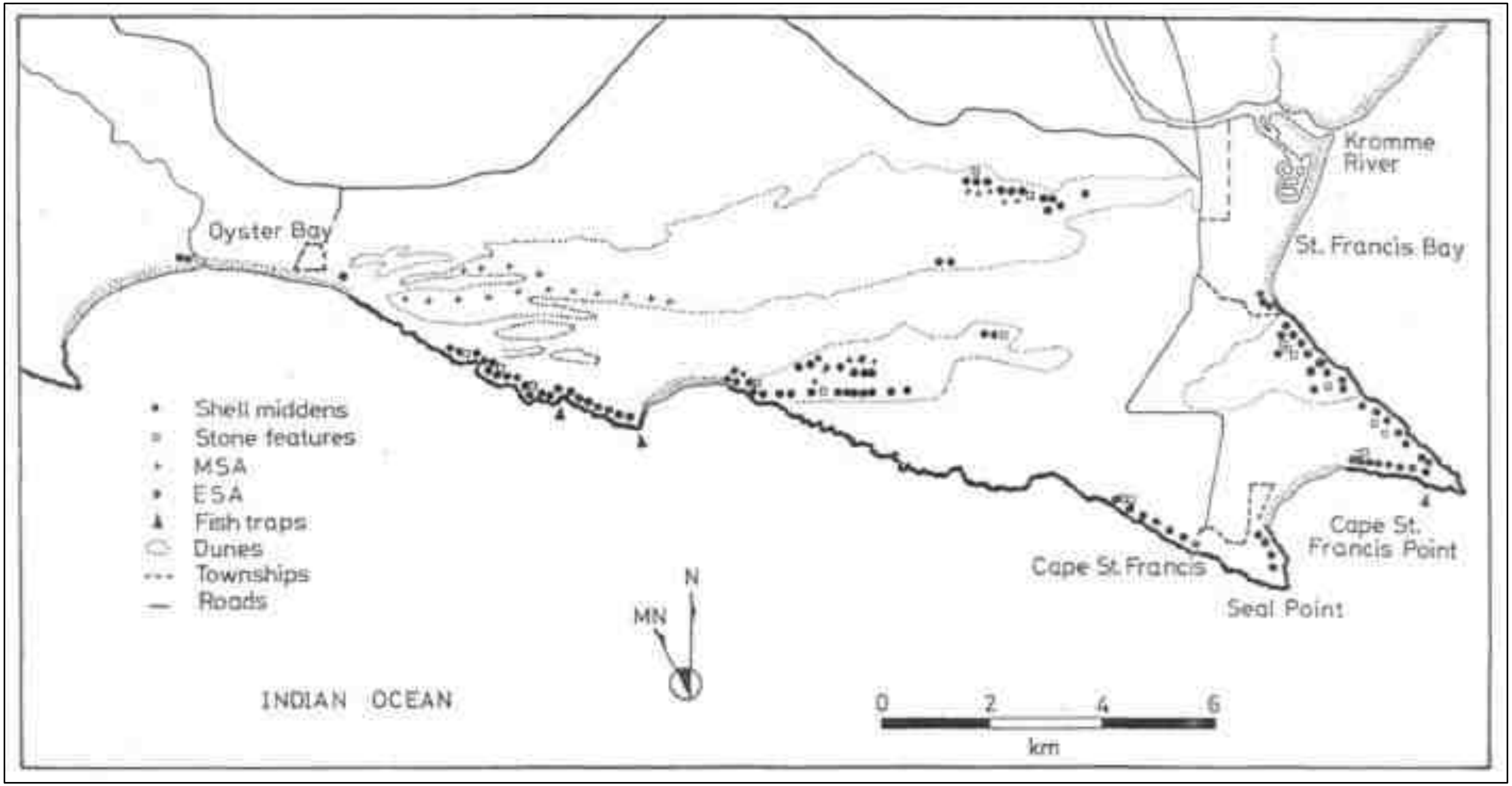

Figure 5-3: Map indicating the distribution of archaeological sites Cape Sit Francis Coast (Binneman 1986 in Webley 2006)

Figure 5-4: Detail map indicating the distribution of archaeological sites and features along the Cape St Francis dune fields (Binneman 1986 in Webley 2006)

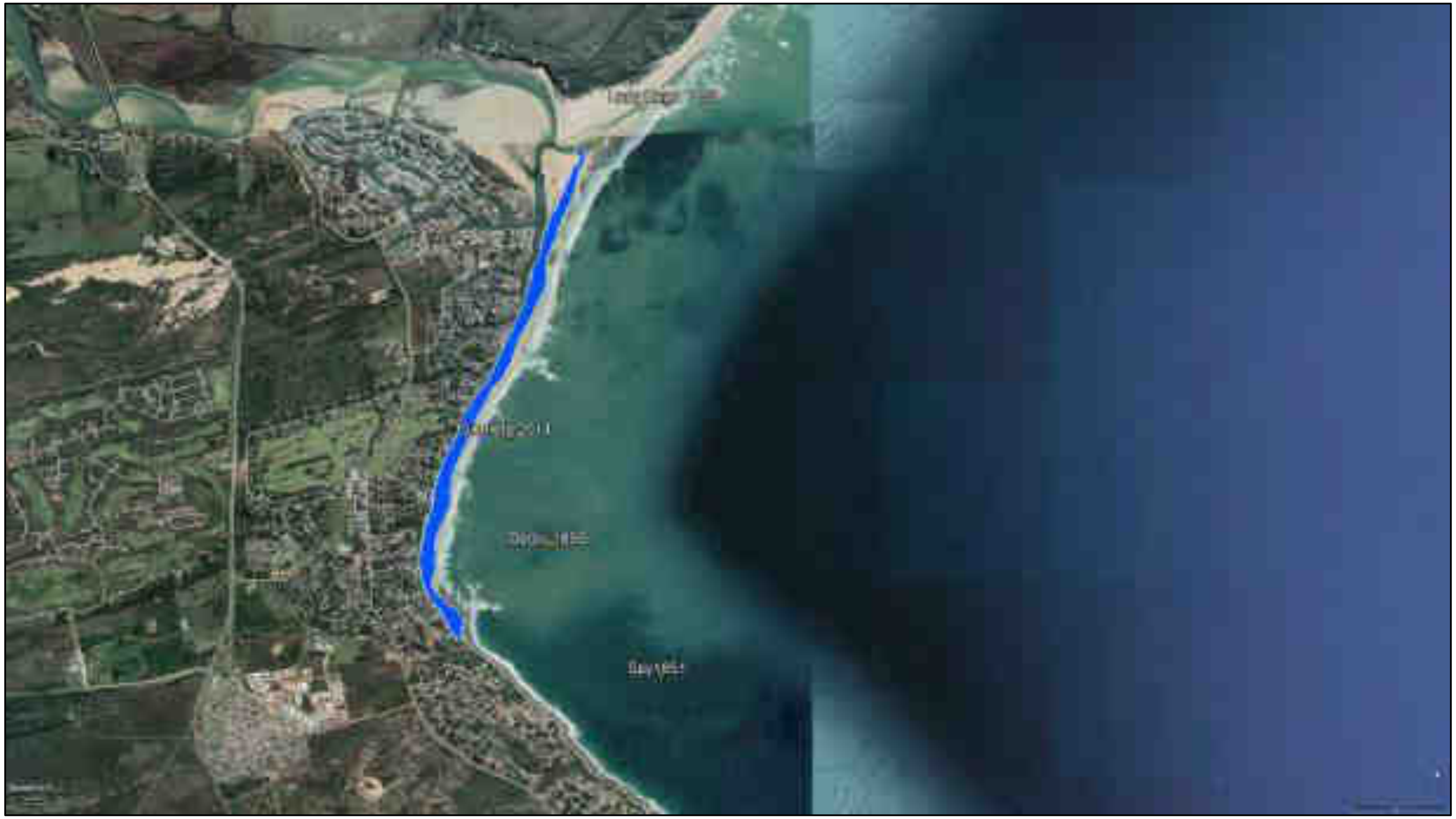

Figure 5-4: Detail map indicating the distribution of known shipwrecks along St Francis Bay and the Kromme River Mouth.

5.2 The Archaeological Site Survey

The archeological site survey did not locate any archaeological sites or material in the project area of the St Francis Bay Coastal Protection Project area. As such, no shell concentrations, stone, bone or pottery fragments were observed and it is highly likely that heritage sites may have been lost due to coastal erosion, through coastal development or during previous ocean front rehabilitation projects where by extensive revetments were constructed in recent years.

It should be noted that the "Community Garden" and the "Two Harbour Walk" situated to the south of the project area near Harbour Road could hold social meaning and significance to local residents, an aspect which should be interrogated during the Public Participation process.

6 RESULTS: STATEMENT OF SIGNIFICANCE AND IMPACT RATING

6.1 Potential Impacts and Significance Ratings[3]

The following section provides a background to the identification and assessment of possible impacts and alternatives, as well as a range of risk situations and scenarios commonly associated with heritage resources management. A guideline for the rating of impacts and recommendation of management actions for areas of heritage potential within the study area is supplied in Section 10.2 of Addendum 1.

6.1.1 General assessment of impacts on resources

Generally, the value and significance of archaeological and other heritage sites might be impacted on by any activity that would result immediately or in the future in the destruction, damage, excavation, alteration, removal or collection from its original position, of any archaeological material or object (as indicated in the National Heritage Resources Act (No 25 of 1999)). Thus, the destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the initial construction period. However, in the long run, the proximity of operations in any given area could result in secondary indirect impacts. The EIA process therefore specifies impact assessment criteria which can be utilised from the perspective of a heritage specialist study which elucidates the overall extent of impacts.

6.1.2 Direct impact rating

Direct or primary effects on heritage resources occur at the same time and in the same space as the activity, e.g. loss of historical fabric through demolition work. **Indirect effects or secondary effects** on heritage resources occur later in time or at a different place from the causal activity, or as a result of a complex pathway, e.g. restriction of access to a heritage resource resulting in the gradual erosion of its significance, which is dependent on ritual patterns of access (refer to Section 11.3 in the Addendum for an outline of the relationship between the significance of a heritage context, the intensity of development and the significance of heritage impacts to be expected). The significances of the impacts were determined through a synthesis of the criteria below:

As no terrestrial heritage receptors were found in the project zone but MUCH resources occur in along the St Francis Coastline. However, no impact to heritage resources is foreseen.

[3] Based on: W inter, S. & Baumann, N. 2005. *Guideline for involving heritage specialists in EIA processes: Edition 1.*

6.2 Evaluation Impacts

6.2.1 Discussion: Evaluation of Results and Impacts

Previous studies conducted in the larger Eastern Cape landscape around the project area suggest an immensely rich and diverse archaeological landscape. The St Francis landscape has been developed extensively during the last decades where large portions of land have been transformed for agriculture and urbanization. In addition, coastal erosion, development and previous rehabilitation projects have transformed much of the coastal dunes in the project area. Cognisance should be taken of archaeological material that might be present in surface and sub-surface deposits.

6.2.2 Archaeology

The study did not identify archaeological sites or features in the project area but the project is situated in the larger archaeological coastal sensitivity zone of St Francis where shell middens and other archaeological sites/materials are found. As such, care should be taken not to destroy previously undetected heritage remains.

6.2.3 Built Environment

A large number of Contemporary Period structures and buildings occur in the project along the St Francis beach but these buildings are not significant in terms of the historical built environment *per se*. Impact on old buildings, structures or features as not anticipated.

6.2.4 Cultural Landscape

The larger area comprises a rich cultural horizon and the natural landscape surrounding the proposed project encompasses vast coastlines and river valleys, typical of the Eastern Cape coast. The cultural landscape holds Herder, Iron Age remains and a Colonial Period frontier which embraces a regional history, represented in a number of significant archeological sites. However, the proposed project is unlikely to result in a significant impact on the general cultural landscape of this area.

6.2.5 Graves / Human Burials Sites

No burial sites were located in the study area. It should be noted that graves and cemeteries often occur within settlements or around homesteads in the rural areas of the Eastern Cape, and they are also randomly scattered around archaeological and historical settlements. The probability of informal human burials encountered during development should thus not be excluded. In addition, human remains and burials are commonly found close to archaeological sites; they may be found in "lost" graveyards, or occur sporadically anywhere as a result of prehistoric activity, victims of conflict or crime. It is often difficult to detect the presence of archaeological human remains on the landscape as these burials, in most cases, are not marked at the surface. Human remains are usually observed when they are exposed through erosion. In some instances packed stones or rocks may indicate the presence of informal pre-colonial burials. If any human bones are found during the course of construction work then they should be reported to an archaeologist and work in the immediate vicinity should cease until the appropriate actions have been carried out by the archaeologist. Where human remains are part of a burial they would need to be exhumed under a permit from SAHRA (for pre-colonial burials as well as burials later than about AD 1500). Should any unmarked human burials/remains be found during the course of construction, work in the immediate vicinity should cease and the find must immediately be reported to the archaeologist, or the South African Heritage Resources Agency (SAHRA). Under no circumstances may burials be disturbed or removed until such time as necessary statutory procedures required for grave relocation have been met.

6.2.6 Marine and Underwater Cultural Heritage (MUCH)

A number of ships are known to have wrecked along the coastline of Cape St Francis and the Kromme River mouth - four vessels in particular are listed as being wrecked in St Francis Bay and of note is the wrecking site of the Lady Head (1859) in an unspecified location in the mouth of the Kromme River. However, target areas for dredging occur largely to the riverside delta of the Kromme River estuary and areas within the river system to the west. In addition, the beach infrastructure (i.e. groyne) is expected to be constructed on top of the existing beach sand and level without the need for excavation. The revetment at the spit will be installed on a nourished beach level, which will be approximately 1 metre higher than the existing beach level. Therefore, no intervention in submerged items and MUCH artefacts are anticipated.

6.3 Management actions

Recommendations for relevant heritage resource management actions are vital to the conservation of heritage resources. A general guideline for recommended management actions is included in Section 11.4 of Addendum 2.

OBJECTIVE: ensure conservation of heritage resources of significance, prevent unnecessary disturbance and/or destruction of previously undetected heritage receptors.

As no archeological features were noted in the project area and cognizant of the transformed state of the frontage, no mitigation measures need to be undertaken. However, the following general recommendations are made for heritage management:

PROJECT COMPONENT/S	All phases of construction and operation.	
POTENTIAL IMPACT	Damage/destruction of sites.	
ACTIVITY RISK/SOURCE	Digging foundations and trenches into sensitive deposits that are not visible at the surface.	
MITIGATION: TARGET/OBJECTIVE	To conserve the historical fabric of the sites and to locate undetected heritage remains as soon as possible after disturbance so as to maximize the chances of successful rescue/mitigation work.	
MITIGATION: ACTION/CONTROL	**RESPONSIBILITY**	**TIMEFRAME**
Fixed Mitigation Procedure (**required**)		
Archaeological Site Monitoring: All construction activities must be monitored by an archaeologist/heritage practitioner or alternatively a person must be specially trained, for example the ECO, to conduct the monitoring. Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites. **MUCH Resources:** A 100m buffer around the river mouth should be implemented. This is demarcated around the high-water line and around the coastal rock outcrop which encompasses the relative location of the Lady Head shipwreck shipwreck. This buffer includes the beach and coastal dune strips around the river mouth which could potentially hold the washed-up remains of wreckage, artefacts as well as possible survivor camp remnants. However, since the estuary and inland river canal south-west of the river mouth have been subjected to historical alteration and more recent riparian rehabilitation, it is recommended that this area be excluded from the 100m buffer. Rather a 50m buffer observed from the highwater mark to include the beachfront and adjoining dune strip east of the dividing spit at the estuary. The exclusion for development of a portion of dredging target area P1 which falls within this proposed buffer zone is recommended. The	ECO, HERITAGE ASSESSMENT PRACTITIONER, MUCH SPECIALIST	Monitor as frequently as practically possible.

extent of this proposed exclusion area is approximately 1.1ha. Bi-weekly monitoring by an informed and trained Environmental Control Office (ECO) of the dredging of target areas P1 and S1 and the placing of the groyne and revetment should be conducted in order to detect possible wreck remains and remains of survivor camps at the earliest opportunity. The ECO should ensure that identified dredging areas are not deviated from and that the exclusion of the portion of target area P1 in the conservation buffer be maintained at all times. The ECO should carefully monitor the placing of the groyne and ensure that sub-surface beach deposits are not impacted on by the activity. A suitably qualified MUCH specialist should be appointed during initial stages of the development in order to provide training to the assigned project ECO and contractors involved in the project activities on site. Training should cover the MUCH sensitivity of the area and heritage Chance Find procedures for the site. The ECO should report to the SAHRA MUCH Unit on a weekly basis, on the dredging progress and site status of target areas P1 and S1 for the duration of activities in these target areas. A Chance Find procedure that outlines what will happen if previously undetected heritage resources, particularly maritime archaeological resources, are encountered during dredging activities should be compiled and implemented. The Chance Find procedure should include some or all of the following measures: - If any heritage resources and particularly maritime heritage resources (remains of the wreck, related artefacts, possible survivor camp remnants) are encountered, dredging activities should immediately be suspended and the SAHRA MUCH Unit should be notified; - If any heritage resources and particularly maritime heritage resources is encountered, the controlled and systematic recovery of the resources should be done by means of rescue excavations. The recovery of heritage resources should be executed by a suitably qualified MUCH specialist; - Any rescue excavations, artefact recovery or sampling must be done after a permit has been issued by SAHRA under Section 35 of the NHRA (Act 25 of 1999) to the qualified MUCH specialist; - The recovery work should be conducted in such a way as to augment the research of shipwrecks along the Cape St Francis coastline; - A close out report on MUCH rescue work must be submitted to SAHRA by the specialist. These recommendations should be included within the Environmental Management Programme (EMPr) for the proposed project.		

PERFORMANCE INDICATOR	Archaeological sites are discovered and mitigated with the minimum amount of unnecessary disturbance.
MONITORING	Successful location of sites by person/s monitoring.

Figure 6-1: Aerial map indicating the required conservation buffers for MUCH resources in the project area along the Cape St Francis coastline.

7 RECOMMENDATIONS

The larger landscape of the Eastern Cape Province and the St Francis area is immensely rich in pre-historical and historical remnants since the area is highly suitable for pre-colonial habitation. The St Francis landscape has been developed extensively during the last decades where large portions of land have been transformed for agriculture and urbanization. In addition, coastal erosion, development and previous rehabilitation projects have transformed much of the coastal dunes in the project area. Cognisance should be taken of archaeological material that might be present in surface and sub-surface deposits. The following recommendations are made based on general observations in the proposed St Francis Bay Coastal Protection Project in terms of heritage resources management.

In terms of terrestrial archaeology, the following should be noted:

- The archeological site survey did not locate any archaeological sites or material in the project area of the St Francis Bay Coastal Protection Project area and it is highly likely that heritage sites may have been lost due to coastal erosion, through coastal development or during previous ocean front rehabilitation projects where by extensive revetments were constructed in recent years. It should be noted that the "Community Garden" and the "Two Harbour Walk" situated to the south of the project area near Harbour Road could hold meaning and significance to local residents and potential impact to these receptors should be addressed during the Public Participation process for the project.
- Considering the localised nature of heritage remains, the general monitoring of the development progress is recommended for all stages of the project. Here, all construction activities must be monitored by an archaeologist/heritage practitioner or alternatively a person must be specially trained, for example the ECO, to conduct the monitoring. Construction managers / foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately.
- It is essential that cognisance be taken of the larger archaeological landscape of the area in order to avoid the destruction of previously undetected heritage sites. It should be stated that it is likely that undetected archaeological remains might occur elsewhere in the project landscape in subsurface despots, along pristine coast dune-veld, near water sources and drainage lines and fountains which would often have attracted human activity in the past. Also, since Stone Age material seems to originate from below present soil surfaces in eroded areas, the larger landscape should be regarded as potentially sensitive in terms of possible subsurface deposits. As Palaeontological remains occur where bedrock has been exposed, all geological features should be regarded as sensitive.

In terms of Marine and Underwater Cultural Heritage (MUCH), a number of ships are known to have wrecked along the coastline of Cape St Francis and the Kromme River mouth - four vessels in particular are listed as being wrecked in St Francis Bay and of note is the wrecking site of the Lady Head (1859) in an unspecified location in the mouth of the Kromme River. A Maritime and Underwater Cultural Heritage Impact Assessment (MUCHIA) was considered as a large part of the proposed development and particularly sand sourcing and beach replenishment are proposed to occur below the high-water mark. However, the MUCH Unit of SAHRA granted exemption from MUCHIA cognisant of the fact that target areas for dredging occur largely to the riverside delta of the Kromme River estuary and areas within the river system to the west. In addition, the beach infrastructure (i.e. groyne) is expected to be constructed on top of the existing beach sand and level without the need for excavation. The revetment at the spit will be installed on a nourished beach level, which will be approximately 1 metre higher than the existing beach level. Therefore, no intervention in submerged items and artefacts are anticipated. The exemption was granted on the following conditions:

- A 100m buffer around the river mouth should be implemented. This is demarcated around the high-water line and around the coastal rock outcrop which encompasses the relative location of the Lady Head shipwreck shipwreck. This buffer includes the beach and coastal dune strips around the river mouth which could potentially hold the washed-up remains of wreckage, artefacts as well as possible survivor camp remnants. However, since the estuary and inland river canal south-west of the river mouth have been subjected to historical alteration and more recent riparian rehabilitation, it is recommended that this area be excluded from the 100m buffer. Rather a 50m buffer observed from the highwater mark to include the beachfront and adjoining dune strip east of the dividing spit at the estuary.
- The exclusion for development of a portion of dredging target area P1 which falls within this proposed buffer zone is recommended. The extent of this proposed exclusion area is approximately **1.1ha**.
- Bi-weekly monitoring by an informed and trained Environmental Control Office (ECO) of the dredging of target areas P1 and S1 and the placing of the groyne and revetment should be conducted in order to detect possible wreck remains and remains of survivor camps at the earliest opportunity. The ECO should ensure that identified dredging areas are not deviated from and that the exclusion of the portion of target area P1 in the conservation buffer be maintained at all times. The ECO should carefully monitor the placing of the groyne and ensure that sub-surface beach deposits are not impacted on by the activity.
- A suitably qualified MUCH specialist should be appointed during initial stages of the development in order to provide training to the assigned project ECO and contractors involved in the project activities on site. Training should cover the MUCH sensitivity of the area and heritage Chance Find procedures for the site.
- The ECO should report to the SAHRA MUCH Unit on a weekly basis, on the dredging progress and site status of target areas P1 and S1 for the duration of activities in these target areas.
- A Chance Find procedure that outlines what will happen if previously undetected heritage resources, particularly maritime archaeological resources, are encountered during dredging activities should be compiled and implemented. The Chance Find procedure should include some or all of the following measures:
    f. If any heritage resources and particularly maritime heritage resources (remains of the wreck, related artefacts, possible survivor camp remnants) are encountered, dredging activities should immediately be suspended and the SAHRA MUCH Unit should be notified;
    g. If any heritage resources and particularly maritime heritage resources is encountered, the controlled and systematic recovery of the resources should be done by means of rescue excavations. The recovery of heritage resources should be executed by a suitably qualified MUCH specialist;
    h. Any rescue excavations, artefact recovery or sampling must be done after a permit has been issued by SAHRA under Section 35 of the NHRA (Act 25 of 1999) to the qualified MUCH specialist;
    i. The recovery work should be conducted in such a way as to augment the research of shipwrecks along the Cape St Francis coastline;

j. A close out report on MUCH rescue work must be submitted to SAHRA by the specialist.

These recommendations should be included within the Environmental Management Programme (EMPr) for the proposed project.

8 GENERAL COMMENTS AND CONDITIONS

This AIA report serves to confirm the extent and significance of the heritage landscape of the proposed St Francis Bay Coastal Protection Project area. The larger heritage horizon encompasses rich and diverse archaeological landscapes and cognisance should be taken of heritage resources and archaeological material that might be present in surface and sub-surface deposits. If, during construction, any possible archaeological material culture discoveries are made, the operations must be stopped and a qualified archaeologist be contacted for an assessment of the find.

If such sites were to be encountered or impacted by any proposed developments, recommendations contained in this report, as well as endorsement of mitigation measures as set out by SAHRA, the National Resources Act and the CRM section of ASAPA will be required. It must be emphasised that the conclusions and recommendations expressed in this archaeological heritage sensitivity investigation are based on the visibility of archaeological sites/features and may not therefore, represent the area's complete archaeological legacy. Many sites/features may be covered by soil and vegetation and might only be located during sub-surface investigations. If subsurface archaeological deposits, artefacts or skeletal material were to be recovered in the area during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately **(*cf*. NHRA (Act No. 25 of 1999)**, Section 36 (6)). It must also be clear that Archaeological Specialist Reports will be assessed by the relevant heritage resources authority (SAHRA).

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10 ADDENDUM 1: HERITAGE LEGISLATION BACKGROUND

10.1 CRM: Legislation, Conservation and Heritage Management

The broad generic term Cultural Heritage Resources refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

10.1.1 Legislation regarding archaeology and heritage sites

The South African Heritage Resources Agency (SAHRA) and their provincial offices aim to conserve and control the management, research, alteration and destruction of cultural resources of South Africa. It is therefore vitally important to adhere to heritage resource legislation at all times.

d. National Heritage Resources Act No 25 of 1999, section 35

According to the National Heritage Resources Act of 1999 a historical site is any identifiable building or part thereof, marker, milestone, gravestone, landmark or tell older than 60 years. This clause is commonly known as the “60-years clause”. Buildings are amongst the most enduring features of human occupation, and this definition therefore includes all buildings older than 60 years, modern architecture as well as ruins, fortifications and Iron Age settlements. “Tell” refers to the evidence of human existence which is no longer above ground level, such as building foundations and buried remains of settlements (including artefacts). The Act identifies heritage objects as:

- objects recovered from the soil or waters of South Africa including archaeological and palaeontological objects, meteorites and rare geological specimens
- visual art objects
- military objects
- numismatic objects
- objects of cultural and historical significance
- objects to which oral traditions are attached and which are associated with living heritage
- objects of scientific or technological interest
- any other prescribed category

With regards to activities and work on archaeological and heritage sites this Act states that:

“No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit by the relevant provincial heritage resources authority.” (34. [1] 1999:58)

and

“No person may, without a permit issued by the responsible heritage resources authority-

(d) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(e) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(f) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(g) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites. (35. [4] 1999:58)."

and

"No person may, without a permit issued by SAHRA or a provincial heritage resources agency-

(h) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(i) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority;

(j) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) and excavation equipment, or any equipment which assists in the detection or recovery of metals (36. [3] 1999:60)."

e. Human Tissue Act of 1983 and Ordinance on the Removal of Graves and Dead Bodies of 1925

Graves 60 years or older are heritage resources and fall under the jurisdiction of both the National Heritage Resources Act and the Human Tissues Act of 1983. However, graves younger than 60 years are specifically protected by the Human Tissues Act (Act 65 of 1983) and the Ordinance on the Removal of Graves and Dead Bodies (Ordinance 7 of 1925) as well as any local and regional provisions, laws and by-laws. Such burial places also fall under the jurisdiction of the National Department of Health and the Provincial Health Departments. Approval for the exhumation and re-burial must be obtained from the relevant Provincial MEC as well as the relevant Local Authorities.

10.1.2 Background to HIA and AIA Studies

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are 'generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. Heritage sites are frequently threatened by development projects and both the environmental and heritage legislation require impact assessments (HIAs & AIAs) that identify all heritage resources in areas to be developed. Particularly, these assessments are required to make recommendations for protection or mitigation of the impact of the sites. HIAs and AIAs should be done by qualified professionals with adequate knowledge to (a) identify all heritage resources including archaeological and palaeontological sites that might occur in areas of developed and (b) make recommendations for protection or mitigation of the impact on the sites. The National Heritage Resources Act (Act No. 25 of 1999, section 38) provides guidelines for Cultural Resources Management and prospective developments:

"38. *(1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as:*

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear

development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50m in length;

(c) any development or other activity which will change the character of a site:

(i) exceeding 5 000 m^2 in extent; or

(ii) involving three or more existing erven or subdivisions thereof; or

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development."

And:

"The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:

(k) The identification and mapping of all heritage resources in the area affected;

(l) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;

(m) an assessment of the impact of the development on such heritage resources;

(n) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;

(o) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

(p) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and

(q) plans for mitigation of any adverse effects during and after the completion of the proposed development (38. [3] 1999:64)."

Consequently, section 35 of the Act requires Heritage Impact Assessments (HIAs) or Archaeological Impact Assessments (AIAs) to be done for such developments in order for all heritage resources, that is, all places or objects of aesthetics, architectural, historic, scientific, social, spiritual, linguistic or technological value or significance to be protected. Thus any assessment should make provision for the protection of all these heritage components, including archaeology, shipwrecks, battlefields, graves, and structures older than 60 years, living heritage, historical settlements, landscapes, geological sites, palaeontological sites and objects. Heritage resources management and conservation.

10.2 Assessing the Significance of Heritage Resources

Archaeological sites, as previously defined in the National Heritage Resources Act (Act 25 of 1999) are places in the landscape where people have lived in the past – generally more than 60 years ago – and have left traces of their presence behind. In South Africa, archaeological sites include hominid fossil sites, places where people of the Earlier, Middle and Later Stone Age lived in open sites, river gravels, rock shelters and caves, Iron Age sites, graves, and a variety of historical sites and structures in rural areas, towns and cities. Palaeontological sites are those with fossil remains of plants and animals where people were not involved in the accumulation of the deposits. The basic principle of cultural heritage conservation is that archaeological and other heritage sites are valuable, scarce and *non-renewable.* Many such sites are unfortunately lost on a daily basis through development for housing, roads and infrastructure and once archaeological sites are damaged, they cannot be re-created as site integrity and authenticity is permanently lost. Archaeological sites have the potential to contribute to our understanding of the history of the region and of our country and continent. By preserving links with our past, we may not be able to revive lost cultural traditions, but it enables us to appreciate the role they have played in the history of our country.

- Categories of significance

Rating the significance of archaeological sites, and consequently grading the potential impact on the resources is linked to the significance of the site itself. The significance of an archaeological site is based on the amount of deposit, the integrity of the context, the kind of deposit and the potential to help answer present research questions. Historical structures are defined by Section 34 of the National Heritage Resources Act, 1999, while other historical and cultural significant sites, places and features, are generally determined by community preferences. The guidelines as provided by the NHRA (Act No. 25 of 1999) in Section 3, with special reference to subsection 3 are used when determining the cultural significance or other special value of archaeological or historical sites. In addition, ICOMOS (the Australian Committee of the International Council on Monuments and Sites) highlights four cultural attributes, which are valuable to any given culture:

- *Aesthetic value:*

Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria include consideration of the form, scale, colour, texture and material of the fabric, the general atmosphere associated with the place and its uses and also the aesthetic values commonly assessed in the analysis of landscapes and townscape.

- *Historic value:*

Historic value encompasses the history of aesthetics, science and society and therefore to a large extent underlies all of the attributes discussed here. Usually a place has historical value because of some kind of influence by an event, person, phase or activity.

- *Scientific value:*

The scientific or research value of a place will depend upon the importance of the data involved, on its rarity, quality and on the degree to which the place may contribute further substantial information.

- *Social value:*

Social value includes the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a certain group.

It is important for heritage specialist input in the EIA process to take into account the heritage management structure set up by the NHR Act. It makes provision for a 3-tier system of management including the South Africa Heritage Resources Agency (SAHRA) at a national level, Provincial Heritage Resources Authorities

(PHRAs) at a provincial and the local authority. The Act makes provision for two types or forms of protection of heritage resources; i.e. formally protected and generally protected sites:

Formally protected sites:

- Grade 1 or national heritage sites, which are managed by SAHRA
- Grade 2 or provincial heritage sites, which are managed by the provincial HRA (MP-PHRA).
- Grade 3 or local heritage sites.

Generally protected sites:

- Human burials older than 60 years.
- Archaeological and palaeontological sites.
- Shipwrecks and associated remains older than 60 years.
- Structures older than 60 years.

With reference to the evaluation of sites, the certainty of prediction is definite, unless stated otherwise and if the significance of the site is rated high, the significance of the impact will also result in a high rating. The same rule applies if the significance rating of the site is low. The significance of archaeological sites is generally
ranked into the following categories.

Significance	Rating Action
No significance: sites that do not require mitigation.	None
Low significance: sites, which may require mitigation.	2a. Recording and documentation (Phase 1) of site; no further action required 2b. Controlled sampling (shovel test pits, auguring), mapping and documentation (Phase 2 investigation); permit required for sampling and destruction
Medium significance: sites, which require mitigation.	3. Excavation of representative sample, C14 dating, mapping and documentation (Phase 2 investigation); permit required for sampling and destruction [including 2a & 2b]
High significance: sites, where disturbance should be avoided.	4a. Nomination for listing on Heritage Register (National, Provincial or Local) (Phase 2 & 3 investigation); site management plan; permit required if utilised for education or tourism
High significance: Graves and burial places	4b. Locate demonstrable descendants through social consulting; obtain permits from applicable legislation, ordinances and regional by-laws; exhumation and reinternment [including 2a, 2b & 3]

Furthermore, the significance of archaeological sites was based on six main criteria:

- Site integrity (i.e. primary vs. secondary context),
- Amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter),
- Social value,
- Uniqueness, and
- Potential to answer current and future research questions.

A fundamental aspect in assessing the significance and protection status of a heritage resource is often whether or not the sustainable social and economic benefits of a proposed development outweigh the conservation issues at stake. When, for whatever reason the protection of a heritage site is not deemed necessary or practical, its research potential must be assessed and mitigated in order to gain data / information, which would otherwise be lost.

11 ADDENDUM 2: CONVENTIONS USED TO ASSESS THE SIGNIFICANCE OF HERITAGE

11.1 Site Significance Matrix

According to the NHRA, Section 2(vi) the **significance** of heritage sites and artefacts is determined by it aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these. The following matrix is used for assessing the significance of each identified site/feature.

2. SITE EVALUATION			
2.1 Heritage Value (NHRA, section 2 [3])	High	Medium	Low
It has importance to the community or pattern of South Africa's history or pre-colonial history.			
It possesses unique, uncommon, rare or endangered aspects of South Africa's natural or cultural heritage.			
It has potential to yield information that will contribute to an understanding of South Africa's natural and cultural heritage.			
It is of importance in demonstrating the principle characteristics of a particular class of South Africa's natural or cultural places or objects.			
It has importance in exhibiting particular aesthetic characteristics valued by a particular community or cultural group.			
It has importance in demonstrating a high degree of creative or technical achievement at a particular period.			
It has marked or special association with a particular community or cultural group for social, cultural or spiritual reasons (sense of place).			
It has strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.			
It has significance through contributing towards the promotion of a local sociocultural identity and can be developed as a tourist destination.			
It has significance relating to the history of slavery in South Africa.			
It has importance to the wider understanding of temporal changes within cultural landscapes, settlement patterns and human occupation.			
2.2 Field Register Rating			
National/Grade 1 [should be registered, retained]			
Provincial/Grade 2 [should be registered, retained]			
Local/Grade 3A [should be registered, mitigation not advised]			
Local/Grade 3B [High significance; mitigation, partly retained]			
Generally Protected A [High/Medium significance, mitigation]			
Generally protected B [Medium significance, to be recorded]			
Generally Protected C [Low significance, no further action]			
2.3 Sphere of Significance	High	Medium	Low
International			
National			
Provincial			
Local			
Specific community			

11.2 Impact Assessment Criteria

The following table provides a guideline for the rating of impacts and recommendation of management actions for sites of heritage potential.

Significance of the heritage resource
This is a statement of the nature and degree of significance of the heritage resource being affected by the activity. From a heritage management perspective, it is useful to distinguish between whether the significance is embedded in the physical fabric or in associations with events or persons or in the experience of a place; i.e. its visual and non-visual qualities. This statement is a primary informant to the nature and degree of significance of an impact and thus needs to be thoroughly considered. Consideration needs to be given to the significance of a heritage resource at different scales (i.e. site-specific, local, regional, national or international) and the relationship between the heritage resource, its setting and its associations.

Nature of the impact
This is an assessment of the nature of the impact of the activity on a heritage resource, with some indication of its positive and/or negative effect/s. It is strongly informed by the statement of resource significance. In other words, the nature of the impact may be historical, aesthetic, social, scientific, linguistic or architectural, intrinsic, associational or contextual (visual or non-visual). In many cases, the nature of the impact will include more than one value.

Extent
Here it should be indicated whether the impact will be experienced:
- On a site scale, i.e. extend only as far as the activity;
- Within the immediate context of a heritage resource;
- On a local scale, e.g. town or suburb
- On a metropolitan or regional scale; or
- On a national/international scale.

Duration
Here it should be indicated whether the lifespan of the impact will be:
- Short term, (needs to be defined in context)
- Medium term, (needs to be defined in context)
- Long term where the impact will persist indefinitely, possibly beyond the operational life of the activity, either because of natural processes or by human intervention; or
- Permanent where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Of relevance to the duration of an impact are the following considerations:
- Reversibility of the impact; and
- Renewability of the heritage resource.

Intensity
Here it should be established whether the impact should be indicated as:
- Low, where the impact affects the resource in such a way that its heritage value is not affected;
- Medium, where the affected resource is altered but its heritage value continues to exist albeit in a modified way; and
- High, where heritage value is altered to the extent that it will temporarily or permanently be damaged or destroyed.

Probability
This should describe the likelihood of the impact actually occurring indicated as:
- Improbable, where the possibility of the impact to materialize is very low either because of design or historic experience;
- Probable, where there is a distinct possibility that the impact will occur;
- Highly probable, where it is most likely that the impact will occur; or
- Definite, where the impact will definitely occur regardless of any mitigation measures

Confidence

This should relate to the level of confidence that the specialist has in establishing the nature and degree of impacts. It relates to the level and reliability of information, the nature and degree of consultation with I&AP's and the dynamic of the broader socio-political context.

- High, where the information is comprehensive and accurate, where there has been a high degree of consultation and the socio-political context is relatively stable.
- Medium, where the information is sufficient but is based mainly on secondary sources, where there has been a limited targeted consultation and socio-political context is fluid.
- Low, where the information is poor, a high degree of contestation is evident and there is a state of socio-political flux.

Impact Significance

The significance of impacts can be determined through a synthesis of the aspects produced in terms of the nature and degree of heritage significance and the nature, duration, intensity, extent, probability and confidence of impacts and can be described as:

- Low; where it would have a negligible effect on heritage and on the decision
- Medium, where it would have a moderate effect on heritage and should influence the decision.
- High, where it would have, or there would be a high risk of, a big effect on heritage. Impacts of high significance should have a major influence on the decision;
- Very high, where it would have, or there would be high risk of, an irreversible and possibly irreplaceable negative impact on heritage. Impacts of very high significance should be a central factor in decision-making.

11.3 Direct Impact Assessment Criteria

The following table provides an outline of the relationship between the significance of a heritage context, the intensity of development and the significance of heritage impacts to be expected

	TYPE OF DEVELOPMENT			
HERITAGE CONTEXT	**CATEGORY A**	**CATEGORY B**	**CATEGORY C**	**CATEGORY D**
CONTEXT 1 High heritage Value	Moderate heritage impact expected	High heritage impact expected	Very high heritage impact expected	Very high heritage impact expected
CONTEXT 2 Medium to high heritage value	Minimal heritage impact expected	Moderate heritage impact expected	High heritage impact expected	Very high heritage impact expected
CONTEXT 3 Medium to low heritage value	Little or no heritage impact expected	Minimal heritage impact expected	Moderate heritage impact expected	High heritage impact expected
CONTEXT 4 Low to no heritage value	Little or no heritage impact expected	Little or no heritage impact expected	Minimal heritage value expected	Moderate heritage impact expected

NOTE: A DEFAULT "LITTLE OR NO HERITAGE IMPACT EXPECTED" VALUE APPLIES WHERE A HERITAGE RESOURCE OCCURS OUTSIDE THE IMPACT ZONE OF THE DEVELOPMENT.

HERITAGE CONTEXTS	**CATEGORIES OF DEVELOPMENT**
Context 1: Of high intrinsic, associational and contextual heritage value within a national, provincial and local context, i.e. formally declared or potential Grade 1, 2 or 3A heritage resources **Context 2:** Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3B heritage resources. **Context 3:**	**Category A: Minimal intensity development** - No rezoning involved; within existing use rights. - No subdivision involved. - Upgrading of existing infrastructure within existing envelopes - Minor internal changes to existing structures - New building footprints limited to less than 1000m2. **Category B: Low-key intensity development** - Spot rezoning with no change to overall zoning of a site. - Linear development less than 100m

Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3C heritage resources **Context 4:** Of little or no intrinsic, associational or contextual heritage value due to disturbed, degraded conditions or extent of irreversible damage.	- Building footprints between 1000m2-2000m2 - Minor changes to external envelop of existing structures (less than 25%) - Minor changes in relation to bulk and height of immediately adjacent structures (less than 25%). **Category C: Moderate intensity development** - Rezoning of a site between 5000m2-10 000m2. - Linear development between 100m and 300m. - Building footprints between 2000m2 and 5000m2 - Substantial changes to external envelop of existing structures (more than 50%) - Substantial increase in bulk and height in relation to immediately adjacent buildings (more than 50%) **Category D: High intensity development** - Rezoning of a site in excess of 10 000m2 - Linear development in excess of 300m. - Any development changing the character of a site exceeding 5000m2 or involving the subdivision of a site into three or more erven. - Substantial increase in bulk and height in relation to immediately adjacent buildings (more than 100%)

11.4 Management and Mitigation Actions

The following table provides a guideline of relevant heritage resources management actions is vital to the conservation of heritage resources.

No further action / Monitoring
Where no heritage resources have been documented, heritage resources occur well outside the impact zone of any development or the primary context of the surroundings at a development footprint has been largely destroyed or altered, no further immediate action is required. Site monitoring during development, by an ECO or the heritage specialist are often added to this recommendation in order to ensure that no undetected heritage\ remains are destroyed.
Avoidance
This is appropriate where any type of development occurs within a formally protected or significant or sensitive heritage context and is likely to have a high negative impact. Mitigation is not acceptable or not possible. This measure often includes the change / alteration of development planning and therefore impact zones in order not to impact on resources.
Mitigation
This is appropriate where development occurs in a context of heritage significance and where the impact is such that it can be mitigated to a degree of medium to low significance, e.g. the high to medium impact of a development on an archaeological site could be mitigated through sampling/excavation of the remains. Not all negative impacts can be mitigated.
Compensation
Compensation is generally not an appropriate heritage management action. The main function of management actions should be to conserve the resource for the benefit of future generations. Once lost it cannot be renewed. The circumstances around the potential public or heritage benefits would need to be exceptional to warrant this type of action, especially in the case of where the impact was high.
Rehabilitation
Rehabilitation is considered in heritage management terms as a intervention typically involving the adding of a new heritage layer to enable a new sustainable use. It is not appropriate when the process necessitates the removal of previous historical layers, i.e. restoration of a building or place to the previous state/period. It is an appropriate heritage management action in the following cases: - The heritage resource is degraded or in the process of degradation and would benefit from rehabilitation. - Where rehabilitation implies appropriate conservation interventions, i.e. adaptive reuse, repair and maintenance, consolidation and minimal loss of historical fabric. - Where the rehabilitation process will not result in a negative impact on the intrinsic value of the resource.

12 ADDENDUM 3: SAHRA MUCH UNIT FINAL COMMENT

AIA OF AREAS DEMARACTED FOR REHABILITATION FOR THE ST FRANCIS BAY COASTAL PROTECTION PROJECT, ST FRANCIS, KOUGA MUNICIPALITY, EASTERN CAPE PROVINCE
Our Ref:

an agency of the
Department of Arts and Culture

T: +27 21 462 4502 | F: +27 21 462 4509 | E: info@sahra.org.za
South African Heritage Resources Agency | 111 Harrington Street | Cape Town
P.O. Box 4637 | Cape Town | 8001
www.sahra.org.za

Enquiries: Briege Williams
Tel: 021 462 4502
Email: bwilliams@sahra.org.za
CaseID: 14916

Date: Tuesday December 08, 2020
Page No: 1

Letter

In terms of Section 38(8) of the National Heritage Resources Act (Act 25 of 1999)

Attention: Mr Neels Kruger
Neels Kruger

ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF AREAS DEMARACTED FOR REHABILITATION FOR THE ST FRANCIS BAY COASTAL PROTECTION PROJECT, ST FRANCIS, KOUGA MUNICIPALITY, EASTERN CAPE PROVINCE

The South African Heritage Resources Agency (SAHRA) would like to thank you for submitting the updated Letter of Motivation for exemption to undertake a Maritime and Underwater Cultural Heritage Impact Assessment (MUCHIA) as part of an Archaeological Impact Assessment (AIA) for the St Francis Bay Coastal Community Protection Project, St Francis, Kouga Municipality, Eastern Cape Province.

In February 2020 a Draft Environmental Impact Assessment and Archaeological Impact Assessment for the St Francis Bay Coastal Community Protection Project was uploaded on SAHRIS for comment. The Maritime and Underwater Cultural Heritage unit at SAHRA issued a comment in March 2020 recommending that a MUCHIA be undertaken to assess possible MUCH resources and to provide mitigation and management measures.

A Letter of Motivation for exemption to undertake a Maritime and Underwater Cultural Heritage Impact Assessment was subsequently submitted by the applicant for consideration by SAHRA in May 2020. The letter set out the reasons for exemption and outlined comprehensive management and mitigation measures in connection to the proposed works. The MUCH unit issued a comment in May 2020 where they considered the reasons for exemption and agreed that a MUCHIA did not need to be undertaken as long as the mitigation and management measures set out in the letter are included in the Environmental Management Programme and strictly adhered to during the proposed work.

In December 2020 an updated exemption letter was submitted to SAHRA with changes in the buffer zone and the inclusion of a beach groyne. The beach groyne will be installed on a nourished beach level, approx. 1m higher than the existing beach level, therefore there is no anticipated impact on any heritage resources.

AIA OF AREAS DEMARACTED FOR REHABILITATION FOR THE ST FRANCIS BAY COASTAL PROTECTION PROJECT, ST FRANCIS, KOUGA MUNICIPALITY, EASTERN CAPE PROVINCE
Our Ref:

South African Heritage Resources Agency | 111 Harrington Street | Cape Town
P.O. Box 4637 | Cape Town | 8001
www.sahra.org.za

Enquiries: Briege Williams
Tel: 021 462 4502
Email: bwilliams@sahra.org.za
CaseID: 14916

Date: Tuesday December 08, 2020
Page No: 2

The reduction of the buffer zone is now proposed to exclude the estuary and inland river canal south-west of the river mouth and near the location of the proposed groyne. The main area of concern for this project was the possible presence of shipwreck material relating to the Lady Head wreck and other possible cultural material in and around the river mouth. As the reduction of the buffer zone has no direct impact on the area of the river mouth SAHRA agrees to the new conditions set out in the updated exemption letter.

SAHRA would like to emphasise the importance of making project participants involved in the proposed works aware of the possibility of encountering MUCH resources and the procedures to follow should anything arise.

Should you have any further queries, please contact the designated official using the case number quoted above in the case header.

Yours faithfully

B. Williams

Briege Williams
Heritage Officer
South African Heritage Resources Agency

Lesa la Grange
Manager: Maritime and Underwater Cultural Heritage
South African Heritage Resources Agency

ADMIN:
Direct URL to case: http://www.sahra.org.za/node/534827

AIA OF AREAS DEMARACTED FOR REHABILITATION FOR THE ST FRANCIS BAY COASTAL PROTECTION PROJECT, ST FRANCIS, KOUGA MUNICIPALITY, EASTERN CAPE PROVINCE

Our Ref:

South African Heritage Resources Agency | 111 Harrington Street | Cape Town
P.O. Box 4637 | Cape Town | 8001
www.sahra.org.za

Enquiries: Briege Williams
Tel: 021 462 4502
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SAHRA would like to emphasise the importance of making project participants involved in the proposed works aware of the possibility of encountering MUCH resources and the procedures to follow should anything arise.

Should you have any further queries, please contact the designated official using the case number quoted above in the case header.

Yours faithfully

B. Williams

Briege Williams
Heritage Officer
South African Heritage Resources Agency

Lesa la Grange
Manager: Maritime and Underwater Cultural Heritage
South African Heritage Resources Agency

ADMIN:
Direct URL to case: http://www.sahra.org.za/node/534827

13 ADDENDUM 4: MOTIVATION FOR EXEMPTION FROM MUCHIA

Email info@exigo3.com
Tel +27 012 751 2160
Fax +27 086 607 2406

Postnet Suite 74,
Private Bag X04,
Menlo Park, 0102

Vat nr: 4910184854
Registration nr: 2006/011434/07

Innovation in Sustainability

www.exigo3.com

Attention: Briege Williams
South African Heritage Resource Agency
111 Harrington Street
Cape Town
8001

2020-12-07

UPDATED LETTER OF MOTIVATION FOR EXEMPTION TO UNDERTAKE A MARITIME AND UNDERWATER CULTURAL HERITAGE IMPACT ASSESSMENT (MUCHIA) AS PART OF AN ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) FOR THE ST FRANCIS BAY COASTAL PROTECTION PROJECT, ST FRANCIS, KOUGA MUNICIPALITY, EASTERN CAPE PROVINCE (SAHRS CASE ID 14916).

The St Francis Property Owners Non-Profit Company (SFPO NPC), on behalf of the Kouga Local Municipality, is proposing the implementation of a coastal protection scheme for St Francis Bay beach. The coastal protection scheme will include sand material sourcing from demarcated areas in the Kromme River, beach nourishment of St Francis Bay beach and the development of coastal structures to retard the erosion of St Francis Bay beach. The implementation of beach nourishment together with the development of 5 short stub groynes (i.e. a low solid barrier built into the sea) was considered to be the most suitable option for long-term coastal protections. To prevent the sea from breaking through the St Francis Bay beach spit during a strong storm surge event, revetment structures have been proposed as an additional coastal protection measure to be implemented. The proposed dredging of sand to replenish the beach is estimated to be approx. 854,000m^3 and the proposed revetment is to run along the length of the beach spit for 620m. The project location is indicated on Figure 1 and proposed dredging target areas in the Kromme River estuary are indicated on Figure 2 in Addendum 2.

An Archaeological Impact Assessment[1] (AIA) was produced as part of the Draft Environmental Impact Report (DEIR) for the project. An Interim Comment[2] was then issued by the South African Heritage Resources Authority (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act (Act 25 of 1999) on 18 March 2020. In the comment, SAHRA indicated the requirement of a Maritime and Underwater Cultural Heritage Impact Assessment (MUCHIA) since a large part of the proposed development and particularly sand sourcing and beach replenishment are proposed to occur below the high-water mark. It was further noted that a number of ships were wrecked along the coastline of Cape St Francis and the Kromme River mouth. The locations of these wrecks are indicated on Figure 3 in Addendum 2 and a list of

[1]Kruger, 2020. Archaeological Impact Assessment of Areas Demarcated for Rehabilitation for the St Francis Bay Coastal Community Protection Project, St Francis, Kouga Municipality, Eastern Cape Province. Exigo Sustainability
[2]Interim Comment in terms of Section 38(8) of the National Heritage Resources Act (Act 25 of 1999): Archaeological Impact Assessment of Areas Demarcated for Rehabilitation for the St Francis Bay Coastal Community Protection Project, St Francis, Kouga Municipality, Eastern Cape Province. SAHRA CaseID: 14916

wrecks are included in Addendum 1 (also refer to Kruger, 2020). There are four vessels listed as being wrecked in St Francis Bay but of note is the wrecking site of the Lady Head (1859) which is recorded as being in the mouth of the Kromme River.

Since the proposed project is resource constrained and cognisant of the fact that target areas for dredging occur largely to the riverside delta of the Kromme River estuary and areas within the river system to the west, exemption from the MUCHIA are hereby requested from SAHRA. It is proposed that the requested exemption be subject to the strict adherence of the following conditions:

1. The implementation of a 100m buffer around the river mouth. This is demarcated around the high-water line and around the coastal rock outcrop which encompasses the relative location of the Lady Head shipwreck shipwreck (please refer to Figure 4 in Addendum 2). This buffer includes the beach and coastal dune strips around the river mouth which could potentially hold the washed-up remains of wreckage, artefacts as well as possible survivor camp remnants. However, since the estuary and inland river canal south-west of the river mouth have been subjected to historical alteration and more recent riparian rehabilitation, it is recommended that this area be excluded from the 100m buffer. Rather a 50m buffer observed from the highwater mark to include the beachfront and adjoining dune strip east of the dividing spit at the estuary.
2. The beach infrastructure (i.e. groyne) is expected to be constructed on top of the existing beach sand and level without the need for excavation. The revetment at the spit will be installed on a nourished beach level, which will be approximately 1 metre higher than the existing beach level. Therefore, no intervention in submerged items and artefacts are anticipated.
3. The exclusion for development of a portion of dredging target area P1 which falls within this proposed buffer zone (see Figure 4 in Addendum 2). The extent of this proposed exclusion area is approximately **1.1ha**.
4. Bi-weekly monitoring by an informed and trained Environmental Control Office (ECO) of the dredging of target areas P1 and S1 and the placing of the groyne and revetment in order to detect possible wreck remains and remains of survivor camps at the earliest opportunity. The ECO should ensure that identified dredging areas are not deviated from and that the exclusion of the portion of target area P1 in the conservation buffer be maintained at all times. The ECO should carefully monitor the placing of the groyne and ensure that sub-surface beach deposits are not impacted on by the activity.
5. The appointment of a suitably qualified MUCH specialist during initial stages of the development in order to provide training to the assigned project ECO and contractors involved in the project activities on site. Training should cover the MUCH sensitivity of the area and heritage Chance Find procedures (see below) for the site.
6. Weekly ECO reporting to the SAHRA MUCH Unit on the dredging progress and site status of target areas P1 and S1 for the duration of activities in these target areas.

7. Compilation and implementation of a Chance Find procedure that outlines what will happen if previously undetected heritage resources, particularly maritime archaeological resources, are encountered during dredging activities. The Chance Find procedure should include some or all of the following measures:
    a. If any heritage resources and particularly maritime heritage resources (remains of the wreck, related artefacts, possible survivor camp remnants) are encountered, dredging activities should immediately be suspended and the SAHRA MUCH Unit should be notified;
    b. If any heritage resources and particularly maritime heritage resources is encountered, the controlled and systematic recovery of the resources should be done by means of rescue excavations. The recovery of heritage resources should be executed by a suitably qualified MUCH specialist;
    c. Any rescue excavations, artefact recovery or sampling must be done after a permit has been issued by SAHRA under Section 35 of the NHRA (Act 25 of 1999) to the qualified MUCH specialist;
    d. The recovery work should be conducted in such a way as to augment the research of shipwrecks along the Cape St Francis coastline;
    e. A close out report on MUCH rescue work must be submitted to SAHRA by the specialist.
8. These recommendations should be included within the Environmental Management Programme (EMPr) for the proposed project.

The positive consideration of the request for exemption from the MUCHIA by SAHRA, subject to terms and conditions set out above would be greatly appreciated.

Please do not hesitate to contact me should any information are found to be unclear or insufficient in terms of adjudicating the request for exemption.

Kind regards,

Nelius Kruger

Heritage & Social Specialist, ASAPA Accredited Heritage Resources Practitioner

Exigo Sustainability

E-Mail: neels@exigo3.com

Tel: +27 082 967 2131

ADDENDUM 1: SHIPWRECK REGISTER

St Francis Bay Shipwreck Register				
Wreck Name	**Type**	**Date of Sinking**	**Location Reference (General)**	**Situation (if known)**
Lady Head	Cargo	1859	Submerged rocks just off the mouth of the *Kromme River*	Grounded
Cape Recife	Cargo	1929	Seal Point	Partially submerged
Queen of the West	Barque	1850	West of Cape St Francis	Sank
The Hope	Steamer	1840	East of Huisklip	
Lyngenfjord	Cargo	1938	Near Tzitzikama Point	Partially submerged
Panaghlia		1938	Near Tzitzikama Point	Partially submerged
Suffolk	Steamer	1900	Near Tzitzikama Point	Grounded
HMS Osprey	Sloop Warship	1867	10 miles West from Seal Point Lighthouse	Beached
Nederlandsche Vlag		1870	St Francis Bay	Grounded
ELiza and Alice	Barque	1870	Mosterts Hoek	Partially submerged
Berwick	Barque	1827	Seal Point	
Auguste	Barque	1858	Cape St Francis	
Milford		1875	Cape St Francis	
British Duke		1880	Oyster Bay, near Cape St Francis	Grounded
Derby	Barque	1895	6 miles East of Cape St Francis	Grounded
Meng Yaw 366	Cargo	1989	Brakkeduine	
L'Agile	Barque	1850	20 miles West of St Francis bay	Grounded
Queen of the West	Barque	1850	West of Cape St Francis	Sank
Spy	Barque	1851	St Francis Bay	Grounded
La Guste	Barque	1858		
Bosphorus	Steamer	1867	Cape St Francis	
Jason	Barque	1869	St Francis Bay	
Niagara	Barque	1870	Oyster Bay, near Cape St Francis	Grounded
Mitford		1875	Cape St Francis	
Freeman Clarke		1883	Cape St Francis	
Suffolk	Steamer	1900	Near Tzitzikama Point	

Cromatyshire		1901	west of Seal Point	
President Reitz	Freighter	1947	Seal Point	Lost
Sikelela	Fishing vessel	2014	St Francis Bay	Submerged
Barcelona	Motor Vessel	1973	Cape St Francis	Wrecked
Bokkeveld	Motor Vessel	1978	Cape St Francis	Foundered
Leif	Sailing Vessel	1895	Cape St Francis	Grounded
Mabel Young	Sailing Vessel	1879	St Francis Bay	Wrecked
Micmac	Sailing Vessel	1879	Cape St Francis	Grounded, Refloated
Nepaul		1862	Cape St Francis	Abandoned
Opkyk	Motor Vessel	1996	Cape St Francis	
Pigot	Sailing Vessel	1785	Cape St Francis	
Rona	Sailing Vessel	1883	Cape St Francis	Foundered
Santa Artemis	Motor Vessel	1972	Port St Francis	Foundered
Southern Reaper	Motor Vessel	2001	St Francis Bay	Wrecked
Stork	Steamer	1940	Cape St Francis	Grounded
Susan Crisp	Sailing Vessel	1851	Cape St Francis	Grounded

ADDENDUM 2: MAPS

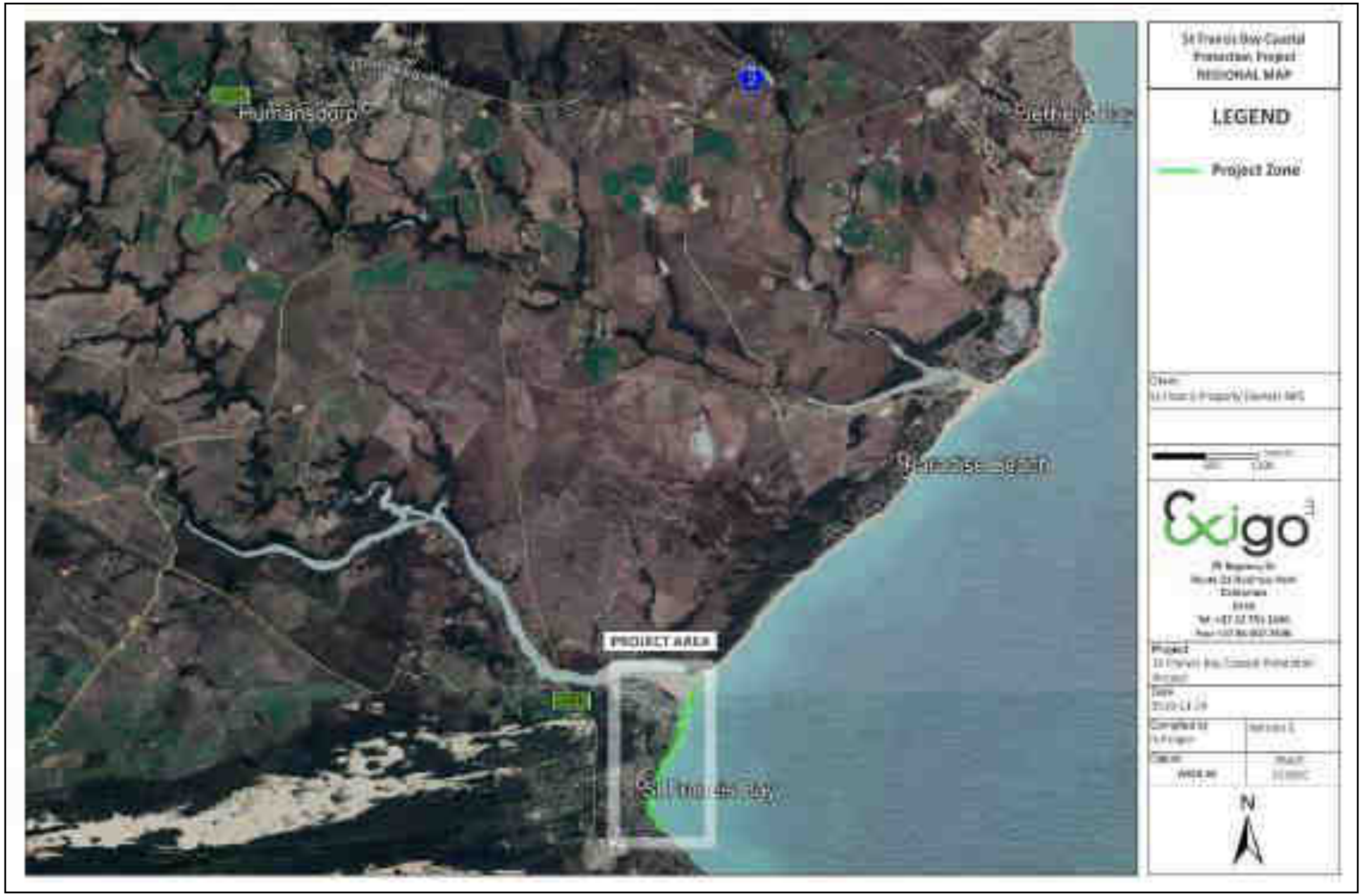

Figure 1: Aerial map providing a regional context for the proposed St Francis Bay Coastal Protection Project.

Figure 2: Aerial map detailing the extent of proposed dredging areas in the Kromme River for the proposed St Francis Bay Coastal Protection Project.

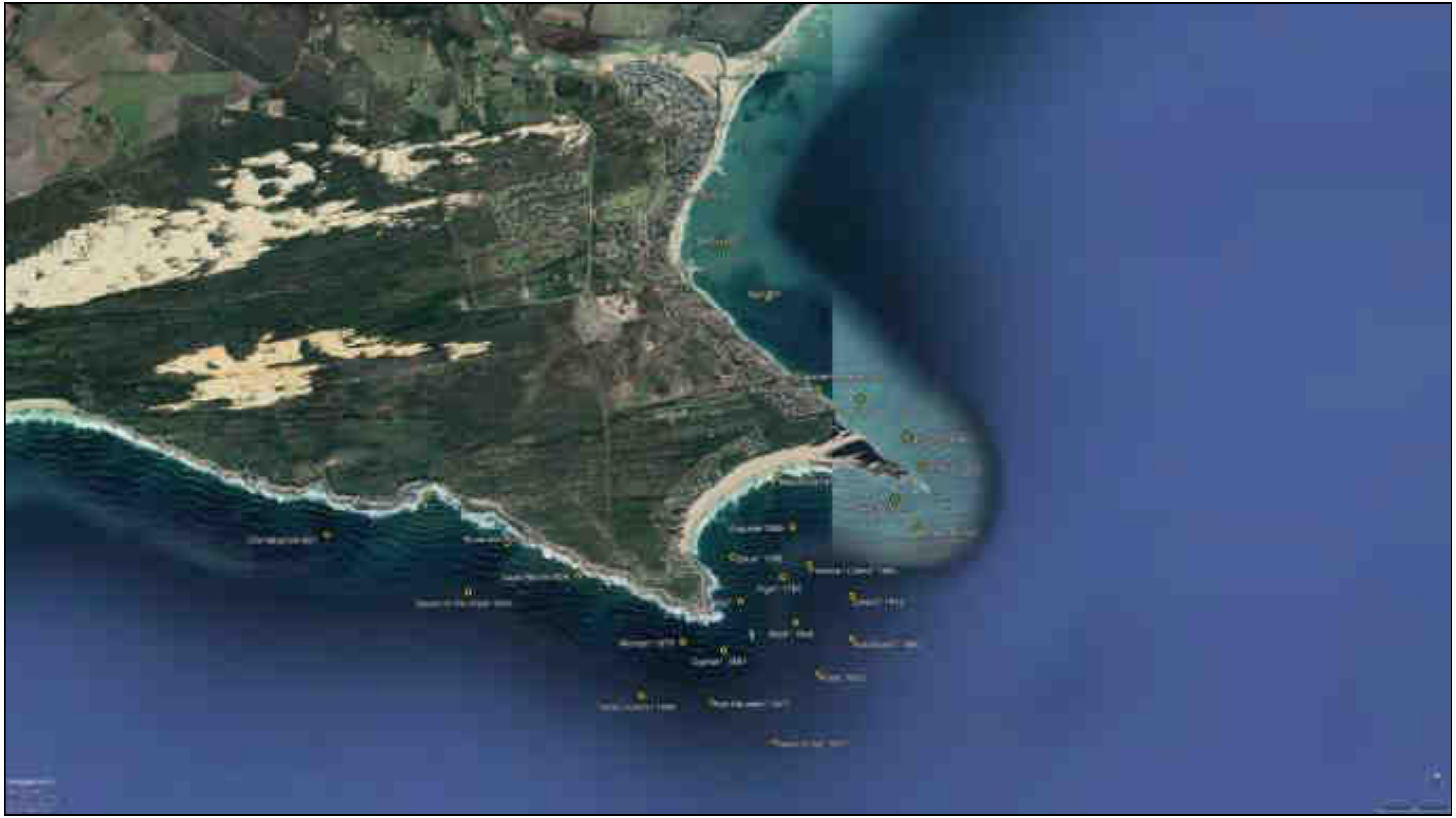

Figure 3: Aerial map indicating the locations of shipwreck sites along the Cape St Francis coastal area.

Figure 4: Detail aerial map of the proposed 100m conservation buffer around the Lady Head shipwreck site at the Kromme River Mouth.

APPENDIX H – EXISTING ENVIRONMENTAL AUTHORISATION

Corner Belmont Terrace and Castle Hill, Central, Port Elizabeth 6001
Private Bag X5001, Greenacres, Port Elizabeth 6057 | Republic of South Africa

Tel: 041 508 5800 | Fax: 041 508 5865 | E-mail: Nicole.Gerber@dedea.gov.za | www.dedea.gov.za

Reference: EC08/C/LN1&3/M/21-2015
Enquiries: N. Gerber

The Municipal Manager: Kouga Municipality
- C/O: The Director of Infrastructure Services
P.O. Box 21
Jeffrey's Bay
6330
Fax: 042 200 8606
E-mail: eduieu@kouga.gov.za

Attention: The Municipal Manager C/O Mr. Eddie Oosthuizen

APPLICATION FOR AUTHORISATION IN TERMS OF SECTION 24 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, ACT 107 OF 1998 TO UNDERTAKE A LISTED ACTIVITY AS SCHEDULED IN THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014: PROPOSED MAINTENANCE AND MANAGEMENT OF THE EXISTING ROCK REVETMENTS & SANDY BEACH BACKSHORE AREAS ALONG THE ST FRANCIS BAY BEACH COASTLINE, INCORPORATING ERVEN 720, 623, 2257, 185, 53, 184 & 625, ZONED PUBLIC OPEN SPACE, WITHIN THE KOUGA LOCAL MUNICIPAL AREA.

With reference to the above-mentioned application (Reference number EC08/C/LN1&3/M/21-2015), please be advised that **the Department has decided to grant authorisation. The Environmental Authorisation and reasons for the decision are attached herewith.**

In terms of Regulation 4(2) of GN R. 982 of the Environmental Impact Assessment Regulations, 2014, you are instructed to notify all registered interested and affected parties, in writing and within fourteen **(14)** days of the date of the Department's decision in respect of your application.

1 The written notification referred to above must -

1.1 Specify the date on which the Environmental Authorisation was issued;

1.2 Inform interested and affected parties of the appeal procedure provided for in terms of the National Appeal Regulations, 2014, as contained in GN R. 993 of 08 December 2014; and

1.3 Advise interested and affected parties that a copy of the Environmental Authorisation and reasons for the decision will be furnished on request.

2. Should you decide to appeal, you must submit your appeal to the appeal administrator, as indicated in the table contained in point 3 below, and serve a copy of the appeal to the applicant, if not the appellant, any registered interested and affected party and any organ of state with interest in the matter within twenty (20) days as described in Regulation 4 of the National Appeal Regulations, 2014.

Only appeals on environmental grounds can be considered. All appeals should be accompanied by relevant supporting documentation.

3. The address to which the **originals** of any such an appeal and any other documents pertaining to the appeal must be mailed is outlined below. Please note that originals may also be delivered per hand or courier.

Department	Economic Development, Environmental Affairs & Tourism
Attention	General Manager: Environmental Affairs
Postal Address	Private Bag X0054, BHISHO, 5605
Hand deliveries at:	Beacon Hill Hockley Close King William's Town 5601
In order to facilitate efficient administration of appeals <u>copies</u> of the appeal and any subsequent appeal documentation must also be submitted as follows:	
General Manager: Environmental Affairs per fax.	(043) 605 7300
Manager: Mr S. Gqalangile - Environmental Impact Management per fax:	(043) 605 7300
It is strongly recommended that electronic copies of all appeal documentation also be e-mailed	E-mail addresses will be supplied on request

DAYALAN GOVENDER
DEPUTY DIRECTOR: ENVIRONMENTAL AFFAIRS
CACADU REGION

DATE: 01/06/2016

Province of the
EASTERN CAPE
ECONOMIC DEVELOPMENT
ENVIRONMENTAL AFFAIRS & TOURISM

Corner Belmont Terrace and Castle Hill, Central, Port Elizabeth 6001
Private Bag X5001, Greenacres, Port Elizabeth 6057 | Republic of South Africa

Tel: 041 508 5800 | Fax: 041 508 5865 | E-mail: Nicole.Gerber@dedea.gov.za | www.dedea.gov.za

Environmental Authorisation

AUTHORISATION NOTICE REGISTER NUMBER	EC08/C/LN1&3/M/21-2015
LAST AMENDED	Not applicable
HOLDER OF AUTHORISATION	Kouga Municipality
LOCATION OF ACTIVITY	Erven 720, 623, 2257, 185, 53, 184, and 625 on the St Francis Bay beachfront, within the Kouga Municipality

DEFINITIONS:

The following definitions are applicable to this Environmental Authorisation:

"EIA regulations" – These are the Environmental Impact Assessment Regulations in terms of Chapter 5 of the National Environmental Management Act, Act 107 of 1998:

As published in Government Notice R. 982 of 04 December 2014.

"The Department" – The Department of Economic Development, Environmental Affairs and Tourism, Eastern Cape Province.

"DEA - O & C" - The National Department of Environmental Affairs, Oceans and Coasts Directorate.

"ICM Act" - Integrated Coastal Management Act, Act No. 24 of 2008, as amended.

"AIS" - Alien Invasive Species.

"KM" - Kouga Municipality.

"AFBAR" - Amended Final Basic Assessment Report titled "The maintenance and management of the existing rock revetments & sandy beach backshore areas along the St Francis Bay beach coastline, incorporating Erven 720, 623, 2257, 185, 53, 184 & 625, zoned Public Open Space, within the Kouga Local Municipality; Sarah Baartman District of the Eastern Cape Province", Final Basic Assessment Report dated 01 February 2016 compiled by Frank Silberbauer Consulting and received on 09 February 2016.

"CEMPr" - Construction Environmental Management Programme.

"OEMPr" - Operational Environmental Management Programme.

"Commencement" – Any physical activity on site that can be viewed as associated with the maintenance and management of the existing rock revetments & sandy beach backshore areas, including construction of new revetments in some areas, along the St Francis Bay beach coastline, incorporating Erven 720, 623, 2257, 185, 53, 184 & 625, inclusive of initial site preparation.

1. Decision

The Department is satisfied, on the basis of information available to it and subject to compliance with the conditions of this Environmental Authorisation that the applicant should be allowed to undertake the activity specified below. Details regarding the basis on which the Department reached this decision are set out in Section 4 of this Authorisation.

2. Activities and regulations for which authorisation has been granted

By virtue of the powers conferred on it by the National Environmental Management Act, Act 107 of 1998 and the Environmental Impact Assessment Regulations, 2014 the Department hereby authorises the Kouga Municipality being the legal or natural person who has applied for this Authorisation, with the following contact details:

Name	**The Municipal Manager - Kouga Municipality**		
Address	**P O Box 21, Jeffrey's Bay, 6330**		
Telephone	**042 200 2200**	**Fax**	**042 200 8606**
Contact Person	**Mr Eddie Oosthuizen**	**E-mail**	**eddieo@kouga.gov.za**

To undertake the following activity (hereafter referred to as "the activity"), in terms of the scheduled activities or activities listed in the table below:

Detailed description of activity
The activity entails construction, as well as repair and maintenance of rock revetments on the coastal zone at Erven 720, 623, 2257, 185, 53, 184, and 625 on the St Francis Bay beachfront within the Kouga Municipal area. The existing rock revetments, totalling a distance of 1.7 km along the St Francis Bay beach have over time been degraded and damaged and are in need of maintenance and in some areas, total upgrading. There are also sandy beach areas totalling 1 km in length which have had no protection, and are now eroding to such an extent that infrastructure and buildings, both public and private, including the St Francis Bay Marina and the golf course are severely threatened by sea encroachment and storm surge damage. This will be Phase 1 of a two phase project, which is inclusive of repair and maintenance of existing rock revetments in the Public Open Space, as well as construction of new revetments along the sandy beach areas with no revetments currently, totalling approximately 1 km in length as described above. These activities will provide a short to medium term defence of the coastline of perhaps only 8 to 10 years, which, with correct maintenance could possibly be

extended. Phase 1 was assessed with two alternatives, rock revetments and GSC sand bags. This **Environmental Authorisation authorises the use of rock revetment structures only, the reasons for which are set out in Section 5.2 of this Environmental Authorisation: Key Factors in making the decision.**

The second phase will be subject to a separate environmental assessment and will focus on beach nourishment and installation of various alternatives to provide further protection and encourage sand accumulation on the beach by means such as groynes, off-shore reefs and/or additional revetments. This second phase will be an ultimate requirement to be undertaken by the Kouga Municipality, in order to ensure the integrity of the Coastal Public Property and Public Open Spaces of the St Francis Bay beachfront. The rock revetments as authorised in this Environmental Authorisation are only a temporary, intermediate solution.

Proposed revetment sections requiring repair and upgrades, as well as the sections for the unprotected sandy beach areas are given in Table 1 below, the zone numbers are indicated in Figure 1-2:

ZONE	ZONE Description	Sandy Beach Revetment	Latitude & Longitude	Latitude & Longitude	ERF	Distance m
1	Salt Area	Sandy Beach	34°8'40.25"S 24°50'22.33"E	34°9'4.57"S 24°50'19.77"E	720	634
2	Revetment - Aldabara	Revetment	34°9'4.57"S 24°50'[illegible]"E	34°9'14.75"S 24°50'15.07"E	720	337
3	POS Carpark Access Aldabara/Hottie Beach	Revetment	34°9'14.75"S 24°50'15.07"E	34°9'16.57"S 24°50'13.98"E	720	57
4	Revetment Residential - Rondenbark	Revetment	34°9'16.52"S 24°50'13.88"E	34°9'24.80"S 24°50'6.00"E	720/623	297
5	POS Revetment Peter Crescent	Revetment	34°9'24.87"S 24°50'4.00"E	34°9'26.40"S [illegible]	623	55
6	Revetment Residential George Road	Revetment	34°9'26.49"S 24°50'6.29"E	34°9'29.25"S 24°50'4.40"E	624	102
7	Golf course	Sandy Beach	34°9'29.25"S 24°50'4.46"E	34°9'32.06"S 24°50'2.30"E	1797	75
8	Revetment Residential Ralph Road	Revetment	34°9'32.06"S 24°50'2.30"E	34°9'35.35"S 24°49'59.01"E	185	214
9	POS Revetment Ralph / Anne Ave / Carpark	Revetment	34°9'39.35"S 24°49'59.01"E	34°9'47.06"S 24°49'55.30"E	185	242
10	Revetment Anne Ave south residential	Revetment	34°9'47.06"S 24°49'55.30"E	34°9'48.20"S 24°49'54.72"E	185/52	77
11	POS CREST	Sandy Beach	34°9'48.20"S 24°49'54.72"E		52	55
12	Hotel site	Sandy Beach			184	86
13	POS Mary Crescent north	Sandy Beach			183	33
14	Residential Mary Crescent south	Sandy Beach			181	19
15	POS Main Beach north	Sandy Beach		34°9'57.47"S 24°49'54.12"E	184	35
16	POS Main Beach Hestie road car park	Revetment	34°9'57.47"S 24°49'54.12"E	34°10'0.43"S 24°49'54.05"E	184	85
17	Revetment Frank Road	Revetment	34°10'0.43"S 24°49'54.05"E	34°10'0.43"S 24°49'54.05"E	184/105	222
18	**Total Distance**		34°8'40.25"S 24°50'22.33"E	34°10'0.43"S 24°49'54.05"E	**Total**	**2738**
19	**Total Revetment**				**Total**	**1715**
20	**Total Sandy Beach**				**Total**	**1023**

21	POS with no protection				POS	167
22	[illegible]				[illegible]	[illegible]
23	Golf course				Golf course	85
24	Revetment Residential seafront				Residential	1269
25	[illegible]				[illegible]	[illegible]
26	No protection residential properties				Residential	127

TABLE 1 – Zones listed in order, with description, content, co-ordinates, Erven and length of zone. At the bottom summary 21 to 22 by characteristic.

The figure on the following page indicates the areas where there is currently no protection and where the above proposed revetment structure, Section C. will be implemented, i.e. in zones 1 and 7 of the figure below, Figure 1-2.

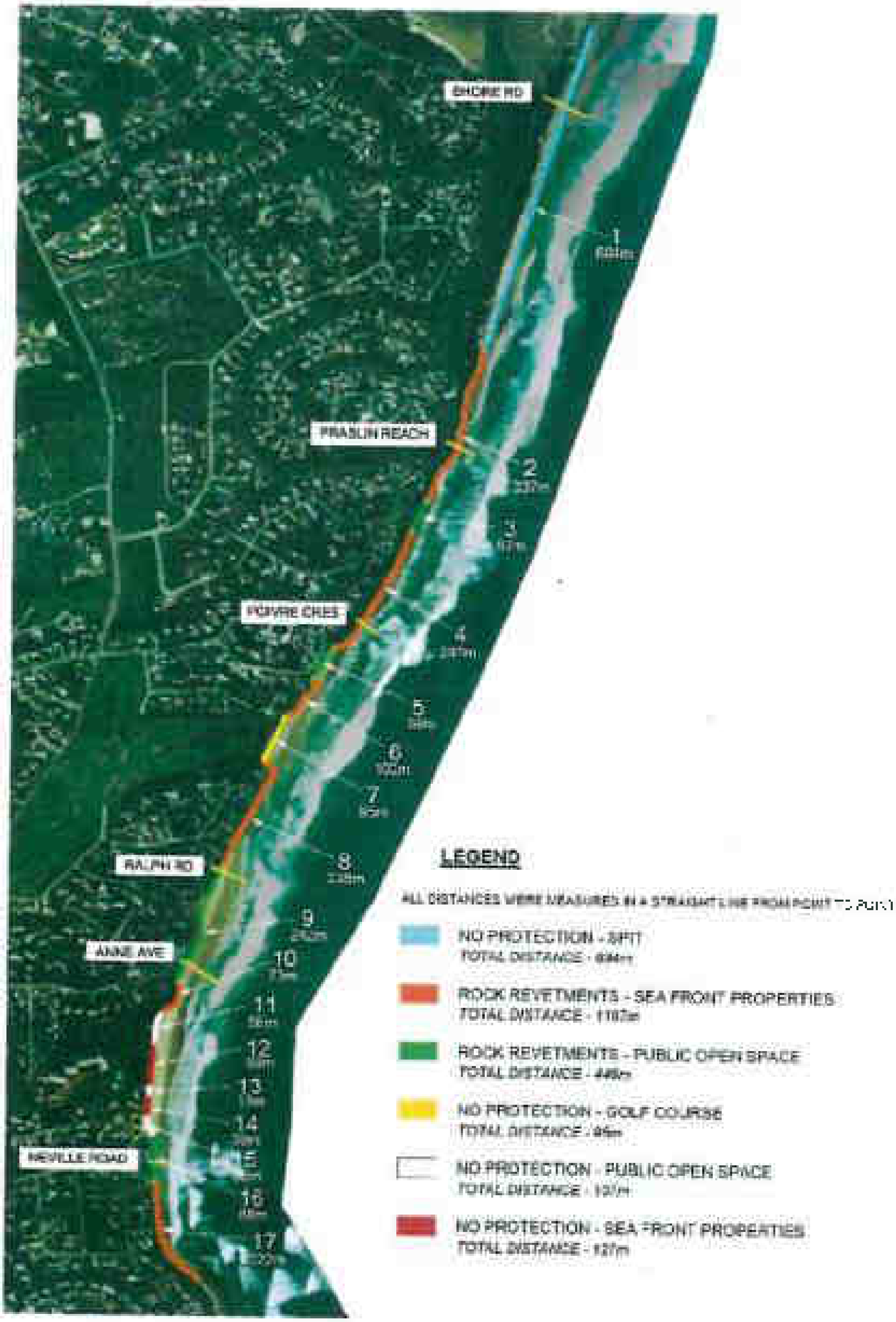

Figure 1-7: Existing Shoreline Protection to St Francis Bay (Frank Silberbauer Consulting).

An engineering company, PRDW Consulting Port and Coastal Engineers, was appointed to design the rock revetments for repairs, upgrades and the new construction of revetments needed. The following three figures indicate the three different structures needed at different areas of the beach.

Fig. 7.1 applies to areas with significant damage like the hole at Anne Avenue and the damage at the parking area in front of Aldabara Run.

Figure 7-1: Revetment Section A

Fig. 7.2 applies to most of the existing rock revetments. Where slopes are flatter than 1:1.5 the armour rock size may be reduced. A proper geotextile filter will be required underneath the existing revetment the loss of fine sand under wave and tidal action.

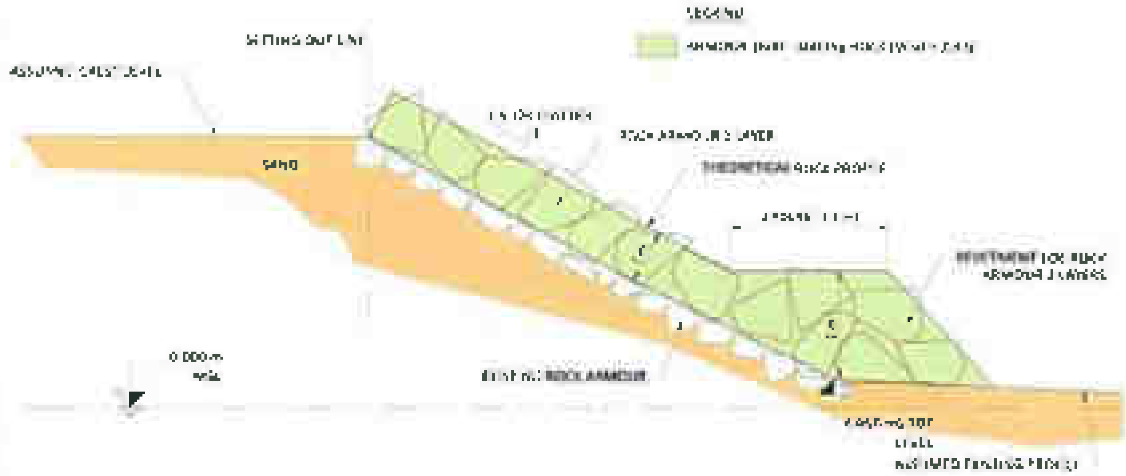

Figure 7-2: Revetment Section B

Fig. 7.3 applies to the protection of the sand spit and golf course dune, which have had no protection structures to date.

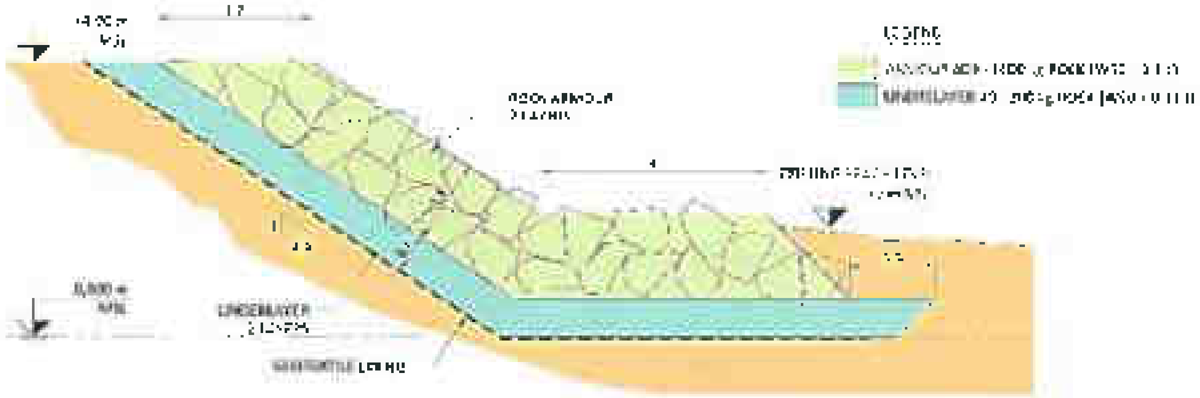

Figure 7-3. Revetment Section C.

As per the engineer's report, this section, Revetment Section C, allows for 2 metres of erosion of sand from the existing beach level, as these areas are currently approximately 2m above MSL (Mean Sea Level), which is predicted to occur down to 0 m above MSL in the next 10 years. In terms of wave overtopping, a crest level above +4 m MSL would keep the mean wave overtopping rate below 10l/s/m which is suitable for the structure provided the crest is covered with vegetation (grass as a minimum).

Section D showed an alternative for GSC (geosynthetic sand containers) bags but has not been included here as this option has not been authorised as part of this Environmental Authorisation.

Where revetments are terminated, it is important to tie ends back into dunes to prevent further erosion by waves wrapping around the ends of the revetment and eroding sand from behind the revetment. Conditions of this Environmental Authorisation will require such to be incorporated into the CEMPr.

Site Access:

Site access is proposed to be gained in the following ways, as per the Figure below and Table 1 on page 3:

1. Access for zones 1 to 4, is proposed to be obtained from the parking lot at Aldabara Run, along the top of the revetments and to extend down to the beach at the area where sandbags were placed (approximately 371 metres in length);
2. An existing access point to the beach at Aldabara Run has been practically destroyed by wave action but a temporary access is proposed to be constructed to allow movement of materials onto the zones described above, whereafter this access point will be replaced by the required revetments at this point;
3. The George Road access to beach is proposed serve zones 1 to 4 at low spring tide, and

adjacent Zones 5 to 7 and parts of 8 at low tide. Upgrading will be necessary to take the required loads

4. From Ralph Road on to the top of the existing rock revetments until Erf 76, a distance of 80 metres, to service zones 8 and 9;
5. Anne Avenue would need repairs to enable access onto the beach to service zones 8 and 9 at low spring tide and zones 10 to 15 if used as a loop route;
6. Mary Crescent directly on to the beach to service zones 11 to 15, as well as 16 at low tide.

All access roads will be temporary and rehabilitated on completion of the works, except for those required for ongoing maintenance, e.g. the Spit (zone 1) and zones 11 to 15.

All of these proposals will be dealt with in terms of **conditions of this Environmental Authorisation which will require a detailed Access Management Plan.**

Possible routing for rocks/materials through St Francis Bay to the designated access points:
1. **Links Circle to Aldabara carpark – 2.43km**
2. **Ditto as above to George Ave. carpark – 1.7km**
3. **Aldabara carpark to sandbags – 371m**
4. **Homestead Ave. to Anne Ave. carpark – 1.67km**
5. **Ditto as above to Mary Crescent. – 1.67km**
6. **Anne Ave to Ralph Rd Revet. – 192m**

5

Listed Activities	
R 983 - 15	The development of structures in the in the coastal public property where the development footprint is bigger than 50 square metres.
R 983 - 17	Development - (iii) within the littoral active zone; (v) if no development setback exists, within a distance of 100 metres inland of the high water mark of the sea or an estuary, whichever is the greater;

	In respect of - (c) embankments; (d) rock revetments or stabilizing structures including stabilizing walls.
R 983 - 18	The planting of vegetation or placing of any material on dunes or exposed sand surfaces of more than 10 square metres, within the littoral active zone, for the purposes of preventing the free movement of sand, erosion or accretion.
R 983 - 19	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from from (iii) the seashore; (iv) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever the distance is greater - but excluding where such infilling, depositing, dredging, excavation, removal or moving - (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or (c) falls within the ambit of Activity 21 in this Notice, in which case that activity applies.
R 983 - 54	The expansion of facilities - (iii) within the littoral active zone, or (v) if no development setback exists, within a distance of 100 metres inland of the high water mark of the sea or an estuary, whichever is the greater; In respect of - (c) embankments; (d) rock revetments or stabilizing structures including stabilizing walls.
R 983 - 55	Expansion (iii) within the littoral active zone; or (v) if no development setback exists, within a distance of 100 metres inland of the high water mark of the sea or an estuary, whichever is the greater; In respect of - (c) inter- and sub-tidal structures for entrapment of sand, (d) breakwater structures.
R 985 - 4	The development of a road wider than 4 metres with a reserve less than 13,5 metres.

	(b) In Eastern Cape: iii. In urban areas (aa) Areas zoned for use as public open space.
R 985 - 12	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance is required for maintenance purposes undertaken in a accordance with a maintenance management plan. (a) In Eastern Cape: iii. Within the littoral active zone or 100 metres inland from the high water mark of the sea or an estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas; iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.

At the locality defined in the Table below, and hereafter referred to as "the property":

District	Sarah Baartman
Municipal Area	Kouga Municipal Area
Farm Name	N/A
Farm Number and Portion	N/A
Erf Number and Township Extension or Suburb	Erven 720, 623, 2257, 185, 53, 184, and 625 on the St Francis Bay beachfront
Co-ordinates	As per Table 1 included above in Section 2 - Description of the Activity (page 3)
Physical address	Erven 720, 623, 2257, 185, 53, 184, and 625 on the St Francis Bay beachfront within the Kouga Municipal area

This Environmental Authorisation is granted subject to the conditions set out below.

3. Conditions

The Department of Economic Development, Environmental Affairs and Tourism may from time to time review this Environmental Authorisation and on good grounds and after written notice to the holder thereof, suspend or amend such Environmental Authorisation.

3.1. Duration of authorisation

3.1.1. Phase 1 of the repair, maintenance and construction of rock revetments as authorised and described in Section 2 of this Environmental Authorisation must commence within a period of 24 (twenty four) months from the date of issue of this Authorisation. If commencement of the activity does not occur within this period, this Environmental Authorisation lapses and a new application for environmental authorisation must be made in order for the activity to be undertaken

3.1.2 Construction of each successive phase to commence immediately upon the completion of the previous phase, and all construction must be completed within 24 (twenty four) months of commencement.

3.1.3. Extension of the Environmental Authorisation may be applied for in writing at least 3 (three) months prior to the expiry thereof as required in Regulation 28(1) of the 2014 EIA Regulations. If no request for extension is received at least three months prior to the expiry of this Environmental Authorisation, it may result in the lapsing of the Environmental Authorisation.

3.1.4. On receipt of any such application for extension, the Department reserves the right to request such information as it may deem necessary to consider the application for extension which may include but not limited to:

3.1.4.1 An updated CEMPr; and

3.1.4.2. Such public participation process as may be deemed necessary at the time of the application for extension.

3.1.5. Conditions relating to the operation of the project are valid in perpetuity.

3.2. Standard conditions

3.2.1. Authorisation is subject to the conditions contained in this Environmental Authorisation which conditions form part of the Environmental Authorisation and are binding on the holder thereof

3.2.2 This Environmental Authorisation applies only to the activities and property described therein.

3.2.3. This Environmental Authorisation does not negate the holder thereof of his/her responsibility to comply with any other statutory requirements that may be applicable to the undertaking of the activity, specifically, amongst others, the National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008), especially as it relates to ORV permits should they be required.

3.2.4. The holder of this Environmental Authorisation shall be responsible for ensuring compliance with the conditions by any person acting on his or her behalf, including but not limited to, an agent, sub-contractor, employee or person rendering a service to the holder of this Environmental Authorisation.

3.2.5. Should any environmental damage be detected, that in the opinion of this Department, is the result of the development, then the applicant shall be required to make good that damage to the satisfaction of the Department at the applicant's own expense.

3.2.6. In the event of any dispute as to what constitutes environmental damage, this Department's opinion will prevail.

3.2.7. Any changes to, or deviations from, the project description set out in this Environmental Authorisation must be approved, in writing, by the Department before such changes or deviations may be effected. In assessing whether to grant such approval or not, the Department may request such information as it deems necessary to evaluate the significance and impacts of such changes or deviations and it may be necessary for the holder of this Environmental Authorisation to apply for further authorisation in terms of the regulations.

3.2.8. This Environmental Authorisation is issued to the applicant described above. Should the applicant wish to transfer this Environmental Authorisation to another person (whether legal or natural), then written notification of such proposed transfer must be sent to this Department a reasonable time before such transfer is proposed to take place. The Department will then consider the request and inform the applicant in writing as to whether the transfer is approved or not. Transfer may only take place if the Department has approved the transfer and issued such written approval. If transfer of the Environmental Authorisation is granted, the new holder of the Environmental Authorisation must accept the responsibility of adherence to the conditions of this Environmental Authorisation. Conditions established in this Environmental Authorisation must be made known to, correctly understood and an acknowledgement in writing must be submitted to the Department within 7 days of such transfer taking place. All conditions are binding on the new authorisation holder.

3.2.9. This Environmental Authorisation must be made available to any interested and affected party who has registered their interest in the proposed development. The applicant is responsible for ensuring that a copy of this Environmental Authorisation is given to any such interested and affected party including the neighbouring landowners within 14 (fourteen) days of receiving this Environmental Authorisation.

3.2.10. This Environmental Authorisation or a certified copy thereof, must be kept on site at all times during construction. Such must be produced to any authorised official of the Department who requests to see it and must be made available for inspection by any employee or agent of the holder of the authorisation who works or undertakes work at the site.

3.2.11. Where any of the applicant's contact details change, including the name of the responsible person, the physical or postal address and/or telephonic details, the applicant must notify the Department as soon as the new details become known to the applicant.

3.2.12. In all cases, the holder of the Environmental Authorisation must notify the Department, in writing, within 30 days if a condition of this authorisation is not adhered to. Any notification in terms of this condition must be accompanied by reasons for the non-compliance.

3.2.13. Non-compliance with a condition of this Environmental Authorisation may result in criminal prosecution or other actions provided for in the National Environmental Management Act, Act 107 of 1998 and the regulations.

3.3. **Project - specific conditions**

3.3.1. Fourteen days written notice must be given to the Department that the activity will commence. Commencement for the purposes of this condition includes site preparation. The notice must include a date on which it is anticipated that the activity will commence.

3.3.2. The Kouga Municipality must take responsibility for appointing the following persons:

3.3.2.1. An Environmental Control Officer (ECO) who must be stationed on-site whilst construction and later rehabilitation is being implemented to oversee the implementation and adherence to all the conditions contained in this Environmental Authorisation, provisions of the CEMPr and all contractors/sub-contractors method statements, as well as the OEMPr. The ECO must draw up a table of all conditions of the Environmental Authorisation and provisions of all other documents as described, especially any pre-commencement conditions that must be adhered to, in order to ensure that all requirements of the Environmental Authorisation are met;

3.3.2.2. A suitably qualified land surveyor to be appointed in conjunction with a suitably qualified engineer. These individuals must ensure that the profiles of all revetments are in accordance with those proposed after detailed inspection and design drawings are completed, as per the requirements in the Engineering Specialist Report by PRDW Consulting Port and Coastal Engineers dated 13 July 2015;

3.3.2.3. It is imperative that only a suitably qualified and competent contractor with a proven track record in coastal protection construction is appointed and suitable construction supervision is maintained by the engineer, and overseen by the ECO. The Department requires that such contractors are not appointed or employed by private individuals or any other outside parties. The Kouga Municipality will be held liable in the event of non-compliance with any condition of this Environmental Authorisation or any stipulation of the CEMPr by any contractor or sub-contractor associated with construction, repair and maintenance activities associated with the implementation of this project. All appointed contractors and/or sub-contractors are to submit a detailed timetable of construction activities and the proposed inspection timetables by both the ECO and the appointed engineer;

3.3.2.4. A suitably qualified Rehabilitation Specialist; and

3.3.2.5. Once the above appointments are finalised, full contact details, qualifications and references of all these persons/companies are to be submitted to the Department for endorsement prior to the commencement of any construction/repair/maintenance works on site.

3.3.3. Any non-compliance in terms of Condition 3.3.2 must be reported to DEDEAT immediately. Provision for penalties and fines is to be made by the ECO for any non-compliance or transgressions, and all contractors and subcontractors are to be held liable, in conjunction with the Kouga Municipality, and will be required to rectify any damages to the environment on site.

3.3.4 The Construction Environmental Management Programme (CEMPr) contained in the consultant's AFBAR as Appendix H1 must be amended to include the following:

3.3.4.1. Any references to the alternatives of GSC bags must be removed, as only rock revetments are authorised in this Environmental Authorisation;

3.3.4.2. Specific management of the construction of each phase of the project, divided into its relevant components, particularly the following:

3.3.4.2.1. An <u>Access Management Plan</u> to be drafted in conjunction with the appointed engineers and the contractor appointed in terms of

Conditions 3.3.2.3 and 3.3.2.4. Such plan must indicate, but is not limited to, the following:

3.3.4.2.1.1. Phase-specific access arrangements for each Phase and erosion protection measures for each Phase;

3.3.4.2.1.2. Order in which work on each phase is to be undertaken, whether it is for repair, maintenance or new construction in the order of importance, i.e. starting point at the area deemed most susceptible to further extreme damage, the following phase to be constructed etc. Phases must be done one at a time;

3.3.4.2.1.3. Specific description of how the trucks required, bearing in mind the weight of rock to be carried and the weight and size of such vehicles, will be accommodated both on top of the spit and the beach areas; and

3.3.4.2.1.4. Specific details regarding construction of the temporary access points, as well as construction of roads (especially on the Spit area) and those needed for any access required for future maintenance including a full description of measures to be taken for such vehicles to access points via the beach for construction, repair or maintenance.

3.3.4.3. Engineering input on the design of the areas where revetments are terminated and the ends are tied back into the dunes, including a detailed description of the efficacy of such design preventing scouring of sand from behind the revetment.

3.3.4.4. All mitigation measures contained in both the consultant's AFBAR and the Engineering Specialist Report by PRDW Consulting Port and Coastal Engineers dated 13 July 2015, especially considering Section 7 of the engineering report, as well as Section 8, the Conclusions and Recommendations of this report, which applies to Condition 3.3.4.3 above.

3.3.4.5. Contractors (and sub-contractor's) method statements are to be submitted to the Department prior to the commencement of any works on site, as well as the ECO's comments on the construction method statements, as well as the ECO's own method statements for controlling impacts and implementing mitigation measures as presented in the consultant's AFBAR and the CEMPr. Such method statements are to be specific to each phase and also specifically address access as per the Access Management Plan included in Condition 3.3.4.2.1 above.

3.3.4.6. Comment from the National Department of Environmental Affairs, Oceans and Coasts Directorate, included in the AFBAR in Appendix F, titled "PPP Correspondence Post September 2015", to be incorporated into the CEMPr which comments indicated the following and must be adhered to:

3.3.4.6.1. Safety signage must be erected on site;

3.3.4.6.2. Temporary storage areas must be properly demarcated to ensure public safety and to ensure that access to the coastal public property is not hindered; and

3.3.4.6.3. The use of vehicles on the beach during construction by the applicant's appointed contractor, and the applicant being an organ of state, constitutes a permissible use and no permit or exemption will be required, but only if such vehicle use meets the criteria of Regulation 3(1) (a) (vi) or 3(1) (d) in terms of the Control of Use of Vehicles in the Coastal Area Regulations. Confirmation from DEA - O & C of the adherence of the vehicles proposed to these criteria must be forwarded to the Department prior to commencement of construction, or, alternatively, should they not adhere to these criteria, an ORV permit must be obtained for the use of these vehicles on the beach.

3.3.4.7. Appropriate measures must be put in place to ensure that the structure does not constitute a hazard to users of the coastal zone in the vicinity of the structure;

3.3.4.8. The upper slope of the fore-dune must not be destabilised, and existing natural vegetation must be retained and the growth of additional natural vegetation encouraged. This must be done in conjunction with the rehabilitation plan for all disturbed areas, as included in the Condition 3.3.18;

3.3.4.9. Applicable conditions contained in this Environmental Authorisation;

3.3.4.10. General principles of environmental management as applicable to construction activities including environmental best practice, erosion prevention and control, minimization of dust, etc. as indicated in Condition 3.3.11 below;

3.3.4.11. Clear stipulations as to who is responsible and accountable for what actions; and

3.3.4.12 A general code of conduct for any contractor that might be carrying out any work on the development sites, including a fine system for any non-compliances committed by such contractor's and/or sub-contractors, as stipulated in Condition 3.3.3.

3.3.5. Disturbance of the beach environment during project implementation must be minimised, and any disturbed areas appropriately rehabilitated. This includes disturbance due to the use of heavy plant machinery or vehicles accessing the Spit or the beach, as well as that caused by the transgressions of illegal commencement by Mr Leithbridge and Mr Nell, as referenced in the Minutes of the Meeting between DEDEAT, the St Francis Bay Riparian Homeowners Association and the EAP, Mr Frank Silberbauer on 27 May 2015, and as noted in the Compliance Notices with Reference Numbers CROB#5/02/2015 and CROB#6/02/2015 respectively.

3.3.6. Further to Condition 3.3.5, vehicular usage during project implementation must be curtailed to what is absolutely necessary, and the applicant is to be mindful of the general duty of care provision as articulated in Section 2 of the National Regulations for Control of Vehicles in the Coastal Zone (Government Notice No. 1399 of 21 December 2001). Cognizance must also be taken of tides and time needed for travel on the beach.

3.3.7. Vehicles must travel at a slow speed at all times and drive below the spring high water mark to encourage removal of all vehicular tracks along the beach between tidal cycles.

3.3.8. All reasonable measures are to be taken to ensure the safety of the general public on the beach during construction, inclusive of the restriction of access to the construction area.

3.3.9. Packing of rock material must take place in a manner which prevents, as far as possible, portions thereof becoming detached from the structure and entering the beach, estuary and / or surf zones. Such must be in accordance with the engineering specifications.

3.3.10. Furthermore, the packing of rock material and the design of the structure must be done in a manner which prevents the formation of coves and scouring into the estuary or any sandy beach areas by ensuring that where revetments are terminated, the ends are tied back into the dunes in such a way as to prevent waves wrapping around the ends of the revetments and eroding sand from behind the revetment. This must be in accordance with the required engineering input for the application of the design sections, transitions and allowing for stormwater run-off.

3.3.11. General principles of environmental management as included in Condition 3.3.4.10 must be adhered to, including, amongst others, the following:

3.3.11.1. No cement/concrete mixing to take place on the soil surface should it be required. Cement mixers to be placed on large trays to prevent accidental spills from coming into contact with the soil/sand surface;

3.3.11.2. Concomitant to Condition 3.3.11.1, any cement mixing must take place above the high-water mark, preferably on an already tarred surface such as one of the car parks, and any wash water or spills onto the beach, into the estuary or the sea must be prevented at all costs and suitable emergency contingency plans must be put in place;

3.3.11.3. Silt curtains are to be utilised in all phases of construction to prevent any destabilized sediment from entering the estuarine channel of the Marina, the Kromme Estuary or the sea;

3.3.11.4. Generators and fuel supply, if needed during construction, must be placed on trays, which rest on clean sand. Once construction has been completed, this sand must be removed from site and disposed of at a registered waste disposal site;

3.3.11.5. Any substrate contaminated by the spillage of hydrocarbons or other pollutants to be removed from the site and disposed of at a registered waste disposal site;

3.3.11.6. No servicing of vehicles and other machinery to take place on site and no fuel or other hazardous material to be stored on site;

3.3.11.7. All excess construction material and any waste generated during construction must be removed from site on an on-going basis and disposed of at a suitably registered waste disposal site;

3.3.11.8. The contractor must provide adequate waste disposal and sanitation facilities and must ensure that these facilities are properly used and maintained; and

3.3.11.9. Sufficient erosion control measures must be stipulated and adhered to.

3.3.12. The Kouga Municipality will be held liable in the event of non-compliance with any condition of this Authorisation Notice or any stipulation of the CEMPr by any contractor associated with this activity.

3.3.13. Non-compliance with any stipulation in the CEMPr or conditions of this Environmental Authorisation will be regarded as non-compliance in terms of this Environmental Authorisation.

3.3.14. All construction activities to be restricted to normal working hours being 08:00 to 17:00 on weekdays. No construction to take place on weekends and public holidays.

3.3.15. Rock material which needs to be imported to the site for construction of the wall is to be obtained from a bona fide source, and must be compatible in appearance with rock used for existing protection structures in the vicinity.

3.3.16. The South African Heritage Resources Agency (SAHRA) must be contacted immediately should any archaeological findings be discovered during the course of the development.

3.3.17. All alien invasive species (AIS) that may occur on site, are to be removed in a progressive manner, and any such species colonising disturbed ground are to be removed before reaching the seed formation stage.

3.3.18. A Rehabilitation Plan to be drafted and submitted to the Department for approval prior to the commencement of construction, by a suitably qualified Rehabilitation Specialist for all disturbed areas, inclusive of the areas where transgressions occurred, as referenced in Condition 3.3.5, as well as erosion control measures, with the exception of those areas required for continued access for management and maintenance of the revetment structures. All areas disturbed as a result of construction to be rehabilitated to a condition equivalent or better than that prior to construction, and dunes are to be rehabilitated with indigenous vegetation specific to the area.

3.3.19. The following auditing to be undertaken by the appointed ECO:

3.3.19.1. A pre-construction audit of the current state of all areas included in this Environmental Authorisation;

3.3.19.2. A monthly audit to be done by the ECO;

3.3.19.3. A quarterly inspection being undertaken by DEDEAT together with the ECO;

3.3.19.4. A post-construction audit, which also specifically addresses the rehabilitation undertaken to be conducted by the ECO once construction is completed;

3.3.19.5. All audit reports submitted to DEDEAT by the ECO are to include photographic records for each of the construction sites for each Phase.

4. Project-specific conditions relation to the operational management and maintenance of the rock revetments

4.1. The OEMPr as contained in the consultant's AFBAR in Appendix H1, Section D, must be amended and submitted for approval by the Department within 3 (three) months from the date of signature of this Environmental Authorisation. The OEMPr must be implemented for the duration of the lifespan of the project. The OEMPr must be regarded as a working document to allow for information gained during the monitoring of activities on site to inform any changes necessary to the OEMPr. Should any changes be required, such must be submitted to the Department for approval prior to the implementation of such changes.

4.2. The OEMPr must include, amongst others:

4.2.1. A Rehabilitation Aftercare Plan drafted by a suitably qualified Rehabilitation Specialist for all disturbed areas, inclusive of the areas where transgressions occurred, as referenced in Condition 3.3.5, as well as erosion control measures, with the exception of those areas required for continued access for management and maintenance of the revetment structures. The Rehabilitation Aftercare Plan must be implemented and monitored monthly by the appointed independent ECO for a period of 1 year from the date of completion of the Rehabilitation Plan undertaken in terms of Condition 3.3.18 of this Environmental Authorisation.

4.2.2. Specific provision, including financial provision, for continuous monitoring, management and maintenance of the revetments and repairs to any damages due to storm surges or extreme weather and tidal events, inclusive of method statements for such;

4.2.3. Specific plans for the provision by the Kouga Municipality in terms of Section 20 (a) to (j) of the ICM Act, Act No 24 of 2008, as amended, including financial provision, for the proposed Phase 2 of the proposal which will focus on beach nourishment and installation of various alternatives to provide further protection and encourage sand accumulation on the beach by means such as groynes, off-shore reefs and/or additional revetments. Such plans, as indicated by the EAP must be in place and the required Environmental Assessment under way within 3 (three) years from the date of this Environmental Authorisation;

4.2.4. Specific provision, including financial provision, for continuous monitoring and maintenance of the areas that were disturbed specifically for the success of rehabilitation measures, as well as signs of erosion, including measures to rehabilitate any such erosion that may be found;

4.2.5. A Maintenance Plan for any infilling or removal of material that may be required for the maintenance of the revetments, and any future rehabilitation of areas disturbed during the construction activity. Such Maintenance Plan to make provision for individual maintenance events for which a specific method statement for that specific maintenance event is submitted to DEDEAT immediately subsequent to the event for approval prior to the commencement of such maintenance works. Such maintenance works are to be overseen by an independent ECO, as included in Condition 3.3.2.1;

4.2.6. Should the structures sustain damage as a result of storm action or any other event, it must be restored to its original state within 90 (ninety) days, in accordance with all approved method statements in terms of the approved CEMPr and Condition 4.25 above;

4.2.7. Monitoring of alien vegetation re-growth in all disturbed areas on site and provision for consistent eradication measures;

4.2.8. Provision of educational boards regarding dune sensitivity, the rehabilitation of the dune and spit areas as well as waste management and littering, as well as education regarding the requirements of the NEMA and the ICM Act for any activities in the coastal zone.

4.3. The Kouga Municipality must take responsibility for appointing any of the contractors or sub-contractors for any maintenance required. The Department requires that such contractors are not appointed or employed by private individuals or any other outside parties. The Kouga Municipality will be held liable in the event of non-compliance with any condition of this Environmental Authorisation or any stipulation of the OEMPr by any contractor or sub-contractor associated with maintenance activities associated with the implementation of any maintenance works required.

4.4. A fine system for any transgressions of the OEMPr and this Environmental Authorisation to be implemented by the Kouga Municipality and their appointed ECO for any maintenance works.

4.5. Notwithstanding the provisions of any of these conditions, all recommendations, guidelines and standard conditions contained in the consultant's AFBAR must be adhered to.

4.6. The revetments must be maintained in a manner which ensures continued functionality, integrity and satisfactory appearance.

4.7. This Department reserves the right to require that parts of/the entire revetment structures, be decommissioned and removed.

4.8. This office must be timeously notified should the applicant intend to remove any part of the structure.

4.9. Monitoring of the revetments to be undertaken monthly to ensure that no scouring is occurring beyond any of the revetments, as well as monitoring of rehabilitation efforts and alien invasive floral species control. If any erosion is detected, measures, as included in the maintenance and management plans must be enacted within two weeks of the observation of such erosion such that further erosion is curtailed as soon as possible.

4.10. Should decommissioning takes place, a detailed report dealing with environmental impact management during decommissioning must be drawn up and submitted to the Department for approval.

5. Reasons for Decision

5.1. **Information considered in making the decision**

In reaching its decision, the Department took, *inter alia*, the following into consideration:

5.1.1. The information contained in the following documentation:

5.1.1.1. Completed application form dated 02 July 2015 and received on 01 September 2015;

5.1.1.2. Minutes of the meeting held on 27 May 2015 regarding the transgressions of the illegal commencement by Mr Leithbridge and Mr Nell, between DEDEAT, the St Francis Bay Riparian Homeowners Association and the EAP, Mr Frank Silberbauer Indicating the Key Resolutions of this meeting;

5.1.1.3. The Compliance Notice with Reference Number CROB#6/02/2015 dated 31 March 2015, as referred to in the letter from the St Francis Bay Riparian Homeowners Association signed by John Robson (undated), which indicates the progress made in terms of the requirements of the Compliance Notice;

5.1.1.4. The letter from the Kouga Municipality dated 01 July 2015 regarding the Compliance Notices issued, with Reference Numbers CROB#05/02/2015 (Beach Area) and CROB#6/02/2015 (Spit), confirming all interactions, discussions and actions undertaken by the Kouga Municipality;

5.1.1.5. The Extension to submit the AFBAR dated 20 November 2015; and

5.1.1.6. The completed AFBAR compiled by Frank Silberbauer dated 01 February 2016 and received on 09 February 2016.

5.1.2. Observations made during a site visit conducted on 27 October 2015 by Ms Nicole Gerber, Mr Dayalan Govender and Mr Andries Struwig from this Department together with Mr F. Silberbauer of Frank Silberbauer Consulting. Officials from DEA O & C were also present as well as the KM, St Francis Bay Resident's Association and the Riparian Homeowners Association.

5.1.3. The EIA Regulations of 2014 and the objectives and requirements of relevant legislation, policies and guidelines, including Section 2 of the National Environmental Management Act, Act 107 of 1998.

5.2. **Key factors considered in making the decision**

5.2.1. A previous Environmental Authorisation was issued on 26 August 2011 which lapsed due to lack of funding. The scope of this Environmental Authorisation is however of a greater scale due to the continued erosion of the beach at St Francis Bay and damage caused to existing revetments due to storm surge events. It also includes previously unprotected areas of sandy beach for new rock revetment construction.

5.2.2. St Francis Bay beach continues to experience a state of on-going erosion. Such erosion constitutes a threat to coastal public property, municipal infrastructure such as the ablution facilities and paved parking areas in the Public Open Space areas, as well as near-shore properties and the St Francis Marina. All authorised revetment structures will occur within Public Open Space areas and the Kouga Municipality is ultimately therefore the applicant and the responsible party to ensure the implementation of all conditions of this Environmental Authorisation, the CEMPr and OEMPr in order to arrest this erosion and protect infrastructure in Public Open Space as well as Coastal Public Property.

5.2.3. DEA's Oceans and Coasts Directorate have commented on the proposed protection structures and have also recommended the use of rock revetments rather than the GSC bags. Their comments have also been included in the conditions of this Environmental Authorisation.

5.2.4. The rehabilitation measures provided for in this Environmental Authorisation, also address the transgressions undertaken by Mr Leithbridge and Mr Nel, and such rehabilitation will be undertaken as part of this Environmental Authorisation.

5.2.5. The Department has granted authorisation for the rock revetments based on the information provided by the EAP as well as the specialist engineering report by PRDW dated July 2015, which indicates that GSC's are less robust, have a reduced lifespan and less certain design guidelines, require more stringent construction quality control and have the potential for vandalism. The source of sand required for the filling of these bags was also not certain, and the relative cost was higher than rock revetments. This coastline experiences especially rough seas and storm surges due to prevailing winds and a previous attempt at installing sand bags was seen to be hopelessly inadequate as they had practically collapsed. The Department has granted this Environmental Authorisation with the understanding that these revetment structures are of a short term nature and are only an intermediate solution. This is Phase 1 of the protection of the coastline along the St Francis Bay beachfront, and provisions have been made in Condition 4.2.3 of this Environmental Authorisation for plans for Phase 2 to be in process within a reasonable time period, to allow for funding provision and legislative requirements in terms of a further Environmental Authorisation. The Department will not entertain another application that does not address a long term solution, only one which will provide for beach nourishment and the prevention of the further loss of coastal public property and public open space. The Department deems it imperative that the Kouga Municipality begin with such plans as soon as possible such that Condition 4.2.3 can be fulfilled in the time frame given.

5.2.6. Conditions contained within this Environmental Authorisation will ensure that implementation of this activity will not result in significant negative impacts on the biophysical environment as the proposed activity is aimed at protecting the area from erosion and floods which might take place.

5.2.7. Provision is made in this Authorisation for the lifelong monitoring of the revetments and remediation of any negative environmental impacts, such as scouring behind the revetments.

5.2.8. Any vegetation disturbed will be rehabilitated and in so doing will ensure the stability of the dunes.

5.2.9. Adequate measures will be in place to ensure the safety of the public during construction.

5.2.10. The project has been advertised and no objections were lodged against the proposed activity. All comments were noted and the EAP addressed them to the satisfaction of the Department and have been included in the conditions of this Environmental Authorisation.

5.2.11. In general the environmental process followed is deemed to be satisfactory. It is the opinion of the Department that the information at hand is sufficient and adequate to make an informed decision. In this regard the Department is satisfied that, subject to compliance with the conditions contained in the Environmental Authorisation, the proposed activity will not conflict with the general objectives of Integrated Environmental Management laid down in Chapter 5 of the National Environmental Management Act, Act 107 of 1998, and that any potentially detrimental environmental impacts resulting from the proposed activities can be mitigated to acceptable levels.

6. Appeal of authorisation

In terms of Regulation 4(2) of GN R. 982 of the Environmental Impact Assessment Regulations, 2014, you are instructed to notify all registered interested and affected parties, in writing and within fourteen (14) days of the date of the Department's decision in respect of your application.

6.1. The written notification referred to above must -

6.1.1. Specify the date on which the Refusal Notice was issued,

6.1.2. Inform interested and affected parties of the appeal procedure provided for in terms of the National Appeal Regulations, 2014, as contained in GN R. 993 of 04 December 2014; and

6.1.3. Advise interested and affected parties that a copy of the Refusal Notice and reasons for the decision will be furnished on request.

6.2. Should you decide to appeal, you must submit your appeal to the appeal administrator, as indicated in the table contained in point 6.3 below, and serve a copy of the appeal to the applicant, any registered interested and affected party and any organ of state with interest in the matter within twenty (20) days as described in Regulation 4 of the National Appeal Regulations, 2014.

Only appeals on environmental grounds can be considered. All appeals should be accompanied by relevant supporting documentation.

6.3. The address to which the originals of any such an appeal and any other documents pertaining to the appeal must be mailed is outlined below. Please note that originals may also be delivered per hand or courier.

Department	Economic Development, Environmental Affairs & Tourism
Attention	General Manager: Environmental Affairs
Postal Address	Private Bag X0054, BHISHO, 5605
Hand deliveries at:	Beacon Hill Hockley Close King William's Town 5601
In order to facilitate efficient administration of appeals copies of the appeal and any subsequent appeal documentation must also be submitted as follows:	
General Manager: Environmental Affairs per fax:	(043) 605 7300
Manager: Mr S. Gqalangile - Environmental Impact Management per fax:	(043) 605 7300
It is strongly recommended that electronic copies of all appeal documentation also be e-mailed	E mail addresses will be supplied on request

In the event that an appeal is lodged with regard to this Environmental Authorisation, no listed activities as described in this Environmental Authorisation may commence prior to the resolution of the appeal and prior to the Department's written confirmation of compliance with all conditions that must be met before construction can commence, whichever event is the latter.

NICOLE GERBER
ENVIRONMENTAL OFFICER: EIM
CACADU REGION

DATE: 01/06/2016

DAYALAN GOVENDER
DEPUTY DIRECTOR: ENVIRONMENTAL AFFAIRS
CACADU REGION

DATE: 01/06/2016

PROPOSED COASTAL PROTECTION SCHEME,
ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

BEACH NOURISHMENT SOURCE MATERIAL STUDY

DEDEAT REFERENCE NUMBER: EC08/C/LN2/M/01-2021

DRAFT

Prepared for	On behalf of
St Francis Property Owners NPC PO Box 18 St Francis Bay 6312	Kouga Local Municipality PO Box 21 Jeffreys Bay 6330

Prepared by

CES
ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

13 Stanley Street, Richmond Hill, Port Elizabeth, 6001

Also in Grahamstown, East London, Johannesburg, Cape Town and Maputo

www.cesnet.co.za

FEBRUARY 2021

REVISIONS TRACKING TABLE

This report should be cited as follows: Coastal & Environmental Services, February 2021: *Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province, Beach Nourishment Source Material Study*. CES, Port Elizabeth.

CES Report Revision and Tracking Schedule		
Document Title	Beach Nourishment Source Material Study: Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province	
Client Name & Address	St Francis Property Owners NPC PO Box 18 St Francis Bay 6312 *On behalf of* Kouga Local Municipality PO Box 21 Jeffreys Bay 6330	
Document Reference	DEDEAT Ref: EC08/C/LN2/M/01-2021	
Status	Draft	
Issue Date	February 2021	
Authors	Mr Roberto Almanza Dr David Brew	Coastal & Environmental Services Royal HaskoningDHV
Reviewers	Mr Gregory Shaw Dr Ted Avis	Coastal & Environmental Services

Port Elizabeth
13 Stanley Street
Richmond Hill,
Port Elizabeth
6001
Info@cesnet.co.za
www.cesnet.co.za
Also in Grahamstown, Cape Town, East London Johannesburg and Maputo

DOCUMENT CHECKLIST

Requirements for this Specialist Report in terms of Appendix 6 of GN R. 982 (as amended in GN R. 326) and where the relevant information can be found within this Report.

Item in GN R.982 (Appendix 6)	Requirement	*Relevant Chapter/ Section*
(a)	Details of— (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Please refer to Section 1.3 and Appendix A.
(b)	A declaration that the specialist is independent in a form as may be specified by the competent authority;	Please refer to Appendix A.
(c)	An indication of the scope of, and the purpose for which, the report was prepared;	Please refer to Section 2.1 and 2.2.
(cA)	An indication of the quality and age of base data used for the specialist report;	Please refer to Section 3.1.
(cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Please refer to Chapter 6.
(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Please refer to Section 4.1.2 and Table 4.1.
(e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Please refer to Chapter 4.1.
(f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Please refer to Section 5.1.
(g)	An identification of any areas to be avoided, including buffers;	Please refer to Section 5.1.
(h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Beyond the scope of this study. Please refer to Section 5.1 for the detailed explanation.
(i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	Please refer to Section 2.3.
(j)	A description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Please refer to Section 7.1.
(k)	Any mitigation measures for inclusion in the EMPr;	Please refer to Section 7.2.
(l)	Any conditions for inclusion in the environmental authorisation;	Please refer to Section 7.3.
(m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Please refer to Section 5.2 as well as Section 7.3.
(n)	A reasoned opinion—	

	(i) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Please refer to Section 7.4. Please refer to Section 7.4 Please refer to Section 7.2 and 7.3.
(o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	Please refer to the Scoping Report and EIR phase.
(p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Please refer to the Scoping Report and EIR phase. All comments regarding the Beach Nourishment Source Study have been addressed in these reports.
(q)	Any other information requested by the competent authority.	No additional information has been requested by the competent authority to date.

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1 INTRODUCTION

1.1 Project Background

The loss of natural sand nourishment of the St Francis Bay beach is believed to be as a result of the stabilisation of the Santareme dune field located between Cape St Francis and the St Francis Bay beach, which began between 1950 and 1960. In addition, the lower reaches of the Kromme Estuary have become sediment loaded as a result of the upstream river impoundments (i.e. the Impofu and Churchill dams) which have effectively removed the ability of large flood events to flush sediment accumulated in the lower reaches of this previously flood-tide dominated estuary system (Advisian, 2018).

The St Francis Property Owners Non-Profit Company (SFPO NPC), on behalf of the Kouga Local Municipality (Kouga LM), has proposed the implementation of a coastal protection scheme proposed for St Francis Bay beach, located within the Eastern Cape Province. The proposed project area is situated approximately 100 km west of Port Elizabeth, and is located within the Kouga LM, seated within the Sarah Baartman District Municipality (SBDM). The coastal protection scheme will include sourcing of sand material from the Kromme Estuary for the purpose of beach nourishment of St Francis Bay beach. The scheme will also entail the development of coastal structures to prevent further erosion of St Francis Bay beach.

CES were appointed by the SFPO NPC to apply for an Environmental Authorisation (EA) by means of conducting a Scoping and Environmental Impact Reporting (S&EIR) process. This was initiated in 2018. In 2019, CES together with the SFPO produced a Draft and Final Scoping Report and Sand Sourcing Specialist Report which was subject to the mandatory 30-day public participation process (PPP) between 20th of August 2019 until the 18th of September 2019. Following on from the approval of the Scoping Report by the Department on the 25th October 2019, CES progressed with the development of the Draft EIR and Draft Estuarine and Dune Assessment Specialist Report which was subject to PPP between 19th December 2019 – 5th February 2020.

It was decided that the Final EIR would not be submitted and the application (EC08/C/LN2/M/42-2019) was allowed to lapse in order to re-visit the design based on comments from I&APs and the Department. The update to the design required additional studies, which have now been completed and this specialist report has been updated to consider the additional information and design available.

A phased implementation will be required due to financial constraints. This phased approach will ensure that construction of infrastructure in any phase will only commence when sufficient funding for that particular phase has been secured, thus negating the risk of partially constructed infrastructure.

The advantage associated with a phased approach is that the performance of the first groyne(s) can be assessed, and that any desired adjustments can be made to groynes constructed in the subsequent phases (Figure 1.1). It is estimated that the total construction period without phasing will be approximately twenty-three (23) months (from start to finish).

The phased implementation which will be implemented is based on five (5) areas along St Francis Bay beach (Figure 4.3). Area 1 will consist of a 650 m length of beach which will undergo beach nourishment as well as the construction of one 200 m long groyne at each end. Area 2 will consist of a 472 m long beach with one (1) 170 m groyne, while Area 3 will consist of a 337 m length of beach and two groynes which are 170 m in length. No groynes will be constructed in Area 4 with one groyne of 170 m in length in Area 5 and the proposed length of the beach in these areas is 282 m and 391 m respectively.

The preliminary design has been updated from that presented in the Scoping Report based on feedback from stakeholders and I&APs. The initial design was based on oblique groyne orientation. While this offered slightly better protection and sand retention on the beach, perpendicular groynes were modelled and presented as the preferred approach.

In addition to the modelling of the revised groyne positions and orientation, Advisian completed bathymetry (and topographic) surveys of the Kromme Estuary and modelled pre- and post-dredging scenarios. The results of the modelling has been considered in the assessment of impacts in this specialist report.

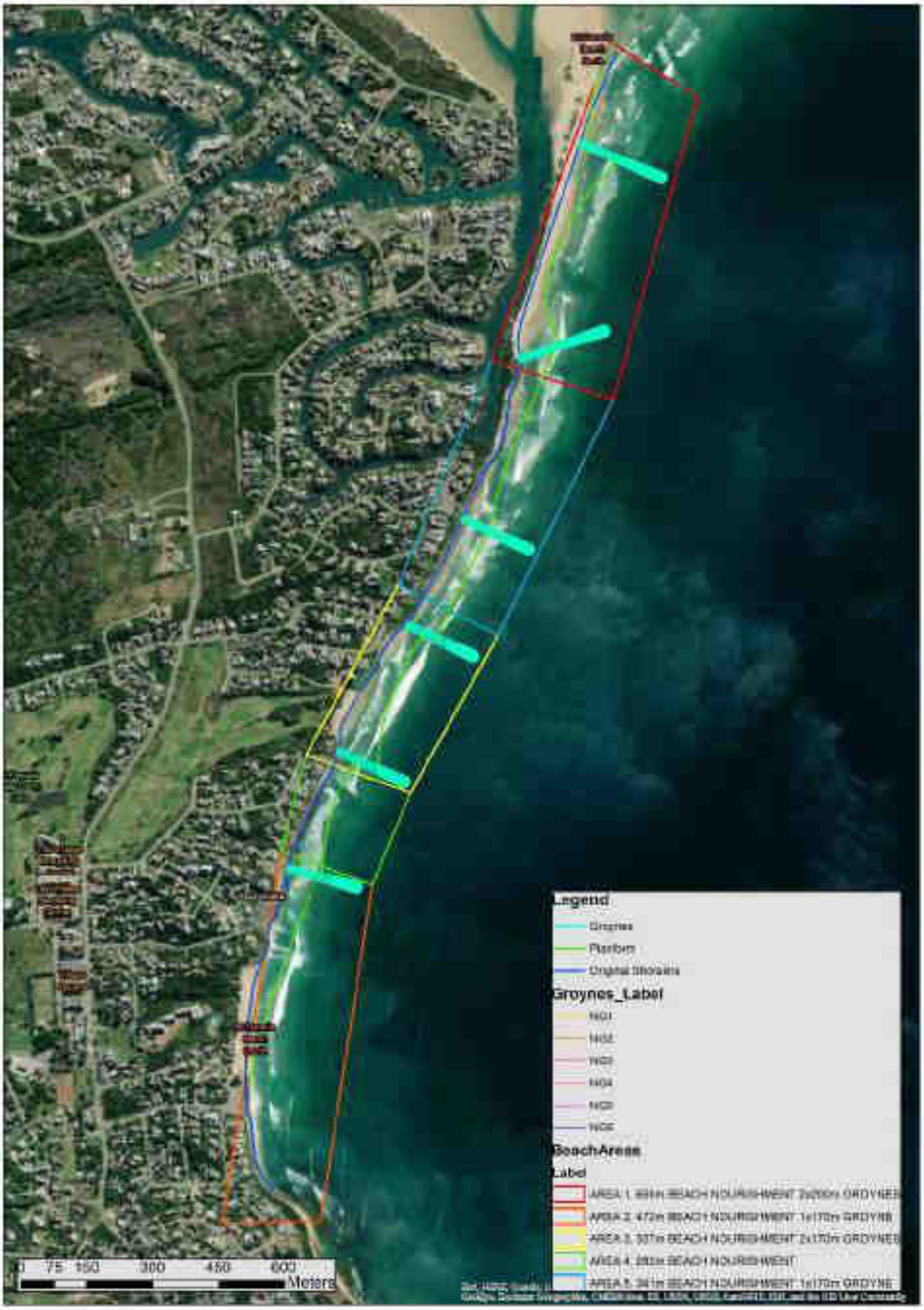

Figure 1.1: Proposed phasing of the coastal protection scheme.

1.2 Beach Nourishment Material Alternatives

In order for beach nourishment to be implemented, sand must first be obtained from a suitable source area. The identification of a suitable source area is based largely on finding an area where sand will consist of similar grain size to that which is required on the beach, as well as being technically and financially feasible to extract and place along the beach. The Kromme River estuary has been identified as the most accessible potential sand source which also is likely to contain the volume of sand required for the proposed beach nourishment.

In 2002, Entech undertook a study of the potential sand sources for beach nourishment, concluding that the two most viable sources were the Sand River dunes and the Kromme Estuary. The extraction of sand from the lower intertidal sand flats of the Kromme Estuary was considered sustainable due to the flood dominated character of the estuary, caused by the damming of the upper reaches and resulting in consequent sand build-up in the lower reaches. At that stage, a total of 500 000 m^3 was the estimated requirement for beach nourishment.

The Sand River dunes have since been declared as a protected area and are therefore no longer considered a viable source of sand material. According to ASR (2006), the Kromme River has previously been used as a source of 'sporadic and un-sustained sand and approximately 600 000 m^3 of sand is available for beach nourishment'. Three (3) potential source areas were initially identified and all are located within the Kromme River estuarine functional zone. According to the engineers appointed for the development of the proposed coastal protection scheme, the maximum volume of sand which will need to be sourced for capital nourishment is approximately 854 000 m^3 and will be transported either via dredger, truck or a pipeline and pumping system.

Beach nourishment can be conducted mechanically and/or hydraulically. Mechanical methods usually involve the mining of sand from one area, its transportation and deposition in the receiving area, which is then shifted into the required position. Hydraulic methods involve dredging and pumping of the sand in a water-based slurry. The preferred option for transportation of sand material will be via a sand pumping system to several outlets along the beach. While the trucking of sand is generally a more cost-effective approach, the access restraints of the project area makes the pumping system a more viable option. The combined capacity of the existing dredgers, which are currently used to dredge the St Francis Bay canal system, are approximately 50 000 m^3per annum. During the capital nourishment phase, substantially more sand will be required, and hence the existing dredgers cannot be used. However, they will definitely be utilised for long-term maintenance of beach nourishment. Sand dunes along the St Francis Bay beach will then be stabilized and restored with suitable vegetation in an attempt to maintain the sand on the beach.

Other alternative sand sources include the use of sand from an off-shore source, the marina canal system and/or material from an external source. Off-shore sources have been considered previously. However, the conclusion with those studies suggested that using the material from an offshore source would have high cost implications due to the off-shore dredging and pumping operations. The marina canal system requires dredging on a regular basis. The material within the marina system is likely to be suitable but the volume available would not be sufficient for the required beach nourishment project. Other alternative sources that have been proposed by several parties include sand material from Oyster Bay and from the port of Port St Francis.

The fundamental alternatives associated with various sand sources are included in the EIR.

1.3 Details of the Specialist

According to Appendix 6, Section 1 (1), of the 2014 EIA Regulations (as amended in 2017), "*A specialist report prepared in terms of these Regulations must contain—*
(a) details of—

> *(i) the specialist who prepared the report; and*
> *(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae."*

Dr David Brew *(Geomorphologist)*

David is a Principal Coastal Geomorphologist in Royal HaskoningDHV's Environment Advisory Group, with 26 years' experience in coastal geology and geomorphology. He has managed and made specialist geomorphological contributions to numerous strategic and research and development projects for a wide variety of clients in the United Kingdom and overseas. These have included coastal process studies for coastal management strategies, coastal and sea bed processes related to nearshore and offshore construction, geomorphological impacts and sustainability of proposed managed realignment and wetland restoration schemes, and design, implementation, and interpretation of morphological and hydrological monitoring programs in coastal environments. His expert geomorphological knowledge has been used to assist appraisal of potential management strategies along the coasts of the United Kingdom, Europe, Middle East, Australia, South Africa, West Africa and the Pacific Northwest.

Mr Roberto Almanza *(Report Compilation)*

Roberto obtained his BSc (Environmental Sciences) from Nelson Mandela Metropolitan University majoring in Geology and Geography and went on to complete his BSc Honours in Geology in 2012 and his MSc Geology in 2017. Since joining EOH CES in August 2015, Roberto has been involved in several projects from Basic Assessments to Full Scoping and Environmental Impact Reports and has conducted Environmental Auditing, Site Remediation and Water Use Licence Applications within Port Elizabeth and the surrounding areas of the Nelson Mandela Bay Municipality (NMBM). Roberto has been involved in a number of projects related to the Coega Industrial Development Zone (Coega IDZ) and has established a number of contacts at the Coega Development Corporation (CDC) and at Transnet National Ports Authority (TNPA). He has also overseen a number of successful projects to completion and authorisation and has developed a good working relationship with the local and provincial authorities.

Mr Gregory Shaw (Report Review)

Greg is a Principal Environmental Consultant and Business Development Manager at CES. Greg has 12 years' experience in conducting environmental consultancy services in the energy, transport, maritime and agricultural sectors on behalf of South African and oversees government departments and agencies, local government authorities, private developers, international funding organisations, and non-government organisations. He has a strong track record of projects completed within budget, on time and in accordance with national and/or international environmental legislation and guidelines. Greg's skills include ESIA, environmental survey development, management, execution and monitoring, report writing, project management and strategic planning.

Dr Ted Avis (Report Review and Final Sign-Off)

Dr Ted Avis is the Managing Director at CES with more than 30 years' experience. He is a leading expert in the field of Environmental Impact Assessments, having project-managed numerous large-scale ESIAs to international standards (e.g. International Finance Corporation). Ted was principle consultant to Corridor Sands Limitada for the development of all environment aspects for the US$1billion Corridor Sands Project. He has managed ESIA studies and related environmental assessments of similar scope in Kenya, Madagascar, Egypt, Malawi, Zambia and South Africa. Ted has worked across Africa, and also has experience in large scale Strategic Environmental Assessments in southern Africa, and has been engaged by the International Finance Corporation (IFC) on a number of projects. Ted was instrumental in establishing the Environmental Science Department at Rhodes University whilst a Senior lecturer in Botany, based on his experience running honours modules in EIA practice and environmental. He is an Honorary Visiting Fellow in the Department of Environmental Sciences at Rhodes. He was one of the first certified Environmental Assessment Practitioner in

South Africa, gaining certification in April 2004. He has delivered papers and published in the field of EIA, Strategic Environmental Assessment and Integrated Coastal Zone Management and has been a principal of CES since its inception in 1990, and Managing Director since 1998. Ted holds a PhD in Botany, and was awarded a bronze medal by the South African Association of Botanists for the best PhD adjudicated in that year, entitled "Coastal Dune Ecology and Management in the Eastern Cape". Ted is a Certified Environmental Assessment Practitioner (EAP, since 2002) and a professional member of the South African Council for Natural Scientific Professionals (SACNASP, since 1993).

Please refer to <u>Appendix A</u> for detailed CVs of the specialist consultants as well as the declaration of the specialist.

2 TERMS OF REFERENCE

According to Appendix 6, Section 1 (1), of the 2014 EIA Regulations (as amended in 2017), "*A specialist report prepared in terms of these Regulations must contain—*
(c) an indication of the scope of, and the purpose for which, the report was prepared; and
(i) a description of any assumptions made and any uncertainties or gaps in knowledge."

2.1 Aim of the Study

One of the most important aspects related to the process of beach nourishment is the selection of an appropriate source material. A beach recharged with sediment of a finer texture than the native sediment will tend to form a flatter beach shape and be susceptible to rapid erosion, thus limiting the long-term success of beach nourishment. The aim of this study is to assess a number of feasible material sources, with particular focus being placed on the sediment texture and particle size, compare source sediment particle size with that of the existing beach sand and analyse the compatibility of the source material for use during the process of beach nourishment. The report aims to supplement the previous studies that have been undertaken by identifying any possible variations in the grain size of potential sand sources, and to determine if any variations in grain size occur at different depths within the source material. In addition, this report aims to provide an outline of the potential hydrodynamic effects, if any, that will result from the removal of sediment from the Kromme Estuary. An assessment of the impacts associated with the sediment removal has been included in this report together, with a number of mitigation measures and monitoring recommendations.

2.2 Scope of the Study

The scope of the beach nourishment source material study includes the following:

- Collection of sediment samples along the St Francis Bay beach as well as within the Kromme Estuary (18th of December 2018 and the 15th of April 2019);
- Analysis of the grain size of the sediment samples collected along the St Francis Bay beach as well as within the Kromme Estuary;
- A high-level review of the potential changes to the sedimentary processes of the Kromme River as a result of the removal of sediment for beach nourishment material, based on existing information as per the study conducted by ASR (2006), inclusive of:
    - A summary of the existing sediment transport regime;
    - A summary of the processes and morphological relationship between the extraction area and the adjacent coasts; and
    - A summary of the likely changes to occur to the system as a result of the sediment extraction;
- A summary of the findings of the hydrodynamic model simulating the hydrodynamic changes to the Kromme Estuary due to the dredging of the sandbanks and river channels (Advisian, 2020a);
- The identification and assessment of the magnitude and significance of the impacts associated with the proposed sand material sourcing; and
- A description of appropriate mitigation measures to minimise negative impacts associated with the sand material sourcing.

2.3 Assumptions, Limitations and Gaps in Knowledge

Much of the information regarding the proposed development and data relating to sediment analyses in this report was based on information provided by the Client in the form of previous studies conducted by a number of specialist companies.

This specialist report is subject to the following additional assumptions and limitations:

- All project-specific information was based on information supplied by the Client (previous studies conducted) and information contained in the Draft Scoping Report (CES, 2019) and was assumed to be accurate;
- New bathymetric data was made available together with an updated hydrodynamic model and pre- and post-dredging scenarios (Advisian, 2020a);
- Due to the equipment limitation of the study, the sample depth obtained during the collection of the sediment samples was 1.8 m below the surface;
- One of the assumptions which is included in a number of previous studies is that the majority of the sand in the Kromme Estuary is derived from the same sources as the sand encountered on the St Francis Bay beach. This assumption is carried forward into this report;
- Based on previous studies that have been undertaken, grain size has been identified as the main determining factor when identifying a suitable source material. This assumption is carried forward into this report;
- The volume of material required for the maintenance of the beach nourishment is likely to differ from the volumes specified in this report. The exact volume of maintenance material required during the operational phase of the proposed project can only be accurately determined once detailed engineering modelling and estimates are implemented during the detailed design stage of the project; and
- The detailed nature and quality of the source material cannot be accurately determined at this stage. The results provided in this report are aimed at providing a desktop assessment of the proposed sand source material and any contaminants and/or debris located within the source material may only be determined at the inception of the project.

Despite the above assumptions and limitations, and given the amount of information available, the report is considered to be sufficiently detailed and accurate to identify impacts and rate their significance, and to provide mitigation measures.

3 PREVIOUS STUDIES UNDERTAKEN

According to Appendix 6, Section 1 (1), of the 2014 EIA Regulations (as amended in 2017), "*A specialist report prepared in terms of these Regulations must contain—*
(cA) An indication of the quality and age of base data used for the specialist report."

3.1 Introduction

A number of studies related to the Kromme Estuary have been conducted over the years. However, with regards to utilising the Kromme Estuary as a potential source of sand, only one detailed study has been conducted, namely the study produced by Entech in 2002 titled 'St Francis Bay Proposed Beach Restoration Specialist Report - Technical Study of Sand Sources.' Bathymetry and sediment surveys of the St Francis Bay beach, near-shore area and the Kromme Estuary were undertaken by ASR (2006). Due to the fact that sediment processes within an estuary are constantly changing, the data included in any study conducted at any period in time would be subject to the conditions experienced at the time of the fieldwork. Nonetheless, the studies conducted by Entech (2002) and ASR (2006) are still considered relevant, and the quality of the data included in these reports is deemed suitable for the establishment of a reasonable baseline for this beach nourishment source material study.

3.2 Results from the Previous Studies Undertaken

3.2.1 *Source Material Suitability*

The sand source report completed by Entech (2002) showed that the average median grain size of the beach sand was 0.22 mm along the lower beach (low tide) and 0.18 mm along the upper beach (high tide). According to ASR (2006) the grain size distribution analyses showed that the estuary, marina canal system and municipal dump sites were all in the same range as the St Francis Bay beach sand (Table 3.1). The opinion of Entech (2002) was that sand from any of the 4 sources was suitable.

Table 3.1: Comparison of median grain sizes from samples collected at different areas surrounding St Francis Bay (Entech, 2002).

Sample Area	Median Grain Size (mm)
Upper Beach	0.18
Lower Beach	0.22
Municipal Dump	0.18
Kromme Estuary	0.18

3.2.2 *Source Material Availability*

Entech (2002) estimated that a 2 m to 3 m reduction in the width of the St Francis Bay beach equates to between 50 000 m^3 and 100 000 m^3 of sand being lost from the system. Therefore, in order to widen the beach by 30 m with the use of beach nourishment only, a total of between 750 000 to 1,5 million m^3 of sand material would be required. Should groynes be developed along the St Francis Bay coastline, this quantity can be reduced by half. According to the engineers appointed for the development of the proposed coastal protection scheme, the volume of sand which will need to be sourced for capital nourishment is approximately 854 000 m^3 (Table 3.2). Additional sand material may be required to account for losses during the nourishment process (e.g. dredging and pumping losses).

This would be followed by placement of approximately 50 000 m^3 of sediment each year for continued maintenance of the St Francis Bay beach. Advisian advised that the current loss of sand material from the entire beach is 50 000 m^3 to 100 000 m^3 per annum, but that the loss after full implementation of the preferred solution can be expected to be in the order of 25 000 m^3 to 50 000 m^3 per annum. The sand required for maintenance will be limited to the requirement of the phases completed. For example, after completion of Phase 1, only sand necessary for maintenance of the Phase 1 beach will be required. The volume of sand required for maintenance will differ as the project progresses through the various phases, but will be limited to a maximum of approximately 25 000 m^3 to 50 000 m^3 per annum (Table 3.3).

Table 3.2: Total initial nourishment requirements of each phase of the coastal protection scheme.

Nourishment Phase	Estimated Initial Sand Volume Required (m^3)
Phase 1	259 000 - 361 000
Phase 2	166 000 -247 000
Phase 3	167 000 - 205 000
Phase 4	78 000 - 134 000
Phase 5	182 000 - 235 000

Table 3.3: Anticipated annual maintenance requirements at the completion of each phase of the coastal protection scheme.

Nourishment Phase	Cumulative maintenance requirement	
	From	To
Annual Maintenance at Completion of Phase 1	8 000	16 000
Annual Maintenance at Completion of Phase 2	13 250	26 550
Annual Maintenance at Completion of Phase 3	17 550	35 200
Annual Maintenance at Completion of Phase 4	20 350	40 850
Annual Maintenance at Completion of Phase 5	24 950	50 050

SRK (2003) indicated that the intertidal areas in the lower Kromme Estuary are supplied with sediment from marine areas and they are accreting over time. Based on various assumptions, Entech (2002) estimated that the supply of sediment to the lower estuary is between 20 000 m^3 and 40 000 m^3 per year. According to Entech (2002), the extraction for continued maintenance would gradually deplete the lower estuary of sediment. As discussed above the sand required for maintenance will be limited to a maximum of approximately 25 000 m^3 to 50 000 m^3 per annum. Sediment extracted for maintenance from the estuary will be augmented with sediment extracted from the marina canal system, which will effectively prevent depletion of sediment in the lower estuary.

Entech (2002) suggested that 600 000 m^3 could be obtained from the wide intertidal areas at the mouth of the Kromme Estuary (assuming an excavation area of 1 000 m long, 300 m wide and 2 m deep) with a further 200 000 m^3 from the estuary channel for 1.5 km downstream of Kromme bridge. SRK (2003) recommended extraction of sand could be accomplished from the lower 4.5 km of the Kromme Estuary (mouth to about 1.5 km upstream of the bridge). Assuming that 20 000 m^3 to 40 000 m^3 of accretion has occurred on an annual basis since 2002, a total of 340 000 m^3 to 680 000 m^3 could be added to the 2002 Entech estimates, equating to an available total of between 940 000 m^3 to 1 280 000 m^3. This total would be reduced by flooding events that have occurred since 2002 but it is anticipated that the volume of sediment accreted over this time is still mostly within the estuarine system.

3.2.3 *Bathymetry and Hydrodynamics*

ASR (2006) completed a study to investigate the implications and impacts of the proposed sand extraction on the hydrodynamics of the estuary mouth and associated canal system. The bathymetry of the Kromme Estuary was measured at an accuracy of 10 cm (Figure 3.1 and Figure 3.2). The three-dimensional hydrodynamic and mass transport model '3DD' was used to simulate flows in the Kromme Estuary over several different sand extraction and dredging scenarios. This study showed that the excavation and removal of up to 600 000 m^3 of sediment from the main sand bank would have negligible impacts on the existing current flows of the Kromme Estuary (Figure 3.3). However, it was expected that there may be very localised impacts on the flows and sediment transport in the lower reaches of the Kromme estuary. Reduction in current velocities in the excavated area and adjacent channel could lead to increased rates of sediment deposition in this area and could lead to reinstatement of the equilibrium of the estuary over time (ASR, 2006).

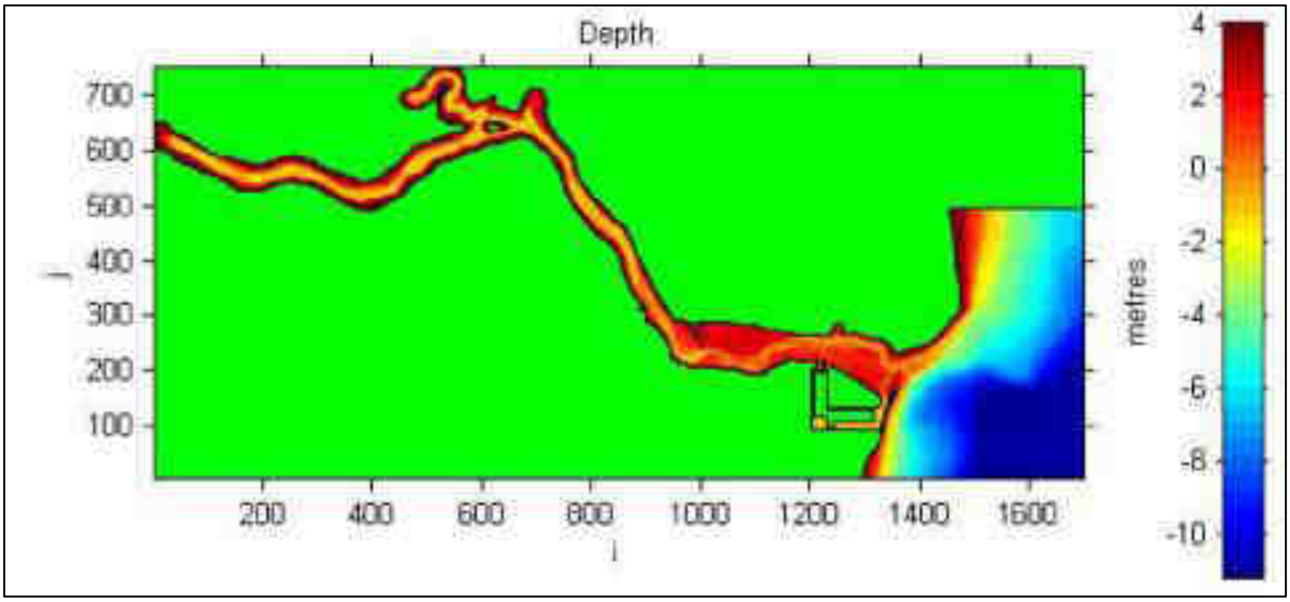

Figure 3.1: Bathymetry of the Kromme Estuary (from ASR, 2006). Note that the legend indicates the metres above mean average sea level.

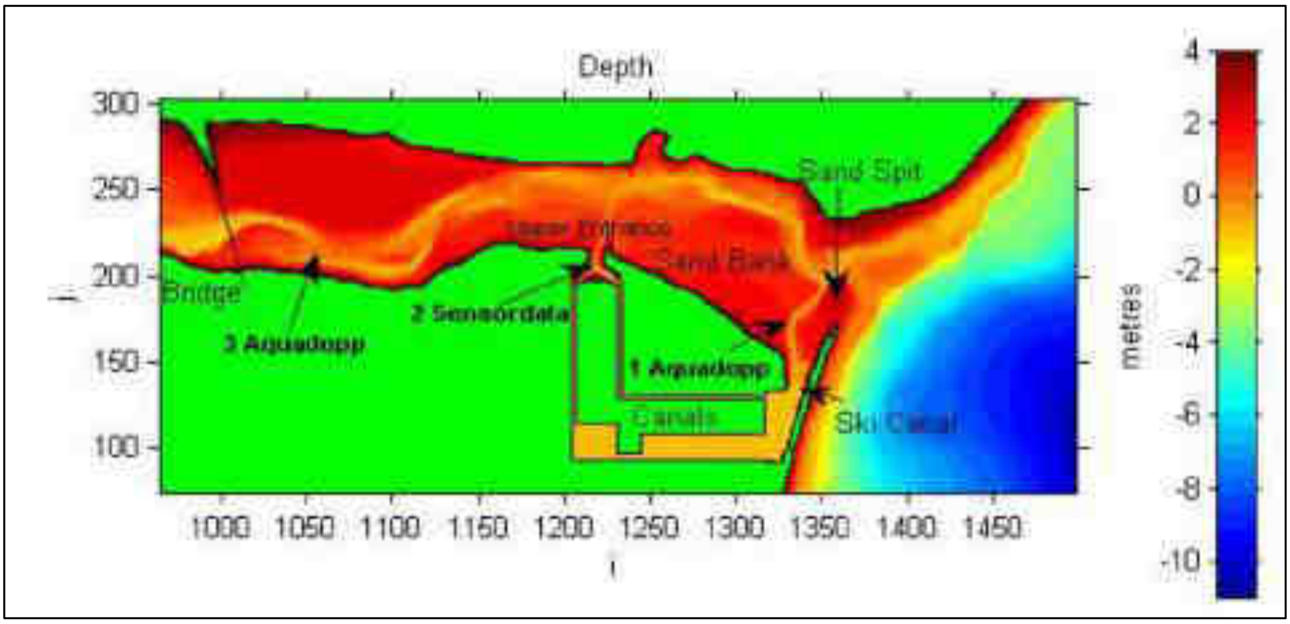

Figure 3.2: Bathymetry of the lower reaches of the Kromme Estuary (from ASR, 2006).

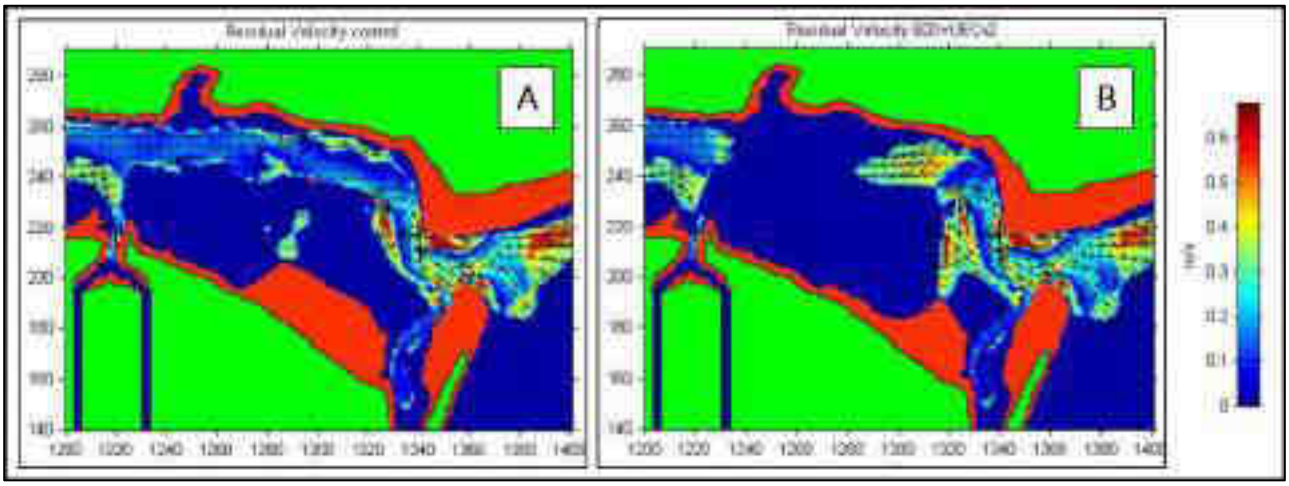

Figure 3.3: Anticipated changes to the hydrodynamics of the lower reaches of the Kromme Estuary (from ASR, 2006): A: Flow velocities with no extraction; B: Flow velocities following the extraction of 600 000 m^3 of sand.

In July 2020, bathymetry data was collected by AAM Geomatics and satellite derived bathymetry via EOMAP (Figure 3.4), made up of the following datasets:

- Bathymetry of the estuary surveyed by AAM Geomatics (July 2020);
- Topography of the estuary surveyed by AAM Geomatics (July 2020); and
- Satellite delivered bathymetry by EOMAP (February 2020).

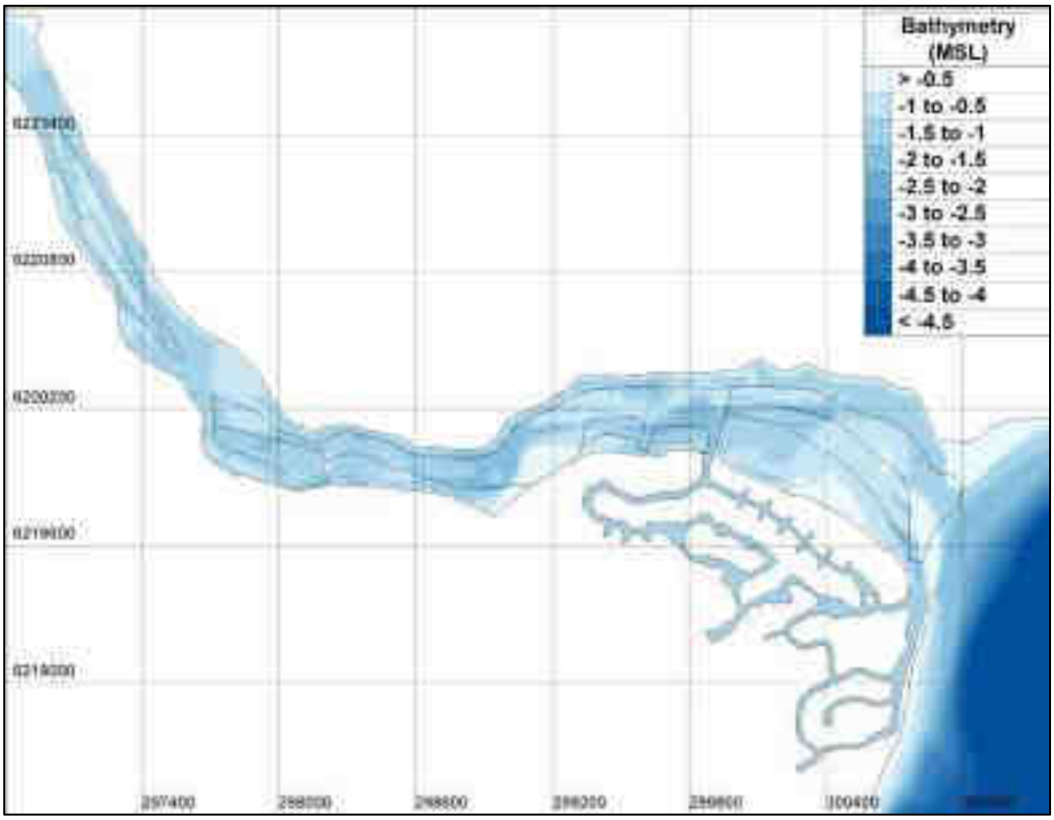

Figure 3.4. Bathymetry of the Kromme Estuary in its current condition (i.e. pre-dredging)

Using the bathymetry data, Advisian developed a hydrodynamic model to determine the water levels and current velocities for pre- and post- dredging of the sandbanks and river channels, in an attempt to quantify the changes to the system. Providing an indication of the potential change would facilitate the assessment of the impacts as a result of the proposed sand extraction.

Model simulations were carried out for the pre-dredging scenario (existing conditions) for two discharge conditions (low and high river discharges), each for a period of two full spring-neap tidal cycles (Advisian, 2020). The simulations determined that the flow in the estuary is mainly tide dominated during lean river discharge condition. During high river discharge condition, the flow is dominated by river discharge. The maximum current velocities at the river mouth is in the order of 1.8m/s and 2.4m/s during lean and high discharge conditions respectively. The current velocities inside the main estuary and river is usually less than 0.3m/s.

Model simulations were then carried out for the post-dredging scenario for lean and high river discharge conditions for one complete tidal cycle. The dredging scenarios simulated are those presented in Section 4 below.

The variation in current velocity as a result of the dredging within the estuary is observed to be negligible under the lean discharge conditions. However, the maximum variation (mostly decrease) of current velocity is in the order of up to 1.3m/s and 1.6m/s over one complete tidal cycle under lean and high river discharge conditions respectively. These mostly occur within the mouth of the estuary (Figure 3.5).

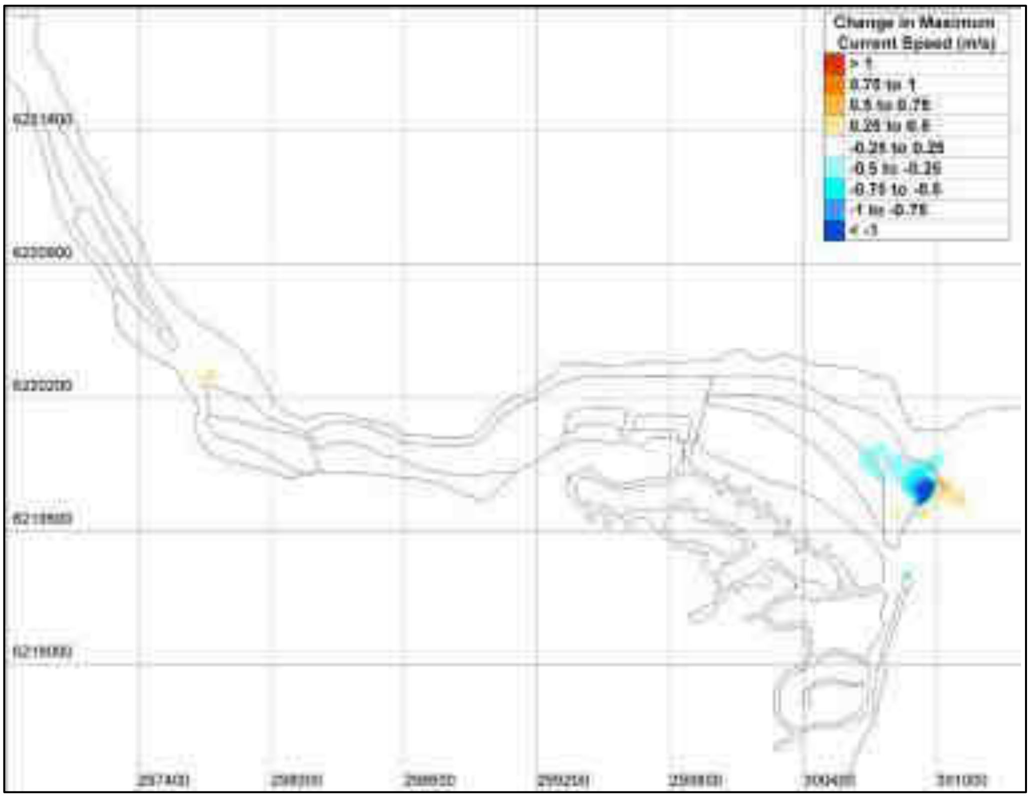

Figure 3.5 Change in maximum currents under normal conditions between pre- and post-dredging simulations.

The high variation in current speed at the estuary mouth could be due to the sudden change in depth after dredging. However, it may be noted that morphological evolution due to post- dredging hydrodynamics is not included in the present study. In actual conditions the estuary mouth will undergo morphological changes, leading to smoother bathymetry and thereby reducing variation in current speeds (Advisian, 2020).

As reported, water level and currents are tide driven along the estuary, but the tidal effect decreases as it moves upstream in the river. The current speed comparison for pre- and post- dredging simulations at the estuary mouth shows a decrease in current speed of approximately 0.6m/s post dredging. Further upstream negligible variation (less than 0.1m/s) is generally observed, other than where there are sudden changes in water depth as the current moves from deeper depth to shallower depth (in post dredging scenario).

High-water levels in the estuary have negligible variation in pre- and post-dredging scenarios. However, low-water levels do show variation due to the shallower water depths in the current condition versus post-dredging scenario. This is understood as being caused by increased tidal propagation into the estuary as a result of increased water depth after dredging. The increase in water depth facilitates higher volumes “flushing” into the sea during ebb phase of the tide.

The variation in the low-water levels will not have any impact on the minimum water depth within the priority and secondary dredge areas. However, in the non-dredging areas the decrease in water level may cause reduction in available water depth during low tide, leading to exposure of shallow sandbanks inside the estuary in the post dredging scenario (Figure 3.6).

The sandbanks exposed at low tide under existing conditions is calculated at 52 ha. Following the dredging activity (assuming the full extraction volume) the exposed sandbanks equate to 51 ha.

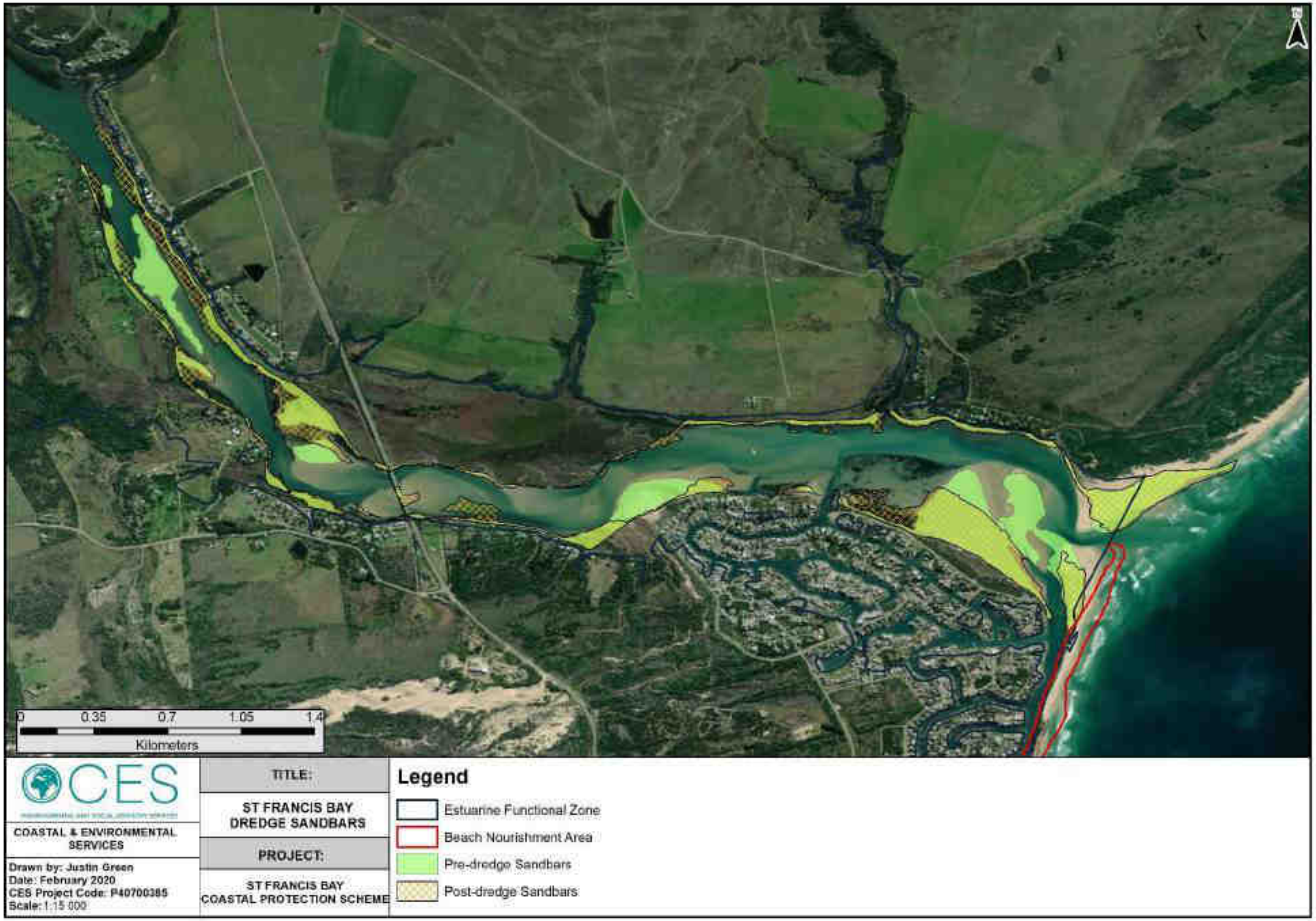

Figure 3.6 Exposed areas of sandbanks during the pre- and post-dredging scenarios (normal flow conditions)

3.3 Conclusions from the Previous Studies Undertaken

3.3.1 *Sand Material Suitability*

According to Entech (2002), the source material should be as coarse or slightly coarser as finer sands will be lost from the system. The study conducted by ASR (2006) found that sediment located in the shallow sub-tidal areas of the Kromme Estuary exhibits a similar grain size to the St Francis Bay beach sand. According to ASR, finer sediments tend to accumulate in the deeper areas of the estuary. According to ASR (2006), the sediment grain sizes from the Kromme Estuary are closely matched to those of the beach. Entech (2002) state that a higher grain size is unlikely to significantly affect the gradient of the St Francis Bay beach as it will mix with the existing beach sand. The organic content of the sand within the Kromme Estuary sand is likely to result in an initial darker colour along the beach. However, Entech (2002) state that sun bleaching and wave action are likely to result in the organics being removed from the sand and, over time, the colour of the sediment will return to its current state.

3.3.2 *Sand Material Availability*

According to the specialist report prepared by IECM (2002), up to 600 000 m^3 of sand can be 'extracted from the large sand bank that has developed on the southern bank opposite the Huis River. ASR (2006), recommended that prior to the final implementation of mitigation measures, a number of design studies should be undertaken which would include the following:

- A bathymetric and topographic survey of the St Francis Bay area;
- A wave climate study, which would include refraction modelling; and
- A detailed assessment of the sediment regime, with a view to quantifying sediment transport and required placement volumes.

In addition, ASR concluded that dredging up to 600 000 m^3 of sand from the lower Kromme Estuary has been identified as the preferred sand source for St Francis Bay Beach nourishment.

3.3.3 *Hydrodynamic Effects*

The removal of sediment from the Kromme Estuary is likely to affect tidal volume and possibly increase tidal currents within the Kromme River mouth. This may only be a temporary condition until equilibrium is re-established within the system. For the purposes of understanding the potential hydrodynamic effects of sediment extraction in the Kromme Estuary, SRK (2003) assumed that 800,000 m^3 would be removed (600 000 m^3 from the intertidal area on the south bank of the mouth and 200 000 m^3 from an area 1.5 km downstream of Kromme Bridge). Removal of this volume of sediment (or indeed any volume between 500 000 m^3 and 1 million m^3) would increase the tidal prism downstream of the bridge.

The conclusions and recommendations of the study conducted by ASR (2006) include the following:

- The above-mentioned dredging will have localised impacts on the Kromme Estuary and canal system hydrodynamics;
- Dredging activities should be restricted to the target area and preferably follow "*the bathymetric scenario where the main excavation was extended to the channel leading to the upper entrance of the canals, but with the confluence and entrance area near the Shore Road parking being left unaltered)*". This must be applied in order to maintain current velocities in the upper entrance of the marina canals and prevent accelerated sediment deposition in this area;
- A 50 m to 100 m buffer should be maintained between dredge areas and the river channel in order to avoid realignment of the system;
- Dredging should be limited to the sand banks; and
- No vegetated shorelines should be disturbed.

Advisian modelled the pre- and post-dredging scenarios for the Kromme Estuary. The dredging scenario modelled was that presented as part of this project where the channels of the estuary will be dredged as priority areas and material from sandbanks, secondary. The modelling output confirms the findings of the previous studies in many ways. In summary:

- The dredging of the river, and in particular the area around the river mouth has the effect of allowing the water to drain out more effectively, which lowers the low water level (with respect to MSL). It is assumed that this low water level will be a variable phenomenon in any case given, the dynamic nature of the river mouth which will govern this low tide level. However, this may lead to exposure of shallow non-dredged areas within the estuary during low tides.
- The variation in current velocity inside the estuary and along the riverbanks due to dredging is generally very small. The estuary mouth shows the greatest change in current velocity with a reduction of up to 1.3m/s and 1.6m/s under normal flow conditions and high river discharge conditions, respectively. These variations in current velocity are expected to be a temporary phenomenon, until the bathymetry of the estuary mouth get smoothed out by natural hydrodynamics and morphological evolution over the time.
- Based on the strong flow (maximum current velocity of 1.8m/s at the estuary mouth observed from the model studies) the estuary mouth is not expected to close.
- The maximum tidal current velocity throughout the simulation period confirm that the currents outside the main channel (i.e. near to the banks) and in particular on the northern bank close to the river mouth are low (up to 0.2m/s) and that the dredging would not lead to any significant change in the currents in this area.

3.3.4 *Other Conclusions*

According to Entech (2002), the removal of sand from the lower reaches of the Kromme Estuary is seen to have benefits for the health of the estuary, navigation of recreational vessels and the reduction of erosion of the St Francis Bay beach. The recommendations of the study conducted by ASR (2006) also included the following points:

- Dredging must commence at the western section of sand bank near the western entrance to the canals and then proceed eastwards; and
- Regular bathymetric surveys of the lower Kromme Estuary must be undertaken throughout the duration of the dredging process. This monitoring data will provide information on the sediment distribution, accumulation and transport within the estuarine system and then be used to assess the volumes of sediment entering the system and, later, to modify to the dredging scheme undertaken as part of the sand sourcing project.

4 SOURCE MATERIAL SUITABILITY

4.1 Methodology

According to Appendix 6, Section 1 (1), of the 2014 EIA Regulations (as amended in 2017), "*A specialist report prepared in terms of these Regulations must contain—*

(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;

(e) A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used."

4.1.1 *Desktop Assessment*

A desktop assessment was initially undertaken to determine suitable sites for the collection of sediment samples from both the source areas as well as the proposed beach nourishment area. In addition to this, several previous studies, which were undertaken to determine a suitable source material area for the proposed beach nourishment, were reviewed for relevant information (Chapter 3).

4.1.2 *Sand Sample Collection*

Sorting of the natural beach sediment has taken place over an extensive period of time. The particle size of the beach sediment (sand) located along the St Francis Bay coastline provides a baseline for the type of sediment that is required for sediment stability following the application of beach nourishment. To characterise the intertidal areas in the Kromme Estuary and the open coast beach, two sampling campaigns were completed on the 18th of December 2018 and the 15th of April 2019. Seventeen samples were collected, eleven (11) in the intertidal areas on the south side of the estuary and six (6) on the beach (Figure 4.1). All the samples in the estuary apart from sample 2 were collected between 1.2 m and 1.8 m below the surface. Sample 2 and all samples along the beach were collected from 0 m to 0.8 m below the surface. The details of the site investigation are included in Table 4.1 below:

Table 4.1: Site Investigation Details.

Site Investigation Date	18 December 2018	15 April 2019
Duration	± 4 hours	± 4 hours
Season	Summer	Autumn
Relevance of the Season	The date, duration and season of the site investigation has no bearing on the results and conclusions of this specialist study. However, it must be noted that at the time of the site investigation, the area had been experiencing minimal rain following a drought period during 2018.	

Samples were collected with the use of a 2 m long hollow polyvinyl chloride (PVC) pipe. The initial surficial sand, which was removed with the pipe, was not sampled in order to ensure that a representative sample from the sampling depth was collected. The sample was then placed in a transparent plastic bag, labelled and sealed for delivery to the laboratory. A Global Positioning System (GPS) was used to record the location of the samples. Samples collected along the beach included samples from the high-water mark as well as the low-water mark observed at the time of the site investigation.

Figure 4.1: Location of sample sites for the collection of sand for grain size analysis.

4.1.3 *Particle Size Laboratory Analysis*

The samples collected on the 18th of December 2018 and the 15th of April 2019 were taken to Tosca Lab (Pty) Ltd in Port Elizabeth for analysis. The particle size analyses that were undertaken as part of this study included the dry sieving of the samples that had been collected. Results were obtained on the 14th of January 2019 and the 6th of May respectively (please refer to Appendix B for the laboratory results). The results obtained on the 14th of January 2019 included sieve analysis for sand passing through various sieve apertures as well as soil mortar analysis for the percentage of material passing through finer sieve apertures. The relative density of the samples was also recorded. The results obtained on the 6th of May 2019 included sieve analysis for sand passing through various sieve apertures including fine sieve apertures (as per SANS 3001: AG1 - Particle size analysis of aggregates by sieving). Some of the sieves used to analyse the samples collected in December 2018 were different to those used to analyse the samples collected in April 2019 (Table 4.2).

Table 4.2: Sieves apertures used in particle size analysis of the sediment samples collected in the Kromme Estuary and beach of St Francis Bay.

Sampling Campaign	Sieve Size (mm)									
	5	4.75	2	1	0.6	0.425	0.3	0.25	0.15	0.075
December 2018 (Sample 1, 3-6, 9 and 11)		X	X			X		X	X	X
April 2019 (Sample 2, 7, 8, 10 and 12-17)	X		X	X	X	X	X		X	X

4.1.4 *Particle Size Interpretation Methodology*

The particle size classification used in this analysis is the Udden-Wentworth grade scale in which the successive size classes differ by a factor of two (Figure 4.2). The statistical parameters used to describe particle size distribution are:

- the median particle size (d_{50});
- the 10% percentile particle size (d_{10}); and
- the 90% percentile particle size (d_{90}).

These parameters are determined graphically using a cumulative frequency curve, where the x-axis is the particle size in millimetres and the y-axis is the cumulative frequency. The median particle size is the value of the particle diameter at 50% in the cumulative distribution.

Grain size: phi	mm/µm	Udden (1914) and Wentworth (1922)
−11	2048 mm	
−10	1024	
−9	512	Cobbles
−8	256	
−7	128	
−6	64	
−5	32	
−4	16	Pebbles
−3	8	
−2	4	
		Granules
−1	2	
		Very coarse sand
0	1	
		Coarse sand
1	500 µm	
		Medium sand
2	250	
		Fine sand
3	125	
		Very fine sand
4	63	
5	31	
6	16	Silt
7	8	
8	4	
9	2	Clay

Figure 4.2: Classification of sedimentary particles according to size (based on the Udden-Wentworth scale).

4.1.5 *Impact Assessment Methodology*

In terms of rating of potential environmental impacts associated with the sourcing of material for use during beach nourishment, the standard CES rating system was applied and the specific context of the proposed project was taken into consideration. Please refer to Appendix C for details regarding the CES impacts rating methodology. In cases where an assessment of the impact of a particular aspect of the material sourcing is considered to fall within the scope of other specialist reports, the impacts are identified but the reader is then referred to other specialist reports for the impact ratings. A relevant example of this would be the assessment of ecological impacts on the Kromme Estuary, which will be covered by the estuarine specialist.

4.2 Results

4.2.1 *Particle Size Analysis*

St Francis Bay Beach

The particle size envelope of the St Francis Bay beach, as per the samples collected in April 2019, indicates that the median particle size ranges from approximately 0.3 mm to 0.38 mm (medium sand) with a single coarser sample of approximately 0.47 mm (medium sand) (Figure 4.3 and Figure 4.4).

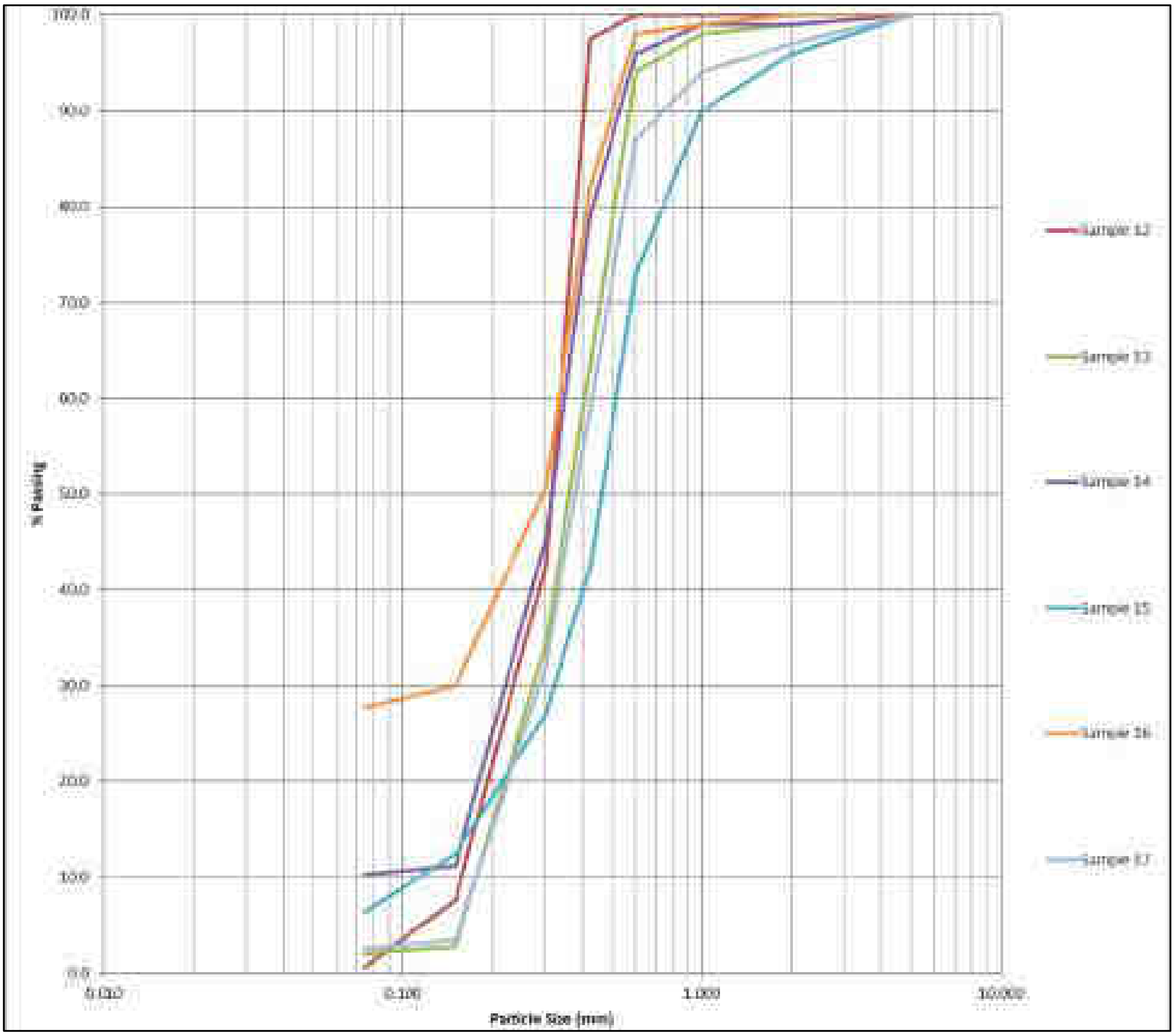

Figure 4.3: Cumulative particle size distribution curves of the six samples collected from the beach of St Francis Bay in April 2019.

The 10% percentile particle size (d_{10}) ranges from less than 0.075 mm to 0.18 mm and the 90% percentile particle size (d_{90}) from 0.4 mm to 1.0 mm.

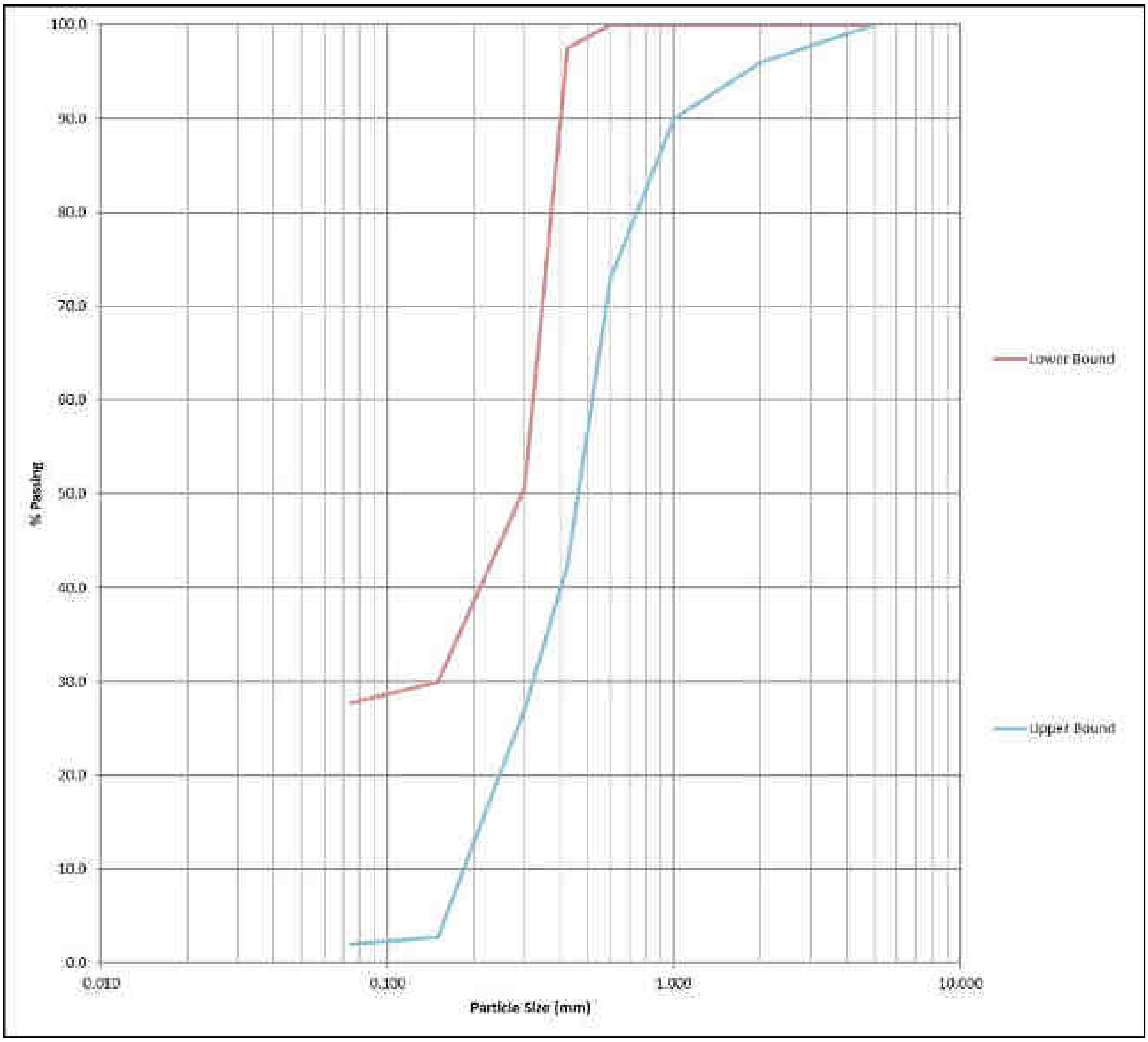

Figure 4.4: Cumulative particle size envelope of the six samples collected from the beach of St Francis Bay in April 2019.

According to Entech (2002), the average median particle sizes of the upper and lower beach are 0.18 mm and 0.22 mm (fine sand), respectively. These are finer than the results of the 2019 sampling campaign. Also, sediment surveys of the offshore sea bed and beach were undertaken by ASR (2006). They found that the beach sand and the sand in the shallow subtidal areas were mostly similar in particle size.

Kromme Estuary South Bank Intertidal Areas – December 2018

The particle size envelope of the intertidal areas on the south side of the Kromme Estuary in December 2018 indicates that the median particle size ranges from about 0.22 mm to 0.31 mm (fine to medium sand) (Figure 4.5 and Figure 4.6). The d_{10} ranges from approximately 0.16 mm to 0.18 mm and the d_{90} from 0.38 mm to 0.8 mm.

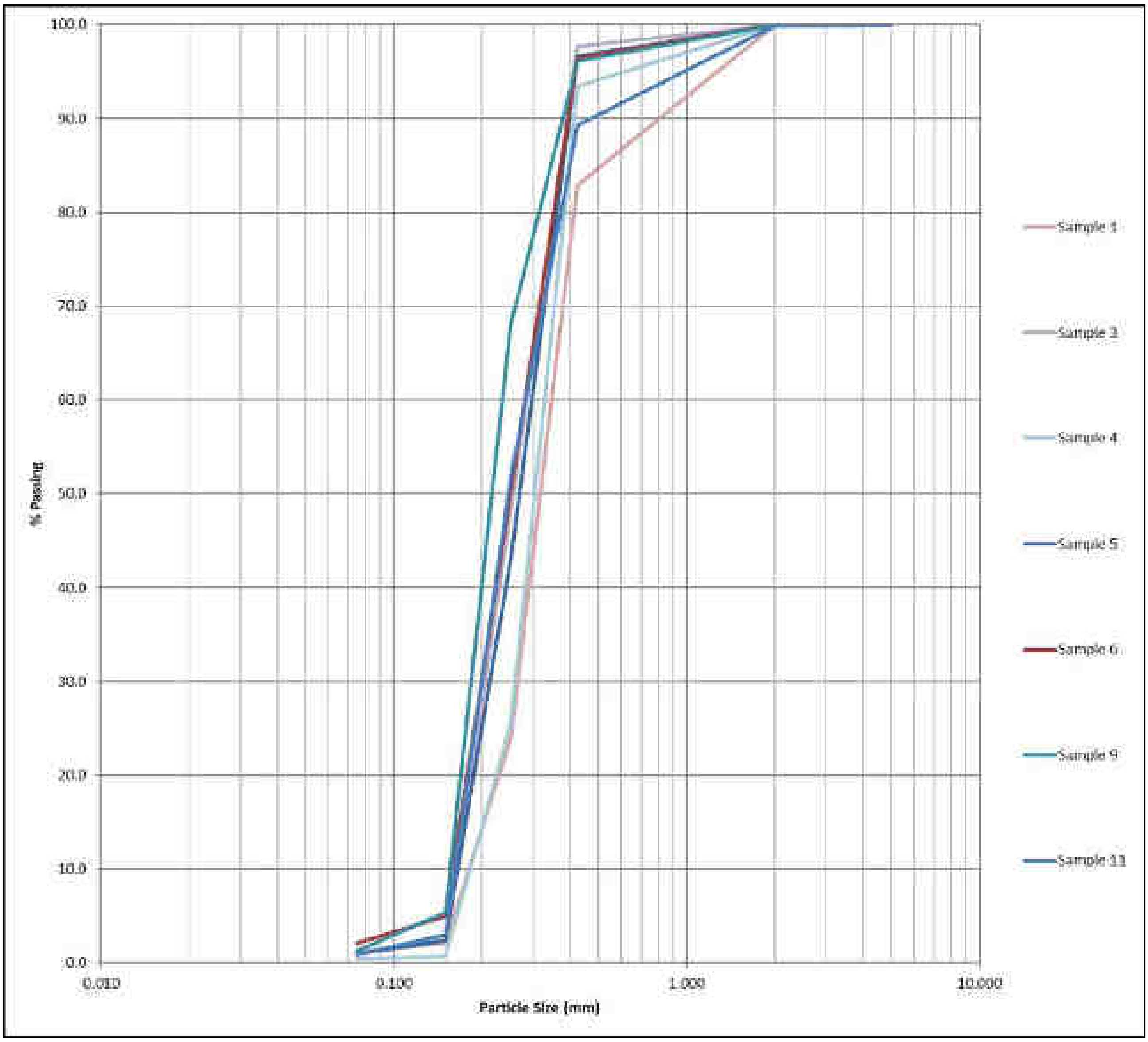

Figure 4.5: Cumulative particle size distribution curves of the seven samples collected from the Kromme Estuary in December 2018.

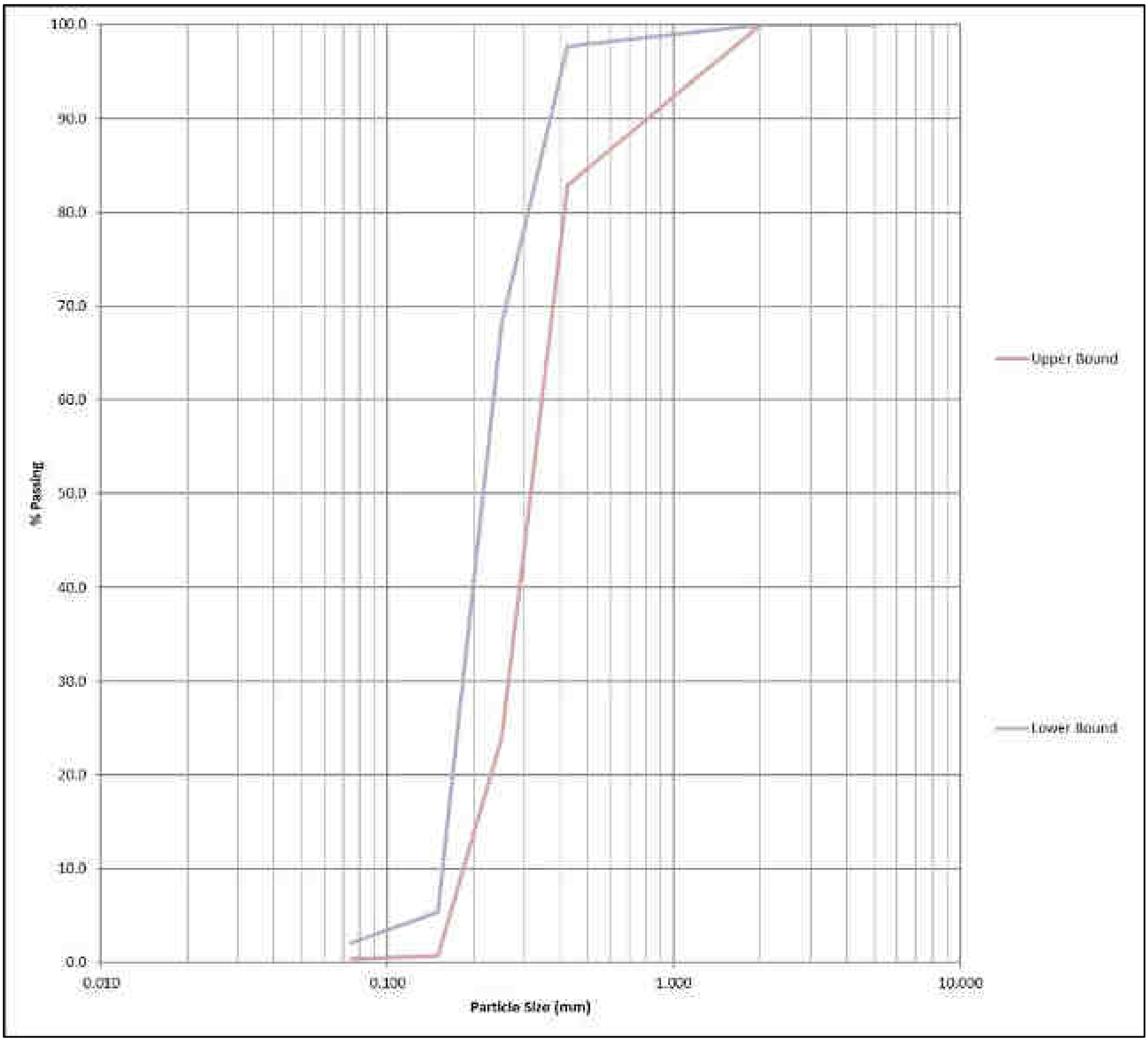

Figure 4.6: Cumulative particle size envelope of the seven samples collected from the Kromme Estuary in December 2018.

Kromme Estuary South Bank Intertidal Areas – April 2019

The particle size envelope of the intertidal areas on the south side of the Kromme Estuary in April 2019 indicates that the median particle size ranges from approximately 0.31 mm to 0.35 mm (medium sand) with a single coarser sample of about 0.45 mm (medium sand) (Figure 4.7 and Figure 4.8). The d_{10} ranges from less than 0.075 mm to 0.19 mm and the d_{90} from 0.42 mm to 0.58 mm.

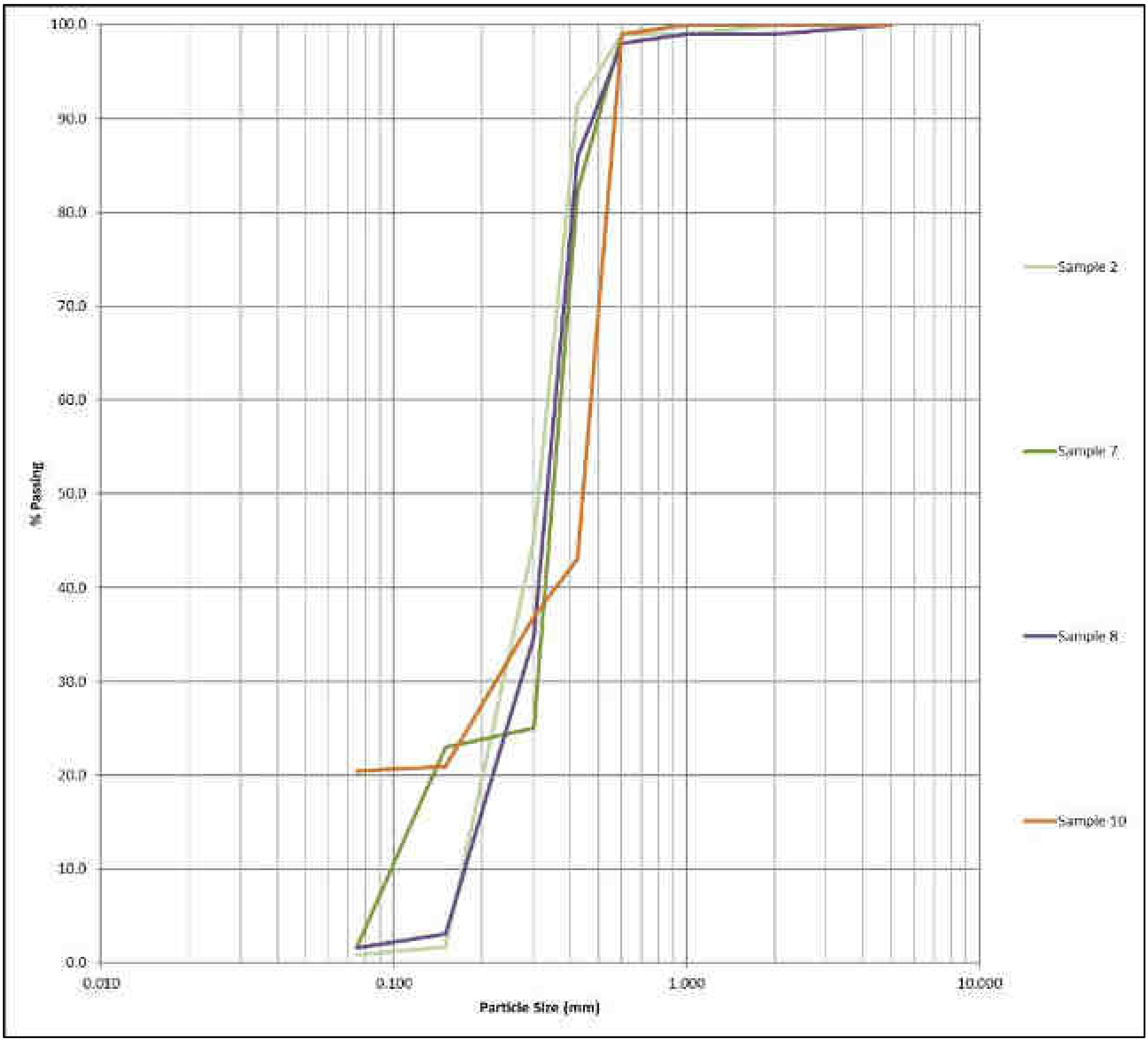

Figure 4.7: Cumulative particle size distribution curves of the four samples collected from the Kromme Estuary in April 2019.

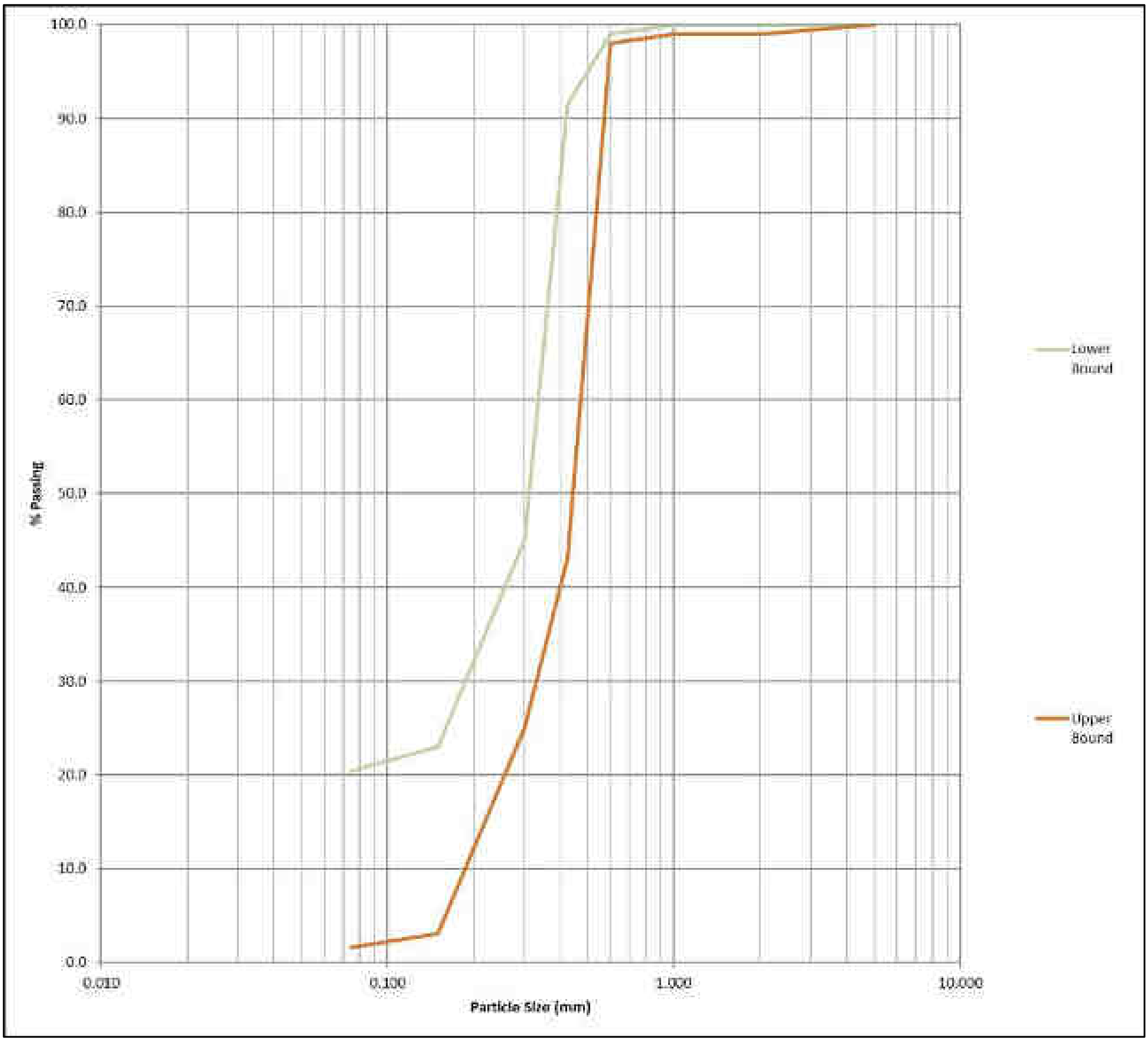

Figure 4.8: Cumulative particle size envelope of the four samples collected from the Kromme Estuary in April 2019.

4.2.2 *Particle Size Variability*

The samples recovered in the Kromme Estuary were recovered from three zones: upper intertidal (Samples 1 - 3), middle intertidal (Samples 4 - 7) and lower intertidal (Samples 8 - 11). The particle size ranges of each zone show there is no significant differences between them (Table 4.3).

Table 4.3: Median particle sizes and d_{90} of sediment samples in the Kromme Estuary.

Location	Median (d_{50}) (mm)		d_{90} (mm)	
	Lower	Upper	Lower	Upper
Upper Kromme Estuary	0.26	0.32	0.39	0.80
Middle Kromme Estuary	0.25	0.35	0.39	0.50
Lower Kromme Estuary	0.22	0.33 (one sample 0.45)	0.38	0.58

4.2.3 *Source Material Compatibility*

Analysis of the results from all the samples shows that the particle size envelope of the estuary sediment describes median particle sizes between 0.22 mm and 0.45 mm. However, the envelope is skewed to the coarse side by a single sample with a median particle size of 0.45 mm. Most of the samples (10 of the 11 collected) have median particle sizes between 0.22 mm and 0.35 mm.

The median particle sizes of all the beach samples are between 0.3 mm and 0.47 mm. However, the envelope is also skewed to the coarse side by a single sample with a median particle size of 0.47 mm. Most of the samples (5 of the 6 collected) have median particle sizes between 0.3 mm and 0.38 mm. The particle size envelopes are compared with and without the two coarser samples included in the analyses (Figure 4.9 and Figure 4.10). A summary of the characteristics of the particle size envelopes is presented in Table 4.4.

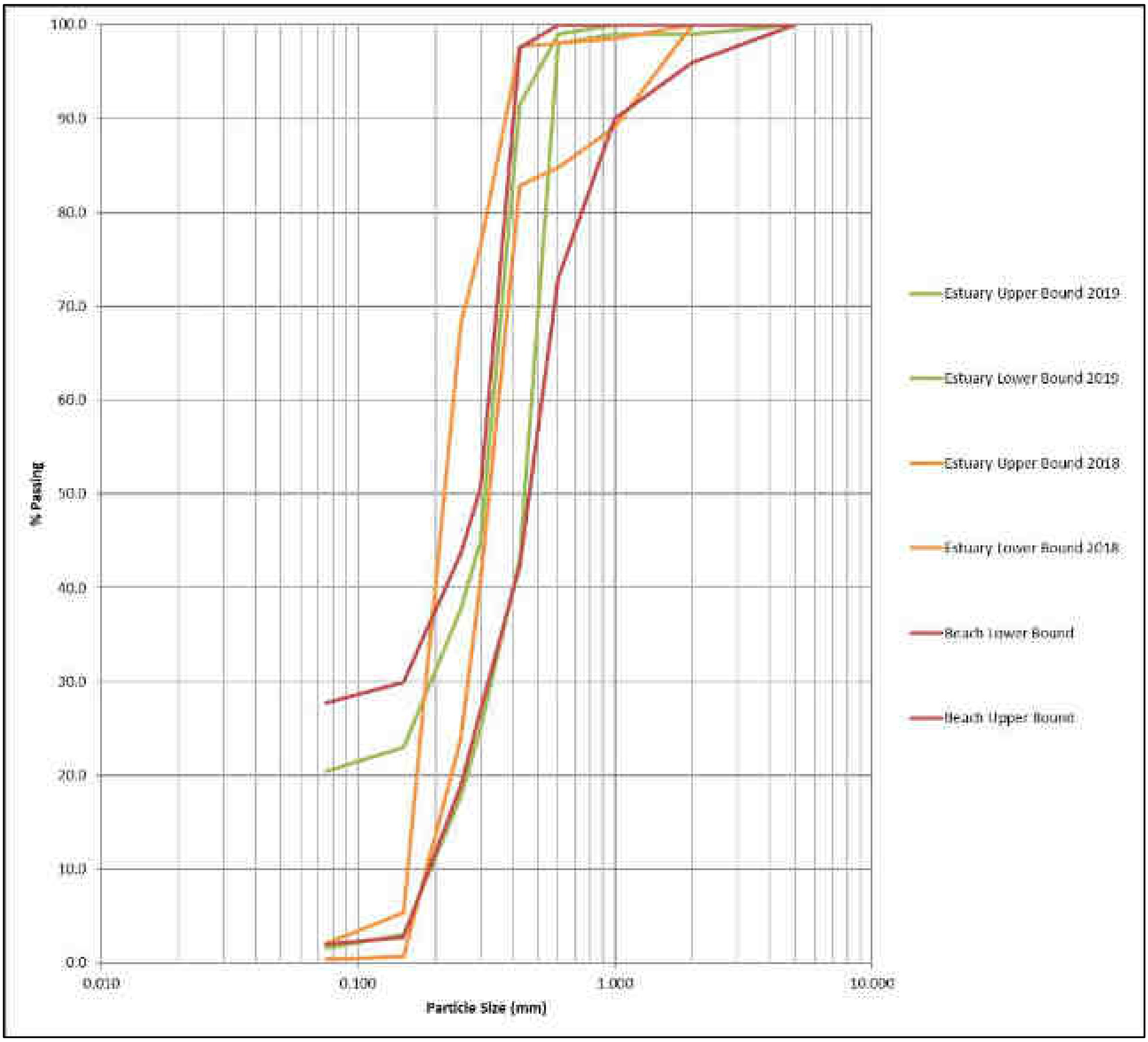

Figure 4.9: Comparison of the cumulative particle size envelopes for all samples collected from the beach of St Francis Bay and the Kromme Estuary.

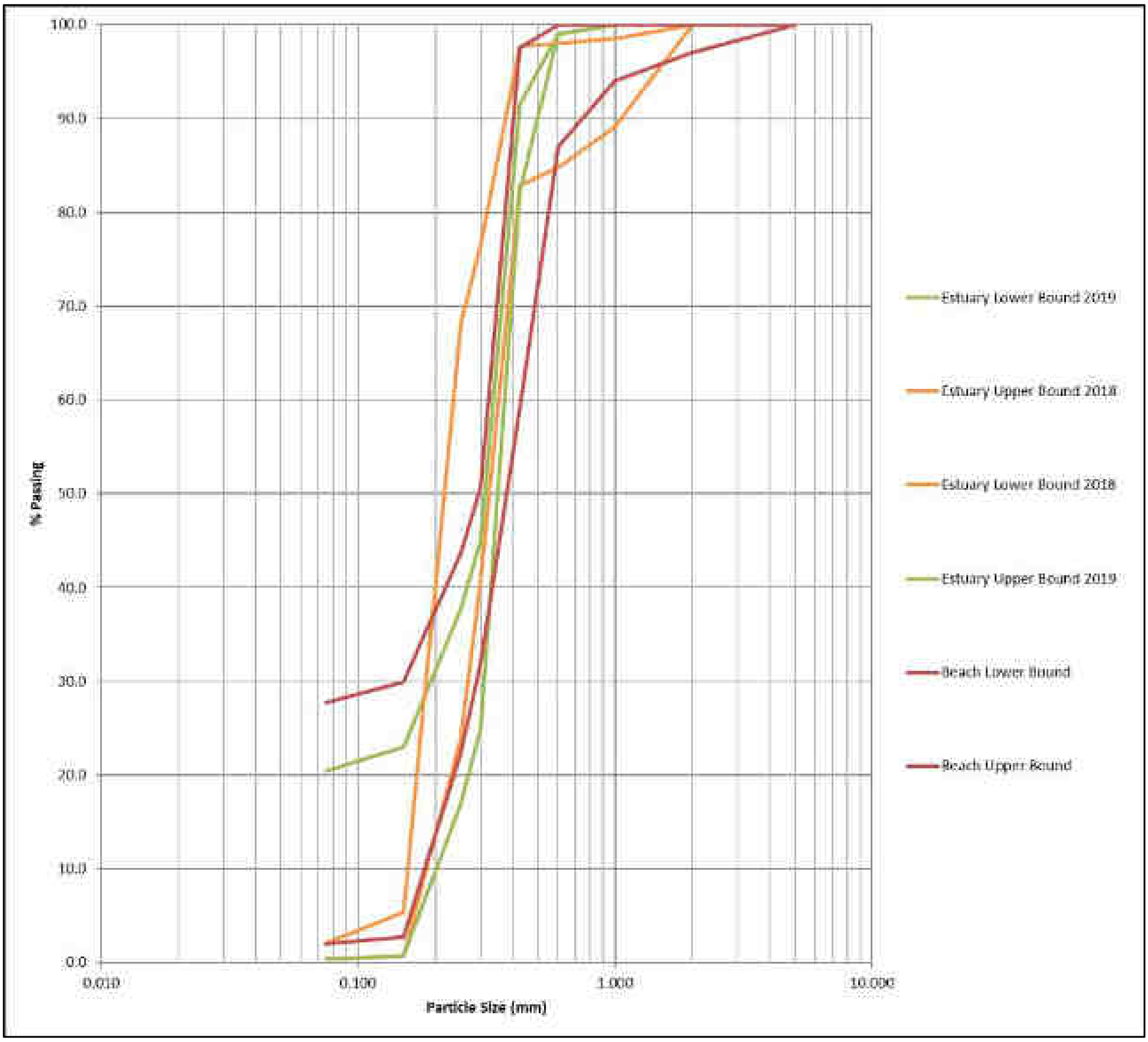

Figure 4.10. Comparison of the cumulative particle size envelopes for samples collected from the beach of St Francis Bay and the Kromme Estuary apart from the two coarser samples.

The comparisons show that overall the particle sizes of the sediment in the estuary are finer than along the beach. There are many samples (mainly in the 2018 data collection) that have median particle sizes less than 0.3 mm, of which there are none in the set of beach samples. However, there is significant overlap of the particle size envelopes from the estuary and beach, particularly between the data collected in 2019. The 2019 estuary samples have median particle sizes (0.31 mm to 0.35 mm) that are compatible with the median particle sizes of the beach (0.3 mm to 0.38 mm). Also, the compatibility at the finer and coarser ends of the envelopes is good.

Given the similarity of the particle size envelopes from the intertidal areas on the south side of the Kromme Estuary and the beach of St Francis Bay, it is concluded that the source (intertidal estuary) and receiver (beach) sites are compatible with respect to particle size distribution. The similarity of particle size distributions between the upper, middle and lower intertidal parts of the estuary indicates that, based on particle size alone, there is no preferred location for extraction of sediment. Also, it is likely that sediments in the subtidal channel, which were not sampled, would be coarser than the adjacent intertidal areas (due to higher current velocities), and so also compatible with the beach.

Table 4.4: Statistical parameters for the cumulative particle size envelopes in the Kromme Estuary and beach of St Francis Bay. Numbers without brackets are for all samples. Numbers in brackets are for samples with the two coarser samples removed from the data.

Location and Date	Median (d_{50}) (mm)		d_{10} (mm)		d_{90} (mm)	
	Lower	Upper	Lower	Upper	Lower	Upper
St Francis Bay beach - April 2019	0.3	0.47 (0.38)	<0.075	0.19	0.40	1.00 (0.75)
Kromme Estuary - December 2018	0.22	0.31	0.16	0.18 (0.19)	0.38	1.10
Kromme Estuary - April 2019	0.31	0.45 (0.35)	<0.075	0.19 (0.20)	0.42 (0.41)	0.58 (0.50)

4.2.4 *Material Availability*

The area of the Kromme Estuary downstream of the R330 road bridge, including both intertidal and subtidal areas, is about 1.5 million m^2. On the assumption that a maximum of 1 million m^3 of capital sediment would be excavated, this would equate to an average depth of removal of about 0.67 m over the entire area. If only 500 000 m^3 would be required, the average extraction depth would reduce to 0.33 m. The sampling in 2019 showed that the sand at specific locations in the intertidal areas is at least 1.8 m thick. Although this thickness may reduce towards the channel where the topography lowers, and is not proven across all the intertidal areas, it is likely that there would be enough sediment in the estuary to meet the requirements of the proposed beach nourishment.

The current locations for potential extraction are based on high-level GIS mapping of the sand banks and estuarine channel, including vegetated sand bank areas where necessary. The Client has also requested that a buffer area from the edge of the Kromme Estuary mouth sand bank is maintained in order to avoid the disturbance of this amenity (Figure 4.11). The recommended 50 m to 100 m buffer between the dredge area and the river channel (as per the ASR recommendations outlined in Section 3.3.3) has not been considered due to the fact that it has been proposed that the main channel would also be dredged in order to obtain the necessary quantity of sand, and to improve the navigability of the system. The total sand that can be extracted based on these values equates to 1 074 000 m^3 (Table 4.5).

Table 4.5: Potential sand available from each source area (assuming 1m deep excavations from the channel and 2m deep excavations from the intertidal areas).

Priority / Secondary Area	Label	Area (m^2)	Depth (m)	Volume (m^3)
Priority Area	P1	167 000	1	167 000
Secondary Area	S1	108 000	2	216 000
			Subtotal	***383 000***
Priority Area	P2	296 000	1	296 000
Secondary Area	S2	19 000	2	38 000
	S3	20 000	2	40 000
			Subtotal	***374 000***
Priority Area	P3	57 000	1	57 000
	P4	42 000	1	42 000
Secondary Area	S4	35 000	2	70 000
	S5	74 000	2	148 000
			Subtotal	***317 000***

Priority Areas	562 000
Secondary Areas	512 000
GRAND TOTAL	1 074 000

Figure 4.11: Location of sand sourcing areas.

4.2.5 *Potential Changes to the Hydrodynamics of the Kromme Estuary*

The increased tidal volume within the Kromme Estuary could result in the potential to change the local sedimentation patterns and the configuration of the intertidal and subtidal area in the lower reaches of the estuary:

- The variation in current velocity inside the estuary and along the riverbanks due to dredging is generally very small (Advisian, 2020). This is unlikely to have a significant effect on sedimentation within the system.
- The change in current velocity at the mouth of the estuary. Initially (i.e. immediately after dredging), the current velocity decreases significantly, by as much as 1.6 m/s at the mouth. Lower velocities are expected to result in additional sedimentation/deposition of material. However, this decrease in current velocities are expected to be a temporary phenomenon until the bathymetry of the estuary mouth get smoothed out by natural hydrodynamics and morphological evolution over the time. Thereafter, current velocities are expected to return to the pre-dredging velocity and sediment regime.
- Even though the mouth is expected to become more of a depositional environment immediately following the dredging is not expected to result in the closure of the estuary mouth.

The scale and geographical distribution of these changes would depend on where and to what depth the sediment would be deposited or removed. Once the entire coastal protection solution is implemented, the maintenance requirement of approximately 25 000 to 50 000 m^3 per year would be similar to or less than the estimated accretion rate for the intertidal areas supplemented by the ongoing maintenance dredging of the marina canal system.

5 SITE SENSITIVITY AND PROPOSED MONITORING PROTOCOL

According to Appendix 6, Section 1 (1), of the 2014 EIA Regulations (as amended in 2017), "*A specialist report prepared in terms of these Regulations must contain—*

(f) Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;

(g) An identification of any areas to be avoided, including buffers;

(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; and

(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation.""

5.1 Site Sensitivity

Removal of large volumes of sediment from the Kromme Estuary has the potential to change the physical and sedimentary processes operating both locally and further afield. It must be noted, however, that the intention is not to remove all sand bank features from the Kromme Estuary, but rather to remove portions of the sand banks and to dredge the main channel of the estuary. An analysis of the ecological sensitivity of the estuary is beyond the scope of this study and the reader is thus referred to the Estuarine Impact Assessment report (CES, 2019) for the details of the site ecological sensitivity.

5.2 Monitoring Requirements

ASR (2006) recommended that following implementation of the proposed beach nourishment, a regular monitoring programme should be implemented to include the following:

- Beach profiles must be measured along the St Francis Bay beach, preferably at the same locations that have been measured in the past;
- The monitoring of wave and wind conditions must be conducted;
- A detailed log of sediment discharge quantities must be maintained by the dredging Contractor in order to track the exact volume of sediment that is removed from the estuary; and
- Changes to beach management practices to be instituted as required.

Regular bathymetric surveys of the lower Estuary area should be undertaken once dredging commences, and post-dredging. These monitoring data will provide valuable information on the sediment distribution, accumulation and transport within this dynamic estuarine system, which can be used to assess the volumes of sediment entering this flood-dominated system and any future modifications to the dredging scheme that need to be implemented.

Periodic profiles of the river should be undertaken in order to monitor erosion of the banks of the Kromme River. In addition to this, the monitoring regime included in the Estuarine Impact Assessment report (CES, 2019) must be incorporated into the project Environmental Management Programme (EMPr).

6 IMPACT ASSESSMENT

According to Appendix 6, Section 1 (1), of the 2014 EIA Regulations (as amended in 2017), "*A specialist report prepared in terms of these Regulations must contain—*

(cB) A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change."

The proposed project and associated sourcing of beach nourishment material will have a number of impacts on the Kromme Estuary. The majority of the impacts associated with the proposed sand sourcing are included in the Estuarine Impact Assessment report (CES, 2019). The section below assesses the effects associated with the sourcing of material with particular focus on the potential changes to the hydrodynamics of the Kromme Estuary. The significance ratings included in this section refer to the magnitude of the potential change to the hydrodynamics. The changes to the hydrodynamics may also not necessarily be negative as there is the potential for positive impacts to result from the deviations to the channel and intertidal areas. For the purposes of assessing the worst-case scenario, the impacts included below have been rated as negative impacts. In addition, recommended mitigation measures have been included for the construction and operational phases.

6.1 Existing Impacts

EXISTING IMPACT 1: INCREASED SEDIMENTATION OF THE KROMME ESTUARY

Cause and Comment

The lower reaches of the Kromme Estuary have become sediment loaded as a result of the upstream river impoundments (i.e. the Impofu and Churchill dams) which have altered the hydrodynamics and effectively removed the ability of large flood events to flush sediment accumulated in the lower reaches of this flood-tide dominated estuary system. It is understood that occasional freshwater releases from the Mpofu Dam do occur, but it is unlikely that these events result in a significant "flushing" of the estuary.

Significance Statement

EXISTING IMPACT 1: INCREASED SEDIMENTATION OF THE KROMME ESTUARY						
IMPACT	EFFECT			RISK OR LIKELIHOOD	REVERSIBILITY	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT			
Existing Impact	Long Term	Study Area	Severe	Definite	Difficult	HIGH-

6.2 Impacts Associated with the Construction and Operational Phases

The construction phase is considered to include the dredging associated with the capital works (i.e. the sediment required for the initial beach nourishment). The operational phase is considered to be when capital material is not being extracted (i.e. no dredging) or when dredging for maintenance purposes is taking place. It is anticipated that maintenance dredging will be of significantly smaller scale than that employed during construction. For this reason, the impacts included in this section are assessed according to their significance during the construction phase because that is the worst-case scenario.

PROJECT IMPACT 1: INCREASE IN THE TIDAL PRISM OF THE KROMME ESTUARY

Cause and Comment

Removal of large volumes of sediment from the Kromme Estuary has the potential to change the physical (hydrodynamics) and sedimentary processes within the estuarine system (Anderson, 2008). Previous hydrodynamic modelling studies (CSIR, 1992; WPR, 1993; Entech, 2002b; Klages *et al.*, 2002) indicated that the removal of 600 000 m^3 of sediment from the sand bank adjacent to the river mouth would lead to an increase in tidal prism (volume of water within the estuary between mean low tide level and mean high tide level) of less than 10% (Entech, 2002b). This has been confirmed through recent modelling carried out by Advisian (2020a). Their findings indicate that the dredging of the river, and in particular the area around the river mouth will allow the water to drain out more effectively. This in turn lowers the low-water level (with respect to MSL) resulting in the exposure of previously submerged sandbanks within the estuary.

The sandbanks exposed under existing conditions is calculated at 52 ha. Following the dredging activity (assuming the full extraction volume) the exposed sandbanks exposed equate to 51 ha. However, it is assumed that this low water level will be a variable phenomenon in any case given the dynamic nature of the river mouth which will govern this low tide level. This may lead to exposure of shallow non-dredged areas within the estuary during low tides.

In this respect, the proposed sand sourcing could be considered a permanent change to the system if all the sediment for the capital works was removed in one phase. Given that this project is likely to progress in phases the estuary is likely to reach a new equilibrium following each phase of the work.

Possible Mitigation Measures

- Maintain the current main sand bank adjacent to Area S1 as per Figure 4.11 to act as a sand sink (i.e. a place for sand to accumulate);
- Avoid sensitive areas identified in the Estuarine Report; and
- At the completion of the initial phases (i.e. Phase 1 and Phase 2), monitor the flow and sedimentation rates of the system to assess the changes, if any, to the hydrodynamics. Use this data to inform the subsequent phases of sand sourcing.

Significance Rating

PROJECT IMPACT 1: INCREASE IN THE TIDAL PRISM OF THE KROMME ESTUARY						
IMPACT	EFFECT			RISK OR LIKELIHOOD	REVERSIBILITY	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT			
Without Mitigation	Long Term	Study Area	Slight	Probable	Difficult	LOW -
With Mitigation	Long Term	Localised	Slight	Probable	Difficult	LOW -

PROJECT IMPACT 2: DEVIATION OF THE MAIN ESTUARINE CHANNEL AND RIVER MOUTH

Cause and Comment

The removal of sand from the intertidal areas, together with the subsequent changes to the hydrodynamics of the Kromme Estuary and mouth, could result in the realignment of the main estuarine channel. While the modification of the course of the main channel is not planned, the dredging activity could result in it changing its current orientation or 'straight-lining' its path resulting in potential impacts to habitats (dunes) and features (property, infrastructure) along the banks.

Recent hydrodynamic modelling showed that current velocities are unlikely to change significantly as a result of the dredging, other than at the mouth. These modified velocities are expected to be temporary and while there might be some movement of the mouth it is unlikely to be a dramatic shift. Similarly, the only realignment of the channel is likely to occur under high flow conditions and not necessarily as a result of the dredging.

In addition, it is understood that there is underlying rock on the northern side of the mouth which would work to fix the position of the mouth under normal conditions.

Possible Mitigation Measures
- Maintain the main sand bank adjacent to S2 as per Figure 4.11 in order to ensure that the effect of the increased tidal prism do not result in deviation of the river mouth; and
- The dredging of the estuary should be undertaken in a manner which does not significantly alter the current orientation of the existing main estuarine channel, which will require ongoing monitoring of the channel's location and bathymetry.

Significance Rating

PROJECT IMPACT 2: DEVIATION OF THE MAIN ESTUARINE CHANNEL						
IMPACT	EFFECT			RISK OR LIKELIHOOD	REVERSIBILITY	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT			
Without Mitigation	Long Term	Study Area	Slight	Probable	Very Difficult	LOW -
With Mitigation	Long Term	Localised	Slight	Probable	Very Difficult	LOW -

PROJECT IMPACT 3: EROSION OF THE KROMME RIVER BANKS AND ST FRANCIS BEACH SPIT

Cause and Comment
Because the Kromme Estuary currently contains a large volume of sediment, the increase in tidal prism due to extraction is likely to be at least 10% (Anderson, 2008). Advisian's (2020) modelling results confirm that the estuary volume will increase. However, the modelling output also indicates that none of the dredging scenarios they tested led to any substantial changes in current velocities within the estuary under normal and/or flood conditions. They concluded that the currents outside the main channel (i.e. near to the banks) and in particular on the northern bank are low (up to 0.2m/s) and that the dredging would not lead to any significant change in the currents. This suggests that erosion of the banks of the river, as a result of the dredging, is unlikely.

Any increase in current velocities have the ability to transport sediment. With current velocities increasing in the mouth under certain conditions, the integrity of the northern end of the spit could be put at risk through erosion. The project is anticipating nourishing the spit area which is also protected by revetments and future groyne infrastructure. While material is expected to be transported in the area, ongoing maintenance of sand material on the spit is planned as part of this project.

Impacts would be immediate during the construction phase when a large volume of sand is removed over a comparatively short time period. However, impacts would diminish to lower levels during operation phase when only maintenance beach nourishment will take place.

A further risk arises from significant flooding of the river under certain unfavourable conditions. For example, a river flood on an ebb tide would exacerbate the situation.

Possible Mitigation Measures
- Please refer to Project Impact 1 and 2 mitigation measures.

Significance Rating

PROJECT IMPACT 3: EROSION OF THE KROMME RIVER BANKS AND ST FRANCIS BEACH SPIT						
IMPACT	EFFECT			RISK OR LIKELIHOOD	REVERSIBILITY	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT			
Without Mitigation	Long Term	Study Area	Slight	May Occur	Very Difficult	LOW -
With Mitigation	Long Term	Localised	Slight	May Occur	Very Difficult	LOW -

6.3 Cumulative Impacts

At present, the specialist is not aware of any other proposed developments within the study area which may contribute to the cumulating of impacts associated with the sourcing of beach nourishment material. The impact below is thus accumulation of an existing impact together with that which is likely to occur as a result of the proposed coastal protection infrastructure development.

CUMULATIVE IMPACT 1: EROSION OF ST FRANCIS BEACH SPIT AND KROMME RIVER BANKS

Cause and Comment

Extraction of sand from the Kromme Estuary will lead to an increase in the volume of water that will enter and leave the estuary between high tide and low tide. This could lead to changes in the configuration of the estuary mouth through the loss of the northern end of the spit (to the north of the northern most groyne) (please refer to Section 4.2.5). However, according to Advisian's modelling of the post-dredging scenario of the Kromme Estuary, normal conditions (i.e. current velocity) are expected to return following the dredging activity. Therefore, while the mouth of the estuary may move it is unlikely to be significant.

The increased volume of water being able to flow during flooding periods could lead to the possible reconfiguration of the channel (both downstream and upstream of the bridge) especially if the dams upstream are at capacity or overtopping. This phenomenon would occur naturally under flood conditions and the dredging of the Kromme Estuary is unlikely to influence this (Advisian, 2020).

Possible Mitigation Measures

- Please refer to Project Impact 1 and 2 mitigation measures; and
- Maintenance of the sandbank adjacent to S1 may provide a buffer to the marina complex and to the spit revetment and groyne during a flood event, providing a more resilient estuarine system.

Significance Rating

CUMULATIVE IMPACT 1: EROSION OF ST FRANCIS BEACH SPIT AND KROMME RIVER BANKS						
IMPACT	EFFECT			RISK OR LIKELIHOOD	REVERSIBILITY	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT			
Without Mitigation	Long Term	Study Area	Slight	Probable	Difficult	LOW -
With Mitigation	Long Term	Localised	Slight	Probable	Difficult	LOW -

6.4 Levels of Acceptable Change

The impacts resulting from the hydrodynamic changes to the Kromme Estuary because of the proposed removal of sediment are both ecological and social and can be more predictable with the modelling that has been carried out. The ecological impacts can be quantified based on the habitats that may be disturbed during the removal of sediment. Please refer to the Estuarine Specialist Report for more information.

From a socio-economic perspective, the estuary offers amenities through recreational use of the exposed sandbanks at low water to boating activities during the higher tides. The direct impact of the removal of material from the system is the loss of sand bank area to the modification of the hydrodynamics, which result in potential increases in current velocity. The benefits from a larger volume of water in the lower reaches is improved navigability for boating and an increase in area for other water-based activities. Please refer to the Scoping Report and subsequent EIR for more information.

Therefore, while the impacts from the change in hydrodynamics have been qualified, and quantified using available data and modelling, determining the exact impacts is based on a precautionary approach.

On a broad-scale, an unacceptable change is considered to be significant erosion of the intertidal areas as well as any subsequent catastrophic damage to existing infrastructure which the work carried out suggests is unlikely to happen under normal and flood conditions.

7 CONCLUSIONS AND RECOMMENDATIONS

According to Appendix 6, Section 1 (1), of the 2014 EIA Regulations (as amended in 2017), "*A specialist report prepared in terms of these Regulations must contain—*

(j) A description of the findings and potential implications of such findings on the impact of the proposed activity or activities;

(k) Any mitigation measures for inclusion in the EMPr;

(l) Any conditions for inclusion in the environmental authorisation;

(n) A reasoned opinion—

(i) whether the proposed activity, activities or portions thereof should be authorised;

(iA) regarding the acceptability of the proposed activity or activities; and

(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan."

7.1 Summary of Findings

Table 7.1 provides a summary of the existing and the potential impacts associated with the proposed project, in terms of the removal of sediment for beach nourishment source material.

Table 7.1: Summary of Existing and Potential Impacts.

PHASES OF DEVELOPMENT & POTENTIAL IMPACTS	SIGNIFICANCE	
	WITHOUT MITIGATION	WITH MITIGATION
EXISTING IMPACTS		
Increased Sedimentation of the Kromme Estuary	HIGH-	*N/A*
CONSTRUCTION AND OPERATIONAL PHASE		
Increase in the Tidal Prism of the Kromme Estuary	LOW-	LOW-
Deviation in the Main Estuarine Channel and mouth position	LOW-	LOW-
Erosion of the St Francis Beach Spit and Kromme River Banks	LOW-	LOW-
CUMULATIVE IMPACTS		
Erosion of the St Francis Beach Spit and Kromme River Banks	LOW-	LOW-

In addition, CES has made the following conclusions pertaining to the results from the beach nourishment source material study:

- The source (intertidal estuary) and receiver (beach) sites are compatible with respect to particle size distribution;
- The similarity of particle size distributions between the upper, middle and lower intertidal parts of the estuary indicate that, based on particle size alone, there is no preferred location for extraction of sediment;
- It is likely that sediments in the subtidal channel, which were not sampled, would be coarser than the adjacent intertidal areas (due to higher current velocities), and therefore also compatible with the beach sediment;
- The sampling in 2019 showed that the sand at specific locations in the intertidal areas is at least 1.8 m thick;
- The total sand that can be extracted, based on high-level GIS mapping (where the material removed from the main channel is dredged to 1 m below the current level and the material removed from the intertidal areas is dredged to 2 m below the surface) equates to 1 074 000 m^3;
- The increased tidal prism within the Kromme Estuary could result in the potential to change the local sedimentation patterns and the configuration of the intertidal and subtidal area in the lower reaches of the estuary; and

- The abovementioned changes to the hydrodynamics of the Kromme Estuary are likely to have several negative and/or positive ecological and socio-economic impacts which are beyond the scope of this report. These impacts will be dealt with in the Estuarine Impact Assessment and the EIA.

7.2 Summary of Mitigation Measures

Table 7.2 below lists the mitigation measures which need to be implemented to mitigate the significance of the abovementioned impacts.

Table 7.2: Summary of Mitigation Measures.

PHASES OF DEVELOPMENT & POTENTIAL IMPACTS	MITIGATION MEASURES
EXISTING IMPACTS	
Increased Sedimentation of the Kromme Estuary	• Not Applicable
CONSTRUCTION AND OPERATIONAL PHASES	
Increase in the Tidal Prism of the Kromme Estuary	• Limit the removal of sediment from Areas P3, P4, S4 and S5 upstream of the road bridge to limit the influence of the tidal prism above the bridge; • Maintain the current main sand bank adjacent to Area S1 as per Figure 4.11; • Avoid the sensitive areas identified in the Estuarine Report; and • At the completion of the initial phases (i.e. Phase 1 and Phase 2), monitor the flow and sedimentation rates of the estuary to assess the changes, if any, to the hydrodynamics. Use this data to inform the subsequent phases of sand sourcing.
Deviation of the Main Estuarine Channel	• Maintain the main sand bank adjacent to Area S1 as per Figure 4.11 in order to ensure that the effect of the increased tidal prism do not result in deviation of the river mouth; and • The dredging of the estuary should be undertaken in a manner which does not significantly alter the current orientation of the existing main estuarine channel, which will require ongoing monitoring of the channel's location and bathymetry.
Erosion of the St Francis Beach Spit and Kromme River Banks	• Please refer to Project Impact 1 and 2 mitigation measures; and • The spit to the north of the northern most groyne should not be protected to allow movement of the mouth
CUMULTIVE IMPACTS	
Erosion of the St Francis Beach Spit and Kromme River Banks	• Please refer to Project Impact 1 and 2 mitigation measures; • Maintenance of the sandbank adjacent to S2 may provide a buffer to the marina complex and to the spit revetment and groyne during a flood event providing a more resilient estuarine system.

7.3 Conditions for Inclusion in the Environmental Authorisation

It is recommended that the following conditions are included in the Environmental Authorisation for the proposed coastal protection project:

1. A regular monitoring programme should be implemented to include the following:
    - Beach profiles must be completed along the St Francis Bay beach, preferably at the same locations that have been measured in the past;
    - Regular bathymetric surveys of the lower Estuary area should be undertaken pre-dredging, once dredging commences, and post-dredging. This monitoring data will provide valuable information on the sediment distribution, accumulation and transport within this dynamic

estuarine system, which can be used to assess the volumes of sediment entering this flood-dominated system and any future modifications to the dredging scheme that need to be implemented. The monitoring surveys could be carried out using a fish finder from a ski boat with reference to a fixed datum;
- Periodic beach profiles of the river should be undertaken to monitor erosion of the banks of the Kromme River;
- A detailed log of sediment discharge quantities must be maintained by the dredging Contractor in order to track the exact volume of sediment that is removed from the estuary.

2. The monitoring regime included in the Estuarine Impact Assessment report (CES, 2019) must be incorporated into the project Environmental Management Programme (EMPr).

7.4 Specialist Opinion

The conclusion is that a large volume of material will be removed from the system to realise the full nourishment of the St Francis Bay frontage. This has the potential for changes to hydrodynamics of the estuary. However, the significant changes in current velocities are limited to the mouth of the Kromme, and some discreet areas within the estuary under certain conditions. The modelling suggests that, overall, the changes experienced within the estuary are expected to be relatively small. The most notable being the exposure of previously submerged sandbanks and the mouth of the estuary being a depositional environment.

There are significant beneficial impacts through the provision of improved navigability and increase in area for water-based activities through more states of the tide. While it is recognised that alternative sources of sediment may be available (e.g. offshore), they are not necessarily feasible.

It is likely that the dredging and subsequent nourishment of the St Francis Bay frontage may be phased. Therefore, it is deemed suitable to proceed with the project and to evaluate the changes as the project progresses. Mitigation measures for most of the potential negative physical impacts during construction are considered feasible and can be resolved contractually (i.e. measures can effectively be instated to ensure adherence to acceptable environmental norms).

No fatal flaw has been identified.

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Klages N, Cambell E, Schoeman D and Woodridge T (2002) St Francis Bay Beach Erosion Environmental Impact Assessment, Specialist Report, Ecological Impact Assessment of the Preferred Technical Alternatives. July 2002, SAB Institute for Environmental and Coastal Management, IECM Report Number C69.

SRK, 2003, Final Environmental Impact Report: Proposed Beach Erosion Remediation at St Francis Bay – Report 292531.

WPR (1993) St Francis Bay Beach Erosion Pre-feasibility Study of Groyne Construction. Submitted to the St. Francis Bay Municipality, February 1993, Watermeyer Prestedge Retief, Cape Town, Report No. 184/0/1, 29p.

APPENDIX A – SPECIALIST DETAILS AND UNDERTAKING UNDER OATH

Province of the
EASTERN CAPE
ECONOMIC DEVELOPMENT, ENVIRONMENTAL AFFAIRS & TOURISM

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST IN TERMS OF REGULATIONS 12 AND 13 OF THE AMENDMENTS TO THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014 AS AMENDED.

	(For official use only)
File Reference Number:	
NEAS Reference Number:	
Date Received:	

Application for environmental authorization in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Amendments to the Environmental Impact Assessment Regulations, 2014. This form is valid as of 6 January 2021.

PROJECT TITLE

COASTAL PROTECTION SHCEME, ST FRANCIS BAY, KOUGA MUNICIPALITY, EASTERN CAPE PROVINCE

SPECIALIST:	Mr Roberto Almanza		
Contact person:	Mr Gregory Shaw		
Postal address:	67 African Street, Grahamstown		
Postal code:	6139	Cell:	+27 606 715 914
Telephone:	046 622 2364	Fax:	
E-mail:	g.shaw@cesnet.co.za		
Professional affiliation(s) (if any)			

Project Consultant:	CES		
Contact person:	Mr Gregory Shaw		
Postal address:	67 African Street, Grahamstown		
	6139	Cell:	+27 606 715 914
Postal code:			
Telephone:	046 622 2364	Fax:	
E-mail:	g.shaw@cesnet.co.za		

4.2 The SPECIALIST

I, Roberto Almanza , declare that –

General declaration:

- I act as the independent Specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting environmental impact assessments, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in regulation 8 of the regulations when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by

interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;

- I will keep a register of all interested and affected parties that participated in a public participation process; and
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- all the particulars furnished by me in this form are true and correct;
- will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I realise that a false declaration is an offence and is punishable in terms of section 24F of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Amendments to Environmental Impact Assessment Regulations, 2014 as amended.
- I have ~~a vested interest in the proposed activity proceeding, such vested interest being:~~

Signature of the environmental assessment practitioner

Coastal and Environmental Services (Pty) Ltd.

Name of company.

4th February 2021

Date.

Signature of the Commissioner of Oaths

04TH FEBRUARY 2021

Date:

Commissioner of Oaths

Designation.

* Curriculum Vitae (CV) attached

Official stamp (below).

LYNN SMIT
COMMISSIONER OF OATHS
REFERENCE NUMBER: 9/1/8/2 EAST LONDON
25 TECOMA STREET, BEREA
EAST LONDON, 5214

Annexure 1

CV

Curriculum Vitae

ROBERTO DANIEL ALMANZA

117 Cape Road, Mount Croix, Port Elizabeth
Mobile: +27 82 930 8711, Email: roberto@habitatlink.co.za

Identity number	9002255020080
Nationality	South African
Languages	English
Driver's licence	Code B

PERSONAL PROFILE

I obtained my BSc (Environmental Sciences) from the Nelson Mandela Metropolitan University majoring in Geology and Geography and obtained my BSc Honours in Geology in 2012. I then went on to complete my MSc (Geology) while working as a geology consultant on a number of exploration projects across South Africa. In 2015 I started managing the environmental aspects of several projects from Basic Assessments to Full Scoping and Environmental Impact Reports. I have completed Environmental Auditing, Site Remediation, Water Use Applications and GIS mapping. Recently, I have become involved in several waste-related studies, including waste assessments for large mining projects, contamination assessment and waste license auditing.

EDUCATION AND PROFESSIONAL STATUS

Qualifications
MSc (Geology), Nelson Mandela University, South Africa, 2017
BSc Honours (Geology), Nelson Mandela Metropolitan University, 2013
BSc (Environmental Science), Nelson Mandela Metropolitan University, 2012

Courses
Rhodes University, 2016: "*Environmental Impact Assessment Procedures Short Course*"
WITS University, 2013: "*Geoskills Geological Career Workshop*"

Registration and Membership
Registered as Candidate Natural Scientist with SACNASP (Registration No 117472)
IAIA Member since 2016

EMPLOYMENT AND JOB RESPONSIBILITIES

November 2019 – current

HABITAT LINK CONSULTING
Senior Environmental Consultant
- Environmental impact assessments
- Environmental management programs
- Environmental advisory services
- Project management & report writing

August 2015 – October 2019

COASTAL & ENVIRONMENTAL SERVICES (CES)
Environmental Consultant
- Project management
- Environmental impact assessments

- Environmental compliance monitoring
- Waste Specialist Studies
- Water Use Licence Applications
- GIS
- Public Participation

March 2013 – July 2015

MARIRI TRADING (LOERIE RUSKAMP)
Geologist

- Exploration Geology
- Fieldwork
- Drilling Programmes
- GIS
- Ore determinations

LIST OF ENVIRONMENTAL PROJECTS AND ROLES

EIAs and Basic Assessments – Project Management and Report Writing

- Wolverton Citrus Development EIA
- Addo Wildlife Big 5 Game Reserve BA
- Keurkloof Citrus Development EIA
- Uster Rangers Piggery BA
- Nelson Mandela Bay Municipality Fish Water Flats WWTW Biogas Plant EIA
- Ganspan, Northern Cape Recreational and Tourism Area Scoping and EIA
- St Francis Coastal Protection Scheme Scoping Report
- Waterfall Citrus Development Scoping Report
- Coega Marine Pipeline Scoping Report
- Innowind Grassridge Wind Energy Farm Transmission Infrastructure BA
- Polokwane N1 Ringroad Eskom Line Deviation BA
- General Motors SA Waste Recycling Facility BA
- SANBI Pretoria National Botanical Gardens Exhibition Centre BA
- Transnet Boshoek and Heysterkrand Railway Loops BA
- Kouga Local Municipal Library BA
- Slang River Low-Level Crossing Proposed Upgrade BA
- Wicklow Citrus Basic Assessment Report BA
- ACSA Ekurhuleni Metropolitan Municipality Filling Station BA
- Senqu Local Municipality Pedestrian Bridges BA

Section 24G Rectifications and EIA Amendments - Project Management and Report Writing

- Diepriver Dam Expansion and Vegetation Clearance S24G
- Royalston Estate Layout EIA Amendment
- Seriso Cultivation S24G
- Nelson Mandela Bay Municipality Fish Water Flats WWTW Biogas Plant EIA Amendment
- Innowind Grassridge Wind Energy Farm Transmission Infrastructure Amendment

Waste Assessments

- Kenmare, Pilivili Mozambique, Heavy Mineral Sands
- Suni Resources Balama Graphite Mine, Mozambique
- Wool Trust Deal Party Soil Contamination
- Automotive Industry Development Centre (AIDC) Paint Manufacturing Facility
- Nirove Paint Stripping Facility

Water Use License Applications

- Glen Hurd Drive Proposed Upgrades
- Graaff-Reinet WWTW
- SANRAL N2 Upgrade Caledon to Riviersondend
- Kap River Low-Level Crossing
- WBHO N2 Fish River Abstraction
- Makana Residential Development
- Andrieskraal Senior Primary School
- Transnet Boshoek Railway Loop
- Fishwater Flats WWTW

Environmental Auditing

- Gibson Bay Wind Energy Farm – Temporary Onsite ECO
- Cemza Cement – Water Use Licence Audit
- General Motors (Isuzu) Waste License Audits
- Paterson WWTW Upgrade
- KwaNobuhle WWTW Upgrade
- Aberdeen Bulk Water Pipeline
- Khayamnandi Extension Construction Site
- Transnet National Ports Authority Vulindlela Site – Site Remediation and Closure Audit
- Transnet National Ports Authority Sand Removal – Site Demarcation and Monitoring
- Capeco Fairview Ascot Housing Development
- AHS Civils Raymond Mhlaba Housing Development
- Fishwater Flats WWTW
- Own Haven Housing, Victoria Drive Housing Development

REFERENCES

Mrs Christelle du Plessis:
Director at Habitat Link Consulting (christelle@habitatlink.co.za)

Dr Chantel Bezuidenhout:
Branch manager at CES Port Elizabeth (c.bezuidenhout@cesnet.co.za)

Mr Jo van Heerden:
Owner of Mariri Trading (mwjjvh@mweb.co.za)

APPENDIX B – LABORATORY RESULTS

TOSCALAB (Pty) Ltd.
CIVIL ENGINEERING MATERIALS LABORATORY
Reg.No. 2011/203092/07

96 Uitenhage Road, Sydenham, PE, 6001
PO Box 27067, Greenacres, PE, 6057
Tel: +27 (0)41 487-3136 - Fax: +27 (0)41 487-3168
E-mail: info@toscalab.co.za

ISO/IEC 17025 ACCREDITED

sanas Testing Laboratory
T 0481

CLIENT: Coastland Environmental Services
67 African Street
Grahamstown

PROJECT : CES Dredging
JOB/ROAD : C21480
SUBMISSION DATE : 19.12.2018
DATE TESTED : 10.01.2019
REPORT DATE : 14.01.2019

ATT: Mr. G Shaw
REF: -
SAMPLING PROCEDURE: Delivered to the laboratory

FOUNDATION INDICATOR RESULT SUMMARY

SAMPLE NUMBER	S4600	S4601	S4602	S4603	S4604	S4605
LAYER	-					
STAKE VALUE	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
POSITION	-					Vestream
OFF SET	-					
DEPTH M	-					
DESCRIPTION	Light Brown Fine sand	Light Brown Fine Sand	Light Brown Fine Sand	Light Brown Fine Sand	Light Brown Fine Sand	Light Brown Fine Sand
MATERIAL CLASSIFICATION	-	-	-	-	-	-

SIEVE ANALYSIS - TMH 1 Test Method A1, A2, A3, A5 & A6

PASSING						
75.0 mm						
63.0 mm						
53.0 mm						
37.5 mm						
26.5 mm						
19.0 mm						
13.2 mm						
4.75 mm						
2.00 mm	100	100	100	100	100	100
0.425 mm	96	97	96	93	98	82
0.075 mm	1	2	1	0	1	1
0.060 mm	0	0	0	0	0	0
0.006 mm	0	0	0	0	0	0
0.0016 mm	0	0	0	0	0	0

SOIL MORTAR ANALYSIS - TMH 1 Test Method A5

Soil Mortar Analysis % < 2.00mm						
2.000 - 0.425	4	3	3	7	2	17
0.425 - 0.250	28	47	54	68	50	59
0.250 - 0.150	63	45	41	25	46	22
0.150 - 0.075	4	3	1	0	1	1
< 0.075	1	2	1	0	1	1

ATTERBERG LIMITS : TMH 1 Test Method A2 - A4

LIQUID LIMIT	-	-	-	-	-	-
PLASTICITY INDEX	NP	NP	NP	NP	NP	NP
LINEAR SHRINKAGE	0.0	0.0	0.0	0.0	0.0	0.0

RELATIVE DENSITY: TMH1 1986 A12T

RELATIVE DENSITY - (g/ml)	2.65	2.60	2.63	2.63	2.65	2.63

C.B.R. : TMH 1 Test Method A7 - A8

MOD AASHTO (Kg/m³)	-	-	-	-	-	-
O.M.C. (%)	-	-	-	-	-	-
C.B.R. @ 100% COMPACTION	-	-	-	-	-	-
C.B.R. @ 98 % COMPACTION	-	-	-	-	-	-
C.B.R. @ 95 % COMPACTION	-	-	-	-	-	-
C.B.R. @ 93 % COMPACTION	-	-	-	-	-	-
C.B.R. @ 90 % COMPACTION	-	-	-	-	-	-
SWELL (MAASHO) %	-	-	-	-	-	-

Deviation from Test Method : Moisture Contents dried overnight at 105 - 110°C.

Name : Frederick Eksteen
Technical Signatory

TOSCALAB (Pty) Ltd.
CIVIL ENGINEERING MATERIALS LABORATORY
Reg.No. 2014/080892/07
11 Uitenhage Road, Sydenham, PE, 6001
PO Box 27007, Greenacres, PE, 6057
Tel: +27 (0)41 487-3030 • Fax: +27 (0)41 487-3160
E-mail: info@toscalab.co.za
ISO/IEC 17025 ACCREDITED
sanas
testing Laboratory
T 0481

CLIENT: Coastland Environmental Services
67 African Street
Grahamstown

PROJECT : CES Dredging
JOB/ROAD : C21480
SUBMISSION DATE : 10.12.2018
DATE TESTED : 10.01.2019
REPORT DATE : 14.01.2019

ATT: Mr. G Shaw
REF: -
SAMPLING PROCEDURE: Delivered to the laboratory

FOUNDATION INDICATOR RESULT SUMMARY

SAMPLE NUMBER	S4606					
LAYER	-					
STAKE VALUE	Site 7					
POSITION	-					
OFF SET	-					
DEPTH M	-					
DESCRIPTION	Light Brown Fine Sand					
MATERIAL CLASSIFICATION	-					

SIEVE ANALYSIS - TMH 1 Test Method A1, A2, A3, A5 & A6

PASSING	75.0 mm						
	63.0 mm						
	53.0 mm						
	37.5 mm						
	26.0 mm						
	19.0 mm						
	13.2 mm						
	4.75 mm	100					
	2.00 mm	99					
	0.425 mm	89					
	0.075 mm	1					
	0.050 mm	0					
	0.005 mm	0					
	0.0018 mm	0					

SOIL MORTAR ANALYSIS - TMH 1 Test Method A5

Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	11					
	0.425 - 0.250	38					
	0.250 - 0.150	49					
	0.150 - 0.075	2					
	< 0.075	1					

ATTERBERG LIMITS : TMH 1 Test Method A2 - A4

LIQUID LIMIT	-					
PLASTICITY INDEX	NP					
LINEAR SHRINKAGE	0.0					

RELATIVE DENSITY: TMH1 1986 A12T

RELATIVE DENSITY - (g/ml)	2.65					

C.B.R. : TMH 1 Test Method A7 - A8

MOD AASHTO (Kg/m³)	-					
O.M.C. (%)	-					
C.B.R. @ 100% COMPACTION	-					
C.B.R. @ 98 % COMPACTION	-					
C.B.R. @ 95 % COMPACTION	-					
C.B.R. @ 93 % COMPACTION	-					
C.B.R. @ 90 % COMPACTION	-					
SWELL (MAASHTO) %	-					

Deviation from Test Method : Moisture Contents dried overnight at 105 - 110°C.

Name : Technical Signatory

TOSCALAB (Pty) Ltd.
CIVIL ENGINEERING MATERIALS LABORATORY
2014/263602/07

56 Uitenhage Road, Sydenham, PE, 6001
PO Box 27067, Greenacres, PE, 6057
Tel: +27 (0)41 487-3130 - Fax: +27 (0)41 487-3199
E-mail: info@toscalab.co.za
ISO/IEC 17025 ACCREDITED

sanas Testing Laboratory
T 0401

CLIENT : CES
36 Pickering Street
Newton Park
Port Elizabeth
6001
ATT : Mr. R Almanza

PROJECT : St. Francis Bay
JOB CARD : C22311
DATE SAMPLED/RECEIVED: 18.04.2019
DATE REPORTED: 30.04.2019
AMENDED 06.05.2019
SAMPLING PROCEDURE : Delivered to the laboratory

AGGREGATE TEST REPORT

Sample Number	S7240	S7241	S7242	S7243	S7244
Sample Reference	Ex - St. Francis Bay				
Material Description	Sand	Sand	Sand	Sand	Sand
Source	Sand River 1	Mouth 2	Mouth 1	Kromme River 1	South Beach - Low Tide 1

Sieve Analysis (%) Passing - SANS 3001:AG1

SIEVE APERTURE (mm)		S7240	S7241	S7242	S7243	S7244
	63. 0					
	50. 0					
	37. 5					
	28. 0					
	20. 0					
	14. 0					
	10. 0					
	7. 1					
	5. 0		100			100
	2. 0		99		100	97
	1. 0	100	99	100	99	94
	0. 600	99	98	99	99	87
Fines	0. 425	82.2	85.9	43.1	91.5	69.1
	0. 300	25.0	34.7	36.9	45.1	32.0
	0. 150	23.0	3.1	20.9	1.7	3.4
Dust	0. 075	1.7	1.6	20.4	0.9	2.5
Silt + Clay	0. 05					
Clay	0. 005					

Material Characteristics

Test	Units	Method	S7240	S7241	S7242	S7243	S7244
Fineness Modulus		SANS 3001:PR5	1.49	1.68	1.1	1.1	1.9
Flakiness Index		SANS 3001:AG4					
* Chloride Content		SANS 202					
* Presence of Sugar		SANS 5833					
ARD	(g/ml)	SANS3001:AG22					
ACV : Dry	(%)	SANS3001:AG10					
10% FACT: Dry	(kN)	SANS3001:AG10					
10% FACT: Wet	(kN)	SANS3001:AG10					
Wet/Dry Ratio	(%)	SANS3001:AG10					
Loose Bulk Density	(kg/m³)	SANS 5845					
Compacted Bulk Density	(kg/m³)	SANS 5845					

The above test results are pertinent only to the samples received and tested at the laboratory. This report shall not be reproduced, except in full, without the prior consent of Tosca Lab (Pty) Ltd.

* Indicate non-accredited tests

Deviation from Test Method: Air pressure 40mm mercury instead of 100mm mercury

Name : Frederik Eijbers
Technical Signatory

2019.03.27 Release 4: TSF 9.5

TOSCALAB (Pty) Ltd.
CIVIL ENGINEERING MATERIALS LABORATORY
2014/263892/07

58 Uitenhage Road, Sydenham, PE, 6001
PO Box 27067, Greenacres, PE 6057
Tel: +27 (0)41 487-3130 • Fax: +27 (0)41 487-3168
E-mail: info@toscalab.co.za

ISO/IEC 17025 ACCREDITED

sanas Testing Laboratory T 0481

CLIENT : CES
38 Pickering Street
Newton Park
Port Elizabeth
6001
ATT : Mr. R Almanza

PROJECT : St. Francis Bay
JOB CARD : C22311
DATE SAMPLED/RECEIVED: 18.04.2019
DATE REPORTED: 30.04.2019
AMENDED 06.05.2019
SAMPLING PROCEDURE : Delivered to the laboratory

AGGREGATE TEST REPORT

Sample Number		S7245	S7246	S7247	S7248	S7249
Sample Reference		Ex - St. Francis Bay				
Material Description		Sand	Sand	Sand	Sand	Sand
Source		South Beach - High Tide 2	South Beach - Low Tide 4	South Beach - High Tide 3	Middle Beach - High Tide	Middle Beach - Low Tide

Sieve Analysis (%) Passing - SANS 3001:AG1

SIEVE APERTURE (mm)		S7245	S7246	S7247	S7248	S7249
	63. 0					
	50. 0					
	37. 5					
	28. 0					
	20. 0					
	14. 0					
	10. 0					
	7. 1					
	5. 0		100	100		100
	2. 0	100	99	96		99
	1. 0	99	99	90		98
	0. 600	96	96	73	100	94
Fines	0. 425	82.1	79.1	42.4	97.5	63.6
	0. 300	50.6	45.2	27.0	42.4	34.3
	0. 150	29.9	11.2	12.4	7.6	2.8
Dust	0. 075	27.7	10.3	6.4	0.6	2.0
Silt + Clay	0. 05					
Clay	0. 005					

Material Characteristics

			S7245	S7246	S7247	S7248	S7249
Fineness Modulus		SANS 3001:PR5	0.70	1.04	1.8	1.1	1.4
Flakiness Index		SANS 3001:AG4					
* Chloride Content		SANS 202					
* Presence of Sugar		SANS 5833					
ARD	(g/ml)	SANS3001:AG21					
ACV : Dry	(%)	SANS3001:AG10					
10% FACT: Dry	(kN)	SANS3001:AG10					
10% FACT: Wet	(kN)	SANS3001:AG10					
Wet/Dry Ratio	(%)	SANS3001:AG10					
Loose Bulk Density	(kg/m³)	SANS 6845					
Compacted Bulk Density	(kg/m³)	SANS 6845					

The above test results are pertinent only to the samples received and tested at the laboratory. This report shall not be reproduced, except in full, without the prior consent of Tosca Lab (Pty) Ltd.

* Indicate non-accredited tests

Deviation from Test Method: Air pressure 40mm mercury instead of 100mm mercury

Name : Frederik Eijbers
Technical Signatory

2019/03/27 Revision 4 TSF 9.5

APPENDIX C – CES IMPACT ASSESSMENT METHODOLOGY

APPENDIX C – CES IMPACT ASSESSMENT METHODOLOGY

The identified impacts have been assessed against the following criteria:

- Temporal scale (Table C1);
- Spatial scale (Table C1);
- Likelihood or risk (Table C1);
- Severity or benefits (Table C2); and the
- Overall significance rating (Table C3).

The relationship of the issue to the temporal scale, spatial scale and the severity are combined to describe the overall importance rating, namely the significance of the impact.

Table C1 Significance Rating Table.

TEMPORAL SCALE *(DURATION OF THE IMPACT)*	
Short term	Less than 5 years (Many construction phase impacts are of a short duration).
Medium term	Between 5 and 20 years.
Long term	Between 20 and 40 years (From a human perspective almost permanent).
Permanent	Over 40 years or resulting in a permanent and lasting change that will always be there.
SPATIAL SCALE *(AREA IN WHICH ANY IMPACT WILL HAVE AN AFFECT)*	
Localised	Impacts affect a small area of a few hectares in extent. Often only a portion of the project area.
Study area	The proposed site and its immediate surroundings.
Municipal	Impacts affect the municipality, or any towns within the municipality.
Regional	Impacts affect the wider area or the province as a whole.
National	Impacts affect the entire country.
International/Global	Impacts affect other countries or have a global influence.
LIKELIHOOD *(CONFIDENCE WITH WHICH ONE HAS PREDICTED THE SIGNIFICANCE OF AN IMPACT)*	
Definite	More than 90% sure of a particular fact. Should have substantial supportive data.
Probable	Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Only over 40% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure/Unlikely	Less than 40% sure of a particular fact, or of the likelihood of an impact occurring.

Table C2: Impact Severity Rating.

IMPACT SEVERITY *(SEVERITY OF NEGATIVE IMPACTS, OR HOW BENEFICIAL POSITIVE IMPACTS WOULD BE ON A PARTICULAR AFFECTED SYSTEM OR AFFECTED PARTY)*	
Very severe	Very beneficial
An irreversible and permanent change to the affected system(s) or party (ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party (ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.
Severe	Beneficial
Long term impacts on the affected system(s) or party (ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.	A long term impact and substantial benefit to the affected system(s) or party (ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.

Moderately severe	Moderately beneficial
Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated. For example constructing a sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party (ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.
Slightly severe	Slightly beneficial
Medium or short term impacts on the affected system(s) or party (ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	A short to medium term impact and negligible benefit to the affected system(s) or party (ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.
No effect	Unknown
The system(s) or party (ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.

Table C3: Overall Significance Rating.

OVERALL SIGNIFICANCE *(COMBINATION OF ALL THE ABOVE CRITERIA AS AN OVERALL SIGNIFICANCE)*	
VERY HIGH NEGATIVE (-)	VERY BENEFICIAL (+)
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects.	
HIGH NEGATIVE (-)	BENEFICIAL (+)
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light.	
MODERATE NEGATIVE (-)	SOME BENEFITS (+)
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial.	
LOW NEGATIVE (-)	FEW BENEFITS (+)
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect.	
NO SIGNIFICANCE	
There are no primary or secondary effects at all that are important to scientists or the public.	
UNKNOWN	
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information.	

PROPOSED COASTAL PROTECTION SCHEME, ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

ESTUARINE AND DUNE SYSTEM IMPACT ASSESSMENT

DRAFT

Prepared for	**On behalf of**
St Francis Property Owners NPC PO Box 18 St Francis Bay 6312	**Kouga Local Municipality** PO Box 21 Jeffreys Bay 6330

Prepared by

36 Pickering Street, Newton Park, Port Elizabeth, 6045

Also in Grahamstown, East London, Johannesburg, Cape Town and Maputo

www.cesnet.co.za

FEBRUARY 2021

REVISIONS TRACKING TABLE

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CES Report Revision and Tracking Schedule

Document Title	Estuarine and Dune Assessment: Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province	
Client Name & Address	St Francis Property Owners NPC PO Box 18 St Francis Bay 6312 *On behalf of* Kouga Local Municipality PO Box 21 Jeffreys Bay 6330	
Document Reference	DEDEAT Ref: EC08/C/LN2/M/01-2021	
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Authors	Mr Gregory Shaw	Coastal & Environmental Services
	Dr Chantel Bezuidenhout	Coastal & Environmental Services
Reviewer	Dr Ted Avis	Coastal & Environmental Services

CES
ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

Port Elizabeth
13 Stanley Street
Richmond Hill,
Port Elizabeth
6001
Info@cesnet.co.za
www.cesnet.co.za
Also in Grahamstown, Cape Town, East London Johannesburg and Maputo

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LIST OF ACRONYMS

AEMP	Aquatic Ecosystem Management Programme
BGIS	Biodiversity Geographical Information Systems
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EI	Ecological Importance
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
ES	Ecological Sensitivity
GIS	Geographical Information Systems
ICM Act	Integrated Coastal Management Act
Imp	Importance Score
IUCN	International Union for Conservation of Nature
LM	Local Municipality
MLRA	Marine Living Resources Act
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
NEMPAA	National Environmental Management Protected Areas Act
NMU	Nelson Mandela University
PES	Present Ecological State
PPP	Public Participation Process
PSU	Practical Salinity Unit
SBDM	Sarah Baartman District Municipality
SFPO NPC	St Francis Property Owners Non-Profit Company
WMA	Water Management Area

EXECUTIVE SUMMARY

1.1 Background

The St Francis Property Owners Non-Profit Company (SFPO NPC), on behalf of the Kouga Local Municipality (Kouga LM), has proposed the implementation of a coastal protection scheme proposed for St Francis Bay beach, located within the Eastern Cape Province. The proposed project area is situated approximately 100 km west of Port Elizabeth, and is located within the Kouga LM, seated within the Sarah Baartman District Municipality (SBDM).

The coastal protection scheme will include sourcing sand material from the Kromme Estuary for the purpose of beach nourishment of St Francis Bay beach. The scheme will also entail the development of coastal structures to prevent further erosion of St Francis Bay beach.

CES were appointed by the SFPO NPC to apply for an Environmental Authorisation (EA) by means of conducting a Scoping and Environmental Impact Reporting (S&EIR) process. This was initiated in 2018. In 2019, CES together with the SFPO produced a Draft and Final Scoping Report and Sand Sourcing Specialist Report which was subject to the mandatory 30-day public participation process (PPP) between 20th of August 2019 until the 18th of September 2019. Following on from the approval of the Scoping Report by the Department on the 25th October 2019, CES progressed with the development of the Draft EIR and Draft Estuarine and Dune Assessment Specialist Report which was subject to PPP between 19th December 2019 – 5th February 2020.

It was decided that the Final EIR would not be submitted and the application (EC08/C/LN2/M/42-2019) was allowed to lapse in order to re-visit the design based on comments from I&APs and the Department. The update to the design required additional studies, which have now been completed and this specialist report has been updated to consider the additional information and design available.

1.2 Methodology

A literature review was conducted using the available information on the Kromme Estuary and the coastline, as well as relevant legislation in South Africa (please refer to the references at the end of this report). There is a wealth of data available on the Kromme River Estuary. A comprehensive reserve determination was conducted for the Kromme Estuary by Ninham Shand and Coastal and Environmental Services from 2003 to 2006, this included an ecological water requirement report (completed in 2005) and estuarine surveys and specialist workshops which took place between September 2004 and February 2005. The literature used to compile this report ranges from 1983-2017 (refer to reference list).

The base map for the Estuarine Functional Zone of the Kromme Estuary was obtained from the National Estuaries (2012) vector geospatial data set obtained from BGIS (www.bgis.sanbi.org). The data set contains information on 299 South African estuarine systems that was digitised using Spot 5 imagery (2008) and Google Earth. The lateral boundaries include all the associated wetlands, intertidal mud and sand flats, beaches and foreshore environments that are affected by riverine or tidal flood events (Edgar, 1999). The 5 m topographical contour (obtained from Chief Directorate Surveys and Mapping) was used as the boundary to delineate the floodplains. From this delineation spatial data such as area, length and perimeter (estuary coastline) and distance to next system could be inferred. The estuarine vegetation within the estuarine functional zone (as determine by BGIS) was delineated using the most recent aerial imagery available on Google Earth Pro in order to determine any changes in vegetation communities over time. The CES methodology has been used for assessing the significance of the impacts.

1.3 Description of the Estuary

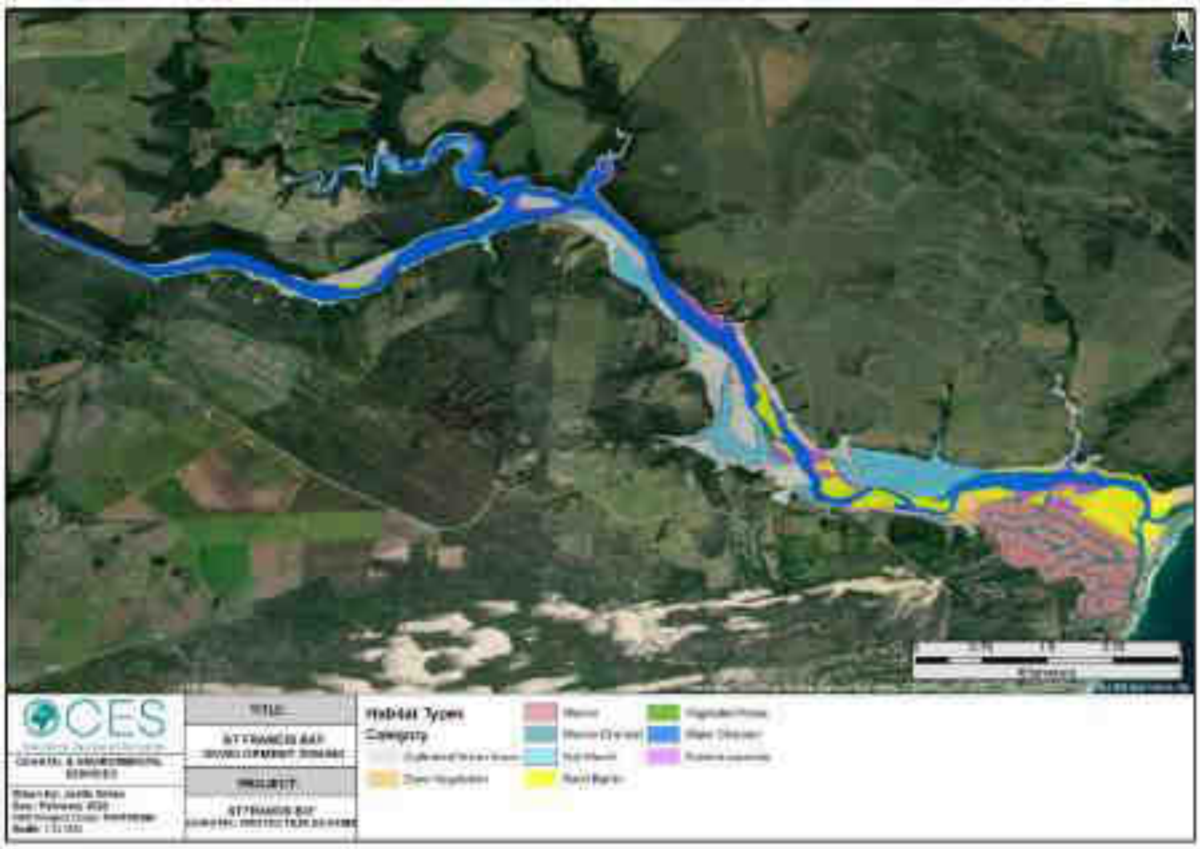
The Kromme River is approximately 95 km long (Scharler and Baird, 2000) and has many unnamed, small ephemeral tributaries that support dense pockets of indigenous vegetation. The main tributary is the Geelhoutboom River, which originates south of Humansdorp, and joins the Kromme Estuary about 8 km upstream of the mouth. The flow pattern of the Kromme River has been modified by two large dams, i.e. the Churchill Dam (built in 1943; capacity of 33 x 10^6 m^3) and the Mpofu Dam (built in 1983; capacity of 107 x 10^6 m^3) (Bickerton and Pierce, 1988; Bate and Adams, 2000). Both dams have the combined capacity of storing ca 133 % of the mean annual run-off of the Kromme River catchment (Bate and Adams, 2000; Scharler and Baird, 2000). The dams in the catchment are considered to attenuate all floods with a return period of less than 1 in 30 years (Bickerton and Pierce, 1988).

The Present Ecological State (PES), the Ecological Importance (EI) and the Ecological Sensitivity (ES) of the Kromme and Geelhoutboom Rivers and their tributaries are presented in the table below (Department of Water and Sanitation, 2014). These rivers define the upper boundary of the tidal influence, or the extent of saline intrusion upstream, of the Kromme Estuary.

Environmental Sensitivity of the Kromme and Geelhoutboom

River		Present Ecological State (PES)	Ecological Importance (EI)	Ecological Sensitivity (ES)
1.	Kromme River	PES D: Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred	High	High
2.	Geelhoutboom River	PES D: Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred	Moderate	High

The estuarine functional zone includes open water, estuarine habitat and the floodplain, and the results of the mapping exercise are presented in the figure below:



The Kromme Estuary Functional Zone and Habitat Map.

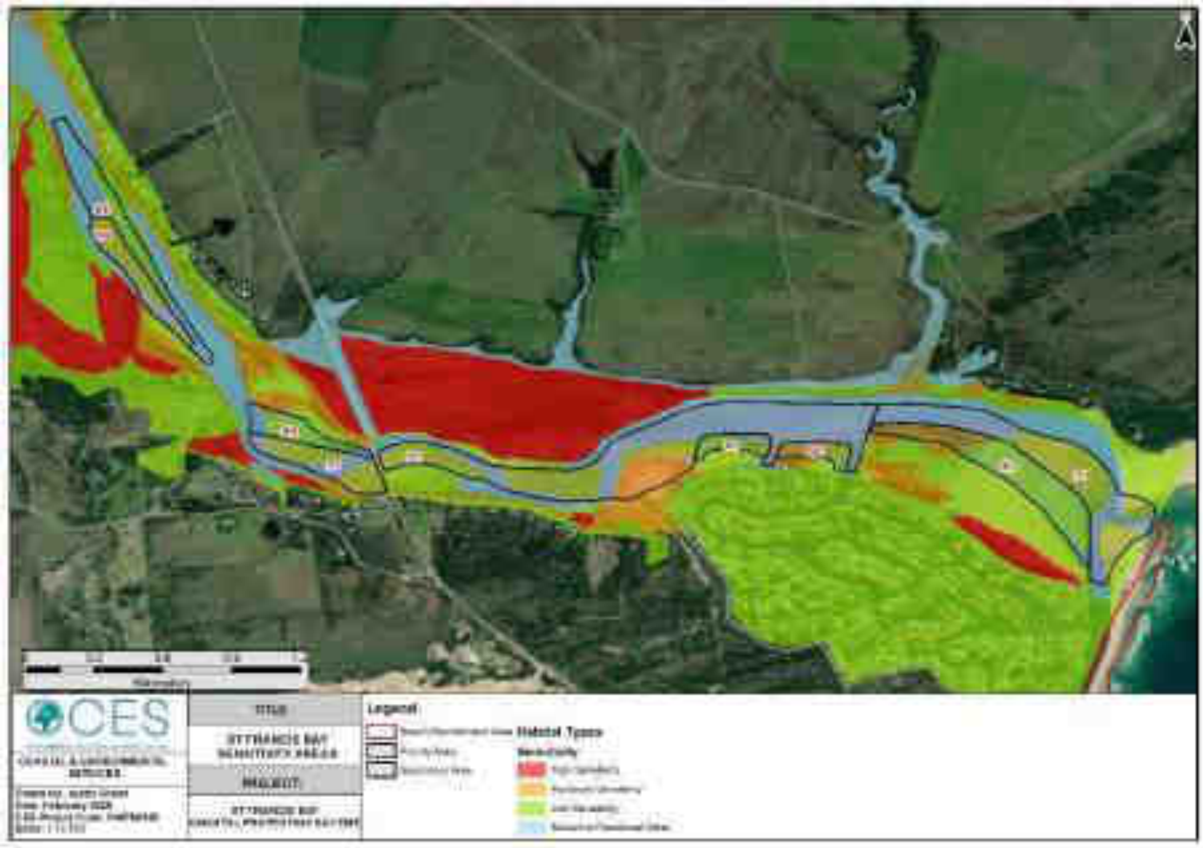
The Kromme Estuary is a permanently open estuary that is situated in a warm temperate biogeographical region. The Kromme is considered a permanently open estuary with all images showing the mouth open to the sea and in a similar position year on year. The analysis of the sediment and its particle size suggest that the sediment in the lower reaches of the estuary are considered to be medium sand according to the Udden-Wentworth scale.

1.4 Description Of The Dune And Beach System

On the south bank of the estuary mouth is a sand spit that extends for approximately 900m, and this spit tends to push the mouth channel northwards. For most of its length the sand spit is well vegetated with typical pioneer woody species such as *Chrysanthemoides monolifera* (Bitou), but the most dominant species is the invasive Acacia, *Acacia cyclops* (Rooikrans). The mouth of the Sand River is located 2km upstream of the mouth, on the south bank of the river. The Sand River's contribution to the freshwater inflow into the Kromme system is negligible. The dominant flow within the Sand River is subterranean, but reduced flows both in the system as well as the Kromme has resulted in a substantial accumulation of sand along this 250m of river bank. The sand mass is approximately 180m wide and 300m long and has become stabilised by pioneer dune and salt marsh vegetation. Further east the sand has not yet become vegetated, as it is still inundated at high tide. Over time, and with ongoing sand accumulation it is expected that this sand will also become stabilised with dune vegetation. The dune system at the Sand river has become well vegetated say with typical saltmarsh species closer to the river's edge, giving way to dune slack species in the depressions.

1.5 Site Sensitivity

The proposed project must avoid all areas of high sensitivity. Areas considered to be of moderate sensitivity could withstand some loss, however this should be avoided as far as practical. The sensitivity map below was developed by identifying areas of high, medium and low sensitivity.



Sensitivity Map of the Kromme Estuary.

1.6 Impact Assessment

The table below provides a summary of the existing and the potential impacts associated with the proposed project.

Summary of the Existing & Potential Impacts

PHASES OF DEVELOPMENT & POTENTIAL IMPACTS	SIGNIFICANCE	
	WITHOUT MITIGATION	WITH MITIGATION
EXISTING IMPACTS		
Estuary Bank Erosion	MODERATE-	
Increased Siltation	HIGH-	
Deterioration in Water Quality	LOW-	
Increased Salinity	HIGH-	
Impact on Submerged Macrophytes	MODERATE+	
Impact on Submerged Salt Marsh	MODERATE-	
Impact on fauna - increase in sandbank habitat as a result of the impoundments upstream	MODERATE+	*NOT APPLICABLE*
Impact on fauna - shift to a marine dominated system	HIGH-	
Impact on Social Amenities	MODERATE+	
Impact on Ecosystem goods and services	LOW-	
Impact on infrastructure and dune habitat as a result of a breach in the spit	HIGH-	
Ongoing erosion to the beaches to the north	MODERATE-	

CONSTRUCTION AND OPERATIONAL PHASE		
Increase in Sedimentation and Turbidity	**MODERATE-**	**LOW-**
Loss of Estuarine Vegetation Communities	**MODERATE-**	**LOW-**
Loss of Estuarine Faunal Communities	**MODERATE-**	**LOW-**
Impacts on the Estuarine Functional Zone	**MODERATE-**	**MODERATE-**
Improvements to the Recreational Amenities Offered by the Kromme	**MODERATE+**	**HIGH+**
Loss of Access to Particular Sites and Restrictions on the use of the Estuary during Dredging Operation	**LOW-**	**LOW-**
A Reduction / Loss of Sandbanks Supporting Fauna	**LOW-**	**LOW-**
Visual Intrusion of Dredging Equipment and Pipelines	**MODERATE-**	**LOW-**
Noise Disturbance Impacts	**MODERATE-**	**LOW-**
Impact on Navigation and Boating Safety	**MODERATE+**	**MODERATE+**
Loss of Dune Vegetation on The Vegetated Sand Bank at The Sand River Mouth	**MODERATE-**	**MODERATE-**
Disturbance to dune vegetation on the sand spit and other foredunes during construction	**LOW-**	**LOW-**
Effects of Groyne Construction on The Beach and Nearshore Area	**MODERATE-**	**MODERATE-**
Accretion and Resultant Widening of The Beaches as A Result of Beach Nourishment Scheme	**MODERATE-**	**HIGH+**
Stabilisation of The Shoreline and Protection from Storm Surges and Sea-Level Rise		[redacted]
Long to Improvement to Recreational Amenities Offered by The Beaches		
Acceleration of erosion as a result of the groynes	**MODERATE-**	**LOW-**
Restriction of Sediment Transport to the North	**MODERATE-**	**LOW-**
DECOMMISSIONING PHASE		
None	-	-
CUMULTIVE IMPACTS		
Increased Estuary Bank Erosion	**MODERATE-**	**LOW-**

While there are sensitive habitats with species deemed vulnerable and near threatened the loss of these species is anticipated to be a small area of their overall distribution within the Kromme Estuary and even smaller proportions regionally. The species that will be directly lost (benthic organisms) as a result of the dredging activity are not sensitive species and while their abundance may be reduced initially it is expected that these species will return and inhabit newly dredged areas. Alternative locations for birds and fish are available throughout the estuary system, since there are similar habitats upstream and along the beach in St Francis Bay.

Those areas of sand bank that are vegetated with dune vegetation do occur within the estuary and within those areas expected to be dredged. Since this vegetation is indigenous, and exhibits a clear successional gradient, its loss will result, despite the fact that it has established as a result of altered flow regimes in the Kromme. However, it is postulated that under normal flow conditions this sand bank would not have been as aggressively colonised by dune species as has occurred, due to reduced flows and infrequent flooding resulting in a more stable habitat. The construction of the groynes, as well as activities associated with beach nourishment will require access over the foredunes in selected areas, and damage to the foredunes and the loss of some vegetation is inevitable. Since much of this vegetation is not indigenous, and the areas disturbed are likely to be localised, the impacts are not expected to be significant. The nourishment of the beach along the St Francis Bay frontage will provide additional habitat for the development of dune species. It will also stabilise the shoreline and protect the foredunes from wave attack from storm surges. These are seen as beneficial impacts.

From a socio-economic perspective the restoration of the beach amenity and additional area within the lower reaches of the estuary are seen as beneficial impacts of the dredging. The visual and noise disturbance impacts as a result of the dredging and potential pumping of sediment can be suitably mitigated to reduce the impacts that may arise from the dredging activity.

Based on this assessment there are no fatal flaws.

1.7 Recommendations

It is recommended that the following Construction Phase and Operation Phase mitigation measures are included in the Environmental Management Programme (EMPr):

Mitigation measures for inclusion in the EMPr and EA.

MITIGATION MEASURES
➢ Only the correct size material (course) will be dredged for beach nourishment. ➢ Sensitive habitats will be identified and avoided. ➢ Only the required volume of sediment will be dredged. ➢ Associated equipment will be placed in areas that are deemed not to be sensitive. ➢ Development and publication of the intended programme of works including work areas. ➢ Identification and publication of buffer areas/safety zones around dredging equipment. ➢ Development of a dredging programme that takes navigation and peak times into account. ➢ Noise attenuation of pumps/pipes associated with the transport of material. ➢ Consideration of operating dredging equipment during daylight hours. ➢ Consider improvement of access to an alternative walking route along the length of the frontage along the beach and estuary. ➢ Development and publication of water safety procedures and enforcement to ensure safety to all users of the estuary. ➢ Development of an adaptive management plan. ➢ Enforcement all provisions contained in the Construction EMP ➢ Do not allow any laydown areas within the sensitive foredune area. ➢ Limit access across the foredunes to four access points in total, where each groyne will be located. The access points will need to serve the groynes in proximity. From North to South, they are expected to be the Aldabara Road parking area, Peter Crescent, George road and Ralph Road parking area. These parking areas must also be used as laydown areas. ➢ Limit pedestrian access to these same points. ➢ Disallow workers from accessing the foredune areas.

REQUIREMENTS OF SPECIALIST ASSESSMENTS AS OUTLINED IN APPENDIX 6 OF THE NEMA EIA REGULATIONS

The Table included below outlines the requirements of a Specialist Report as outlined in Appendix 6 of the NEMA EIA Regulations (as amended) and cross-reference the Sections in this report where the relevant information can be found.

NEMA REQUIREMENT	RELEVANT SECTION IN THE REPORT
A specialist report prepared in terms of the NEMA EIA Regulations must contain details of: → The specialist who prepared the report; and → The expertise of that specialist to compile a specialist report including curriculum vitae	Detail of the specialists are provided in the following sections of the report: → Presented at the start of this report: Project Team → Appendix 1: Curriculum Vitae
A declaration that the specialist is independent in a form as may be specified by the competent authority.	Specialist declarations are available in Appendix 2.
An indication of the scope of, and the purpose for which, the report was prepared	Section 2.1 in Chapter 2 of this report provides the terms of reference for the estuarine assessment
An indication of the quality and age of base data used for the specialist report.	There is a wealth of data available on the Kromme River Estuary. A comprehensive reserve determination was conducted for the Kromme Estuary by Ninham Shand and Coastal and Environmental Services from 2003 to 2006, this included an ecological water requirement report (completed in 2005) and estuarine surveys and specialist workshops which took place between September 2004 and February 2005. The literature used to compile this report ranges from 1983-2017 (refer to reference list). Bathymetry data was collected in 2020 and used in the dredging scenario modelling.
A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Existing impacts are outlined in Chapter 8.1.1 – 8.1.3. Cumulative impacts are outlined in Chapter 8.1.4.
The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Chapter 4.2 describes the surveys carried out.
A description of the methodology adopted in the preparing of the report or carrying out the specialised processes inclusive of equipment and modelling used.	Chapter 3 describes the methodology used for the preparation of this report.
Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives.	Chapter 7 provides a sensitivity analysis of the proposed site and an explanation on the requirements for layout adjustments.
An identification of all areas to be avoided including buffers.	Chapter 7 provides a sensitivity analysis of the proposed site and identifies all areas of high sensitivity that must be avoided.

NEMA REQUIREMENT	RELEVANT SECTION IN THE REPORT
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.	Chapter 7 provides a sensitivity map of the proposed site superimposing project activities. This map identifies all areas of high sensitivity that must be avoided.
A description of any assumptions made and any uncertainties or gaps in knowledge.	This is available in Chapter 2 Section 2.2
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Chapter 11 deals with the recommendations to be considered should this project proceed.
Any mitigation measures for inclusion in the EMPr	These are outlined in Chapter 11, Table z11.2
Any conditions for inclusion in the Environmental Authorisation	These are outlined in Chapter 11, Table 11.2
Any monitoring requirements for inclusion in the EMPr or Environmental Authorisation.	These are included in Chapter 10 of this report.
A reasoned opinion: → As to whether the proposed activity, activities or portions thereof should be authorised; → Regarding the acceptability of the proposed activity or activities; and → If the opinion is that the proposed activity or activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable the closure plan.	Chapter 11 considers whether there are any fatal flaws with this project. It is the opinion of the expert that the project can proceed. However, there are requirements for monitoring and the development of an adaptive management plan to ensure that measures to reduce unforeseen impacts can be implemented without resulting in delays to the project.
A description of any consultation process that was undertaken during the course of preparing the specialist report.	This is outlined in Chapter 2, Section 2.3.
A summary and copies of any comments received during any consultation process and where applicable all responses thereto.	Comments on this draft report have been considered recorded in the Issues and Response Trail for the EIR.
Any other information requested by the competent authority.	The competent authority have raised the following on the Estuarine and Dune Ecology Specialist Report: *"The Estuarine and Dune System Assessment, dated August 2019, has not, as per the comments in the acceptance of the FSR dated 25 October 2019, addressed possible impacts of the proposed coastal protection scheme on the areas northwards of the area proposed for the groynes, specifically addressing any potential accretion / erosion of the northern beaches/*coastline." This report has been updated to address these concerns (See Section 5 and Section 9.

PROJECT TEAM

Details of the Specialists

Mr Gregory Shaw *(Estuarine Specialist: Site Investigation & Lead Report Writer)*

Mr Shaw is a Principal Environmental Consultant. Gregory has more than 10 years consulting experience in Environmental Impact Assessment (EIA) in the coastal and marine environment. He has an MSc in Botany and has been involved in marine studies for projects throughout Africa and the United Kingdom.

Dr Chantel Bezuidenhout *(Estuarine Specialist: Report Writing Assistance)*

Dr Chantel Bezuidenhout is a Principal Environmental Consultant with 10 years' consulting experience and she is the Branch Manager of the Port Elizabeth branch. Chantel holds MSc and PhD degrees in Botany (estuarine ecology) and a BSc degree in Botany and Geography from Nelson Mandela University (NMU). Chantel's main focus is estuarine ecology and she has done extensive work on 13 systems from the Orange River Mouth in the Northern Cape to the Mngazi Estuary in the Transkei. As a result she has been involved in a number of ecological reserve determination studies including the Kromme, Seekoei and Olifants systems. Chantel is well versed in environmental legislation and has been involved in number of environmental impact assessments and management plans in South Africa, Zambia, Mozambique and Madagascar.

Ms Nicole Wienand *(Consultant / GIS)*

Ms Nicole Wienand is an Environmental Consultant with less than 1 years' experience and she is based in the Port Elizabeth branch. Nicole obtained her BSc Honours in Botany (Environmental Management) from Nelson Mandela University (NMU) in December 2018. She also holds a BSc Degree in Environmental Management from NMU. Nicole's honours project focused on the composition of subtidal marine benthic communities on warm temperate reefs off the coast of Port Elizabeth (a baseline survey) and for her undergraduate project she investigated dune movement in Sardinia Bay. Although she is new to the environmental consulting field, her key interests include the GIS Mapping, the general EIA process, Public Participation Process (PPP) and Ecological Impact Assessments.

Dr Ted Avis *(Dune Ecology, Report Review and Final Sign-Off)*

Ted Avis is a leading expert in the field of Environmental Impact Assessments and environmental management, having project-managed numerous large-scale ESIAs and ESMPs to International Finance Corporation Performance Standards. Ted has been EIA study leader on numerous large scale ESIA's and ESHIA's for projects with capital investments ranging from US$200m to over US$1billion. He has been study leader for ESIAs and related environmental studies completed to international standards (e.g. International Finance Corporation). Ted was principle consultant to Corridor Sands Limitada for the development of all environment aspects for the US$1billion Corridor Sands Project. He has managed ESIA studies and related environmental assessments of similar scope in Kenya, Madagascar, Egypt, Kenya, Liberia, Mozambique, Madagascar, Malawi Sierra Leone, South Africa and Zambia. Ted also has experience in large scale Strategic Environmental Assessments in southern Africa and has been engaged by the International Finance Corporation (IFC) on a number of projects.

Most of the ESIA work Ted has been involved in has included the preparation of various Environmental & Social Management Plans, Resettlement Action Plans and Monitoring Plans. These ESIA's cover a range of sectors including infrastructure, mining (heavy minerals, graphite, tin, copper, iron), agri-industrial, forestry, resorts and housing development, energy, ports and coastal developments.

Ted holds a PhD in Botany and was awarded a bronze medal by the South African Association of Botanists for the best PhD adjudicated in that year, entitled “Coastal Dune Ecology and Management in the Eastern Cape”). He has delivered papers and published in the field of EIA, Strategic Environmental Assessment and Integrated Coastal Zone Management and has been a principal of CES since its inception in 1990 and Managing Director since 1998.

Ted was instrumental in establishing the Environmental Science Department at Rhodes University whilst a Senior lecturer in Botany, based on his experience running honours modules in EIA practice and environmental management. He was one of the first certified Environmental Assessment Practitioner in South Africa, gaining certification in April 2004. He has been a professional member of the South African Council for Natural Scientific Professionals since 1993.

1 INTRODUCTION

1.1 Background

The St Francis Property Owners Non-Profit Company (SFPO NPC), on behalf of the Kouga Local Municipality (Kouga LM), has proposed the implementation of a coastal protection scheme proposed for St Francis Bay beach, located within the Eastern Cape Province. The proposed project area is situated approximately 100 km west of Port Elizabeth, and is located within the Kouga LM, seated within the Sarah Baartman District Municipality (SBDM).

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It was decided that the Final EIR would not be submitted and the application (EC08/C/LN2/M/42-2019) was allowed to lapse in order to re-visit the design based on comments from I&APs and the Department. The update to the design required additional studies, which have now been completed and this specialist report has been updated to consider the additional information and design available.

1.2 Value Of Estuaries

The South African National Biodiversity Assessment (NBA, 2011) defines estuaries as:

> *"An estuary is a partially enclosed, permanent water body, either continuously or periodically open to the sea on decadal time scales, extending as far as the upper limit of tidal action or salinity penetration. During floods an estuary can become a river mouth with no seawater entering the formerly estuarine area, or, when there is little or no fluvial input, an estuary can be isolated from the sea by a sandbar and become a lagoon or lake, which may become fresh or hypersaline"* (Van Niekerk & Turpie, 2012).

Van Niekerk & Turpie (2012) describe estuaries as valuable national assets that provide essential ecosystem services. The ecosystem services typically provided by estuaries could include, but are not limited to:

- → Inflow of freshwater and nutrients from rivers to the marine environment;
- → Fish nursery habitats for marine fish and invertebrates;
- → Regulation of greenhouse gases and opportunities for carbon sequestration;
- → A significant buffer against floods as well as sea storms;
- → Recreational and tourism areas (e.g. sports fishing, boating, bathing and scenic views);
- → Resources for food (e.g. bait harvesting and subsistence fishing);
- → Unique and diverse habitats to microalgae, macrophytes, benthic invertebrates and fish; and
- → Bird feeding and roosting areas.

Turpie and Clark (2007) updated estuary importance scores for all South African estuaries. The overall importance score (Imp) is calculated from the size score (S), habitat importance score (H), zonal type rarity score (Z) and the updated biodiversity importance score (B). The estuarine importance score of the Kromme Estuary is as follows:

SIZE	HABITAT IMPORTANCE	ZONAL TYPE RARITY	BIODIVERSITY IMPORTANCE	IMPORTANCE SCORE
100	90	20	95.5	88.4

This means that the Kromme Estuary is ranked as the 17th most important estuary in South Africa. Even though the Kromme Estuary is not currently considered to be a protected area, it does form part of the list of desired protected areas (i.e. the Kromme forms part of the minimum set of estuaries required in a protected area network to represent 100% of estuarine species).

Turpie and Clark (2007) recommend that "*all estuaries are zoned using similar types of zones and markings, and that each estuary may contain a fully protected area, or sanctuary area (including a portion of the terrestrial margin which is protected from development and excessive use), and a conservation area (which includes the remainder of the terrestrial margin). The latter might be zoned in a number of different ways, depending on the vision and requirements for that estuary*." In terms of the Kromme Estuary the following is recommended:

PART OF THE CORE SET REQUIRED TO MEET BIODIVERSITY TARGETS	RECOMMENDED EXTENT OF SANCTUARY PROTECTION	RECOMMENDED EXTENT OF UNDEVELOPED MARGIN	RECOMMENDED MINIMUM ECOLOGICAL MANAGEMENT CLASS	PRIORITY FOR REHABILITATION
Yes	Half	50%	A/B	High

The Kromme Estuary is considered to be in a fair state of health (Whitfield, 2000) and in need of rehabilitation. According to Turpie and Clark (2007), the Kromme Estuary is listed as a high priority for rehabilitation, particularly water quality (silt), water quantity and the clearance of alien vegetation.

In 2007 Anchor Environmental Consultants prepared the CAPE Action Plan for the Environment (C.A.P.E) Regional Estuarine Management Programme. The main aim of the programme was to develop a strategic conservation plan for the estuaries of the Cape Floristic Region (CFR), and to prepare detailed management plans for each estuary. The overall objective of the study was to identify (in collaboration with estuarine managers and scientists and the broader stakeholder community) which CFR estuaries should be assigned Estuarine Protected Area (EPA) status, and to prioritise estuaries in need of rehabilitation, on the bases of an updated classification of estuaries in terms of health, conservation importance and socio-economic value.

CES have provided a high-level review of the Regional Estuarine Management Programme since the specific Estuarine Management Plans have not been developed. Estuaries were prioritised in terms of the need for rehabilitation, and the type of rehabilitation required was described (see Table 1.1). It was further recommended that each estuary should contain a fully protected area, or sanctuary area (including a portion of the terrestrial margin which is protected from development and excessive use), and a conservation area (which includes the remainder of the terrestrial margin). Table 1.1 provides results for the Kromme and others in the vicinity of the study area. It indicates that the Kromme estuary is part of the identified core set of estuarine systems required to meet biodiversity targets. To achieve the protection required, in terms of the proportion of targeted habitats and populations requiring full protection in a sanctuary, half the system requires Sanctuary Protection. The recommended proportion of terrestrial marginal area to be included as a no-development area is 50%, to achieve an ecological management class of A/B. Note that the recommended extent of protection should be seen as ideal goals.

Table 1.1. Summary of the recommended extent of protection required and priority for rehabilitation for each of the estuaries in the study area.

Estuary (West to East)	Core biodiversity set	Recommended extent of sanctuary protection	Recommended extent of undeveloped margin	Recommened minimum Ecological Management Class[1]	Priority for rehabilitation (blank = not required)
Tsitsikamma		None	-	D	Low
Klipdrif		None	-	D	Med
Slang		None	-	D	Low
Kromme	Core	Half	50%	A/B	High

1 Management class denotes the future state of health of the estuary, from A (near natural) to D (functional), and with A-class systems having greater water requirements than D-class systems.

The top 40 estuaries and their former rankings are shown in Table 1.2. Three-quarters of these are temperate estuaries.

Table 1.2. Top 40 estuaries in South Africa in terms of the updated importance rating of South African estuaries. Temperate estuaries are marked with an asterisk

	Overall importance score	Rank (this study)	Rank (Turpie *et al.* 2004)	Rank (Turpie *et al.* 2002)
Knysna	100	1	1	1
Orange	99	2	4	7
Berg	98	3	3	3
Olifants	98	4	2	2
Klein	97	5	9	9
Kosi	97	6	5	4
Swartvlei	97	7	7	6
Bot/Kleinmond	97	8	8	8
St Lucia	97	9	6	5
Durban Bay	92	10	11	88
Swartkops	92	11	12	11
Gamtoos	92	12	16	14
Great Fish	92	13	13	12
Mfolozi	91	14	14	13
Keiskamma	91	15	17	15
Mngazana	91	16	15	22
Kromme	88	17	20	17

The associated socio-economic values estimated for each estuary are presented in Table 1.3, highlighting estuaries for which certain types of value are noteworthy. The Kromme has substantial recreational and nursery value, and a scenic value of medium.

Table 1.3. Preliminary estimates of the recreational, subsistence and nursery value of estuaries, and their relative existence value (which is largely associated with scenic beauty). Highest values are shown in bold.

Estuary (West to East)	Recreational value (R millions/y)	Subsistence value (R millions/y)	Nursery Value (R millions/y)	Scenic/Existence value
Keurbooms	>100	0.1-0.5	10-20	Medium
Matjies/Bitou	<0.05	<0.05	<0.1	Medium
Sout (Oos)	<0.05	<0.05	1-5	High
Groot (Wes)	5-10	<0.05	1-5	High
Bloukrans	0.05-0.5	<0.05	<0.1	Medium
Lottering	0.05-0.5	<0.05	0.5-1	Medium
Elandsbos	0.05-0.5	<0.05	0.1-0.5	High
Storms	0.05-0.5	<0.05	<0.1	Medium
Elands	0.05-0.5	<0.05	<0.1	Medium
Groot (Oos)	0.05-0.5	<0.05	<0.1	Medium
Tsitsikamma	<0.05	<0.05	<0.1	Medium
Klipdrif	<0.05	<0.05	<0.1	Medium
Slang	<0.05	<0.05	<0.1	Medium
Kromme	20-50	0.1-0.5	10-20	Medium

Part of the Regional Estuarine Management Programme mandate was to prioritise estuaries for rehabilitation. A total of 50% of estuaries were considered to be in need of rehabilitation (Table 1.4). Water quality was the most important rehabilitation issue, but alien clearing and water quantity (too much as well as too little) were also important issues. The Kromme was rated as priority 1, with water quality (silt), water quantity and alien vegetation clearing identified as concerns.

Table 1.4 Temperate estuaries, their state of heath according to Whitfield (2000) or updated at workshop (signified by *), the need for rehabilitation and level of priority, and the type of rehabilitation required.

Estuary	Health (Whitfield 2000)	Need Rehab)	Priority 1 = High, 2 = Med, 3 = Low	Water Quality (Pollution)	Water Quality (Silt)	Water quantity	Alien Clearing	Fix inappropriate bank stabilisation	Mouth Management	Other
Matjies/Bitou	Excellent	No								
Sout (Oos)	Excellent	No								
Groot (Wes)	Good	Yes	1				x		x	Breaching mouth to protect septic tanks
Bloukrans	Excellent	No								
Lottering	Good	Yes	3				x			
Elandsbos	Good	Yes	3				x			
Storms	Excellent	No								
Elands	Good	Yes	3				x			
Groot (Oos)	Good	Yes	3				x			
Tsitsikamma	Good	Yes	3	x		x	x			
Klipdrif	Fair	Yes	2	x		x	x			
Slang	Poor	Yes	3	x		x				Remove groynes near mouth
Kromme	Fair	Yes	1		x	x	x			No Dredging

The Turpie *et. al.* report developed a set of criteria against which all estuaries could be classified and prioritised for the establishment of protection areas. The Kromme was deemed to be an important ecological (17 of 40 estuaries) and socio-economic (recreational and nursery value) asset. The data in the report suggest that these two characteristics may have a positive correlation, although not necessarily a strong one. The report recommends that the Kromme Estuary be prioritised for rehabilitation with the intention of returning it to a Category A/B estuary (i.e. near natural). The main types of rehabilitation required were:

1. Water quality;
2. Water quantity; and
3. Alien clearing.

There was an “other” statement of no dredging.

The report does not expand on these rehabilitation requirements nor does it provide data on which of these recommendations have been made. CES have provided their understanding for these below:

1. Clear water is deemed to be more suitable than water that has higher suspended sediment. This is due to silt limiting the ability of estuarine organisms to photosynthesize (vegetation) and to locate their food (fauna). Settlement of fine silt material may also lead to smothering of species that are not able to move. The “no dredging” statement has been added presumably due to the existing dredging of the canals and placement of material on the adjacent spit. Given the low flow within the canals it is anticipated that the material is finer than that of the estuary since finer material in the estuary does not settle.
2. It has been well documented that there has been a significant reduction in the volume of water entering the estuary due to the development of the dams upstream. Water flow in an estuary helps to “flush” the system. Higher flow maintains water channels, water quality and in some cases maintains the mouth characteristics of estuaries. Conversely, low flow reduces the ability to flush the estuary of sediment build up and maintain water quality.
3. Alien vegetation has a higher water requirement than that of indigenous vegetation. This has been well documented with natural and regional Working for Water schemes aiming to reduce the distribution of alien vegetation, especially in catchment areas. Property owners also have an obligation to manage alien vegetation.

The priorities therefore relate to water quality and quantity, and alien vegetation clearing. It remains unclear what the “other” statement of no dredging specifically relates to.

1.3 Value Of Dune Systems

Coastal Sand Dunes have a unique mobile physical structure and ecological composition. Frontal dunes are part of the sediment exchange system between land and sea, as they generally occur within the littoral active zone. The protection of especially frontal dunes is therefore critical to maintaining both the ecological integrity of the dune system and maintain its important function of coastal defence. This is particularly important at the mouth of an estuary, where not only the forces of wind and wave attack are important, but also the erosional forces of the estuarine system.

Together with beaches, frontal dunes form the most important sea and wind energy dissipating system. Together with beaches, they protect the hinterland from storm surges and wave attack. This is particularly important when coastal developments might be threatened, and the risks to social infrastructure will be exacerbated when the beach system is eroding, as is the case at St Francis Bay. This is further compounded by sea-level rise associated with climate change.

At St Francis Bay it is a well-known fact that the beaches have suffered from significant erosion events over the past few decades. This has been attributed to the stabilisation of the large headland bypass dune system during the 1970s and 1980s. This led to a reduction in sediment supply to the beach, compounded by the construction of the Impofu dam upstream of the Kromme River. This has resulted in a rapid retreat of the shoreline (Advisian, 2018. Advision, 2020). The most susceptible area is the sand spit immediately south of the river mouth, in front of Ski Canal in the Marina.

1.4 Key Legislation

An extensive legal framework governs the marine and coastal environments in South Africa. Table 1.5 lists the legislation that is applicable to the Kromme Estuary and its associated coastal dune system and describes these Acts.

Table 1.5: Relevant estuarine legislation.

LEGISLATION	DESCRIPTION
National Environmental Management: Integrated Coastal Management Act (ICM, Act No. 24 of 2008, as amended 2014)	The ICM Act aims to achieve harmony between the physical processes of estuaries and human activities. This is achieved by the protection of essential estuarine and dune ecological processes and diversity, while accommodating sustainable estuarine and coastal resource utilisation.
National Environmental Management: Biodiversity Act (NEMBA, Act No. 10 of 2004)	The Biodiversity Act aims to conserve biological diversity and to regulate the sustainable use of biological resources, which includes the unique estuarine and coastal systems and their resources.
National Environmental Management: Protected Areas Act (NEMPAA, Act No. 57 of 2003)	The Protected Areas Act aims to protect and conserve the ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes.
Marine Living Resources Act (MLRA, Act No. 18 of 1998, as amended in 2000)	The Marine Living Resources Act focuses on the utilisation, conservation and management of marine living resources. Marine living resources include all aquatic fauna and flora.
Local Government: Municipal Systems Act (Act No. 32 of 2000)	The Municipal Systems Act focuses on Integrated Development Planning with the objective of harmonising planning over a range of sectors such as water, transport, land use and environmental management. It requires each local authority to adopt a single, inclusive plan for the development of the municipality which, among other things, aligns the resources and capacity of the municipality with the implementation of the plan.

2 TERMS OF REFERENCE & PROJECT DESCRIPTION

2.1 Terms of Reference

The Estuarine and Dune Assessment terms of reference include, but are not limited to:

→ A detailed description of the Kromme Estuary within the vicinity of the proposed development, including the physio-chemical characteristics;
→ An ecological description of the frontal dune system at the mouth of the system, and on the sand flats at the mouth of the Sand River further upstream;
→ A description of the flora, fauna and avifauna of the estuary;
→ A description of the physical nature of the banks of the estuary;
→ The identification and assessment of the magnitude and significance of the positive and negative impacts on the estuary associated with the proposed project;
→ The identification and assessment of the magnitude and significance of the positive and negative impacts on the dune systems associated with the beach and estuarine, and
→ A description of appropriate mitigation measures to minimise negative impacts or to maximize positive impacts on the estuarine and dune system features.

The significance of the potential impacts and benefits will be assessed using the methodology prescribed by CES (refer to Chapter 3 included below).

2.2 Assumptions and Limitations

There are a number of assumptions and limitations associated with this report.

They are:

- The data has been taken from desktop information which has been referenced at the end of this report;
- A site visit was carried out in December 2018. The site visit included the collection of sediment samples and representative photographs of the habitats adjacent to the project site. The site visit lasted one day and the experts travelled by boat from the eastern most point of the study area (Kromme River Mouth) to the western most point of the study area (approx. 500 m past the bridge crossing the Kromme River). The survey was conducted in summer as this is the peak growing season for floral species. Faunal species are unlikely to exhibit significant seasonal variation.
- The site visit also included an investigation of the beach and dune systems on either side of the Kromme River Mouth, but this was limited to a visual inspection. No quantitative sampling of vegetation was undertaken as this was not required.
- New bathymetry data was collected in 2020 and used to inform the modelling of the pre- and post-dredging scenarios.
- A brief discussion on the particle size of the sediment within the Kromme is included in Chapter 4. A more detailed description of the sediment is included in the Sand Sourcing Specialist Study;
- Many chemical contaminants have an affinity for fine-grained sediment particles. These contaminants generally arise from industries located in or upstream of urban areas, or industries that discharge wastes into waterways. Dense populations also contribute contaminants through sewage discharges and agricultural runoff. The Kromme estuary does not have a history of heavy industry and while there is the potential for agricultural contaminants from fertilizers (phosphates and nitrogen) these are not anticipated to be significant, especially since the particle size of the sediment is coarse. Research into the

nutrient status of the estuary following a release from the upstream impoundments showed that the estuary returned to its “normal” state within days; and
- It is assumed that a pre-construction survey will take place prior to construction of the project to establish the parameters for monitoring contamination during the project.

2.3 Public Participation

The Final Scoping Report described the Public Participation Process (PPP) followed to date. This Specialist report was released for public review during the period December 2019 and January 2020, prior to the EIA process being placed on hold. This version of the report therefore includes comments received from IAPs.

This specialist report forms part of the updated Draft EIR report and will be made available for a formal 30 day commenting and review period again. All comments and issues received during this second review period related to the estuarine and dune assessment will be included in the Final Estuarine and Dune Assessment Report.

2.4 Project Description

As a result of significant erosion events occurring over the past few decades, the St Francis Bay beach has lost a considerable amount of sand material, and the existing frontal dune area has become more vulnerable to being breached during storm surges. The effects of the erosion of the beach (in both width and depth of sediment) has been realised across the full frontage, stretching from the car park at the end of Nevil Rd in the south to the Kromme Estuary mouth in the north (Figure 2.1). Approximately 700 m of the frontage, referred to as “the spit” is particularly vulnerable. The erosion has been significant and dramatic that over the 42 year period between 1975 and 2017, the high water mark has retreated by 75 metres. As a result, the beach has effectively been lost, and erosion of the vegetated sand spit is occurring. In 2020 the spit breached 4 times during particularly high tides and storm swell. Not only does the erosion of the spit impact on the recreational amenity that is the beach area, but it also has the potential to threaten the existing infrastructure (houses, roads and canals) which are located behind the beach spit.

The Spit breached for the first time on the 8th April 2020. The second breach occurred on 5th July 2020 and the third breach on 15th August 2020. On each occasion the Kouga Local Municipality (KLM) reacted immediately and closed the breach within days. The breaches were closed with sand material using front end loaders, and bolstered with rock placed with excavators.


Plate 2.1. The breached spit on 5 July 2020.

After the first breach the KLM commenced with the construction of an emergency rock revetment along the spit in certain areas, with the scope increasing as the number of breaches increased. KLM's marine engineers, PRDW, provided the design for the emergency revetment and guided the on-site work. The emergency revetment has now been completed along the entire length of the spit. The structure is approximately 640 m long, approximately 6 m wide and 2.5 m high from the bottom of the toe (Plate 6.9).

The fourth breach occurred on 13/14th September 2020 at the northern end of the spit. This breach has not yet been repaired, but in the meantime properties at the northern end of Ski Canal have been protected through the construction of revetments.

A risk analysis undertaken by PRDW (St Francis Bay Spit Protection Emergency Revetment: Construction History, Surveys and Risk Assessment, 2020) noted that:

- The emergency rock revetment is vulnerable and could be undermined / damaged at any time by wave activity / storm surges; and
- The Phase 2 permanent solution should be implemented as soon as possible to minimise further expenditure on emergency works.

A number of interventions have been implemented in the past. All have been short term solutions, and a long-term approach has now been proposed in order to prevent this section of coastline from undergoing further erosion.

Several conceptual options were initially investigated by Advisian (a division of the Worley Parsons Group). However, the implementation of beach nourishment (i.e. the placement of a large volume of sand on the beach) together with the development of short stub groynes (i.e. a low solid barrier built into the sea) was considered to be the most suitable option (Figure 2.1 and Figure 2.3). The details of the other alternatives which were considered are provided in Chapter 3 of the Environmental Impact Report. The description below is therefore based on the preferred design option.

Figure 2.1: Location of the proposed beach nourishment.

2.4.1 *Beach Nourishment*

In order to protect the St Francis Bay coastline from further erosion, the option to artificially nourish the beach with sediment from a suitable borrow source has been identified as the preferred option. In order for beach nourishment to be implemented, sand must first be obtained from a suitable source area. The identification of a suitable source area is based largely on finding an area where sand material has similar grain size to that which is required on the beach.

Three (3) potential source areas were initially identified, which are all located within the Kromme River estuarine functional zone. These were subsequently refined into two areas defined as priority and secondary areas (Figure 2.2). Within these areas there are additional zones within which source material will be used. The approach for the priority and secondary areas is to target those areas of lower sensitivity (ecological and social) as well as those closest to where the material is required (i.e. the spit and beaches).

The maximum volume of sand which will need to be sourced is approximately 854,000 m^3. It will be transported either via dredger, truck or a pipeline and pumping system. The aim of the beach nourishment scheme is be to establish an area above the high-tide water mark that is 40 m wide. At the moment (December 2020) the beach is non-existent, and is regarded as 0 m wide. This sand will provide protection from erosion as waves will dissipate their energy before reaching the existing eroding area, and will to some extent re-instate the beach to what it was prior to the severe erosion experienced in the last two decades.

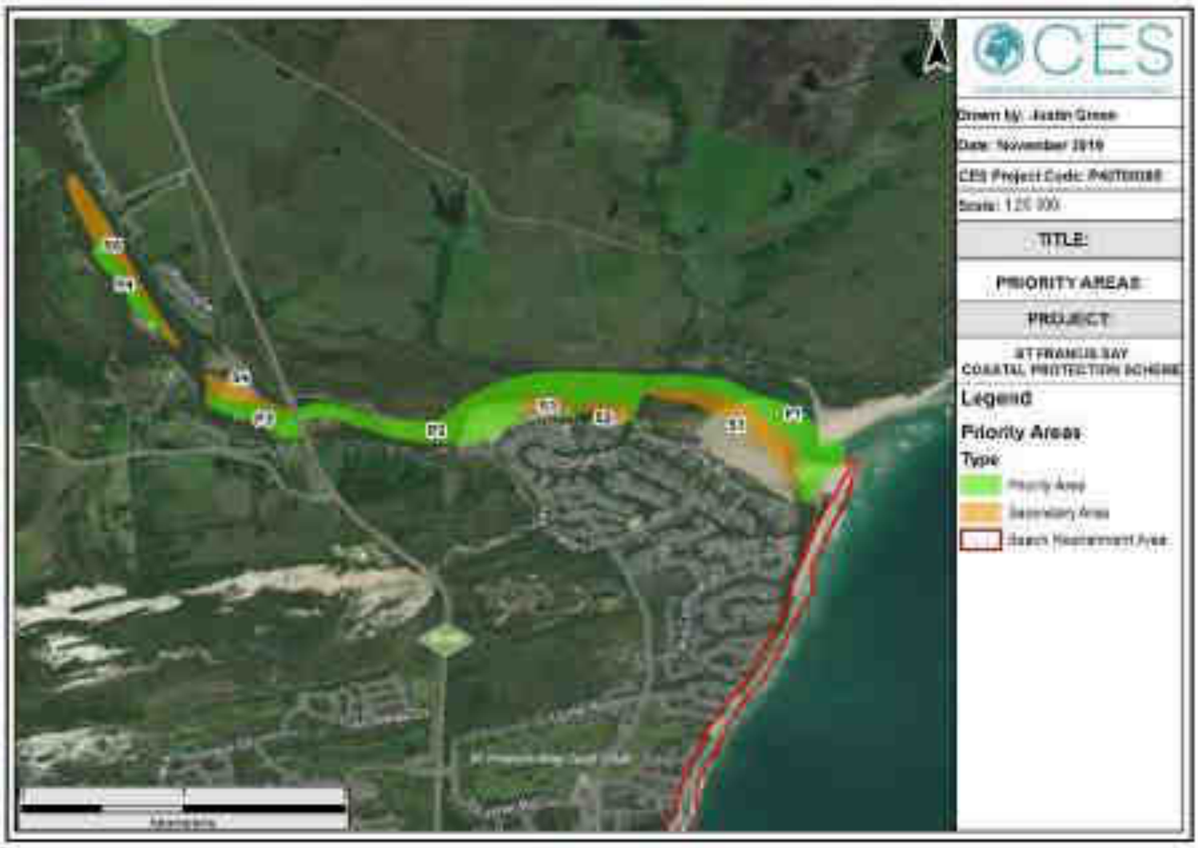

Figure 2.2: Potential areas to be used to source sand material.

2.4.2 *Stub Groynes*

In order to maintain the sand on the beach, and to promote increased sedimentation in the future (changing the beach from an erosional system to an accreting system), six (6) stub groynes will be constructed along the length of the beach. These stub groynes will extend from the back end of the beach, above the HWM, and will be anchored into the frontal dune system. They will extend between 170 m and 200 m offshore (Figure 2.3). The stub groynes will be angled perpendicular to the shoreline (except groyne 5 which is oblique), and will be shorter than full length groynes which are generally used for erosion prevention. The shorter (stub) groynes will allow a certain percentage of sediment to pass between each groyne. The Supplementary Shoreline Modelling Report (2020) suggests that 50% of the sediment will by-pass the groyne structures. It also indicates that the new shoreline will effectively re-establish a beach where one presently does not exist. This is referred to as the Planform – the shape or outline of something as projected upon a horizontal plane - in Figure 2.3 below.

A maximum of approximately 44 300 m^3 of rock material will be required to construct the proposed stub groynes. The rock material used for the groynes will be sourced from a licenced local quarry, the details of which will be subject to availability, grading of rock material and cost.

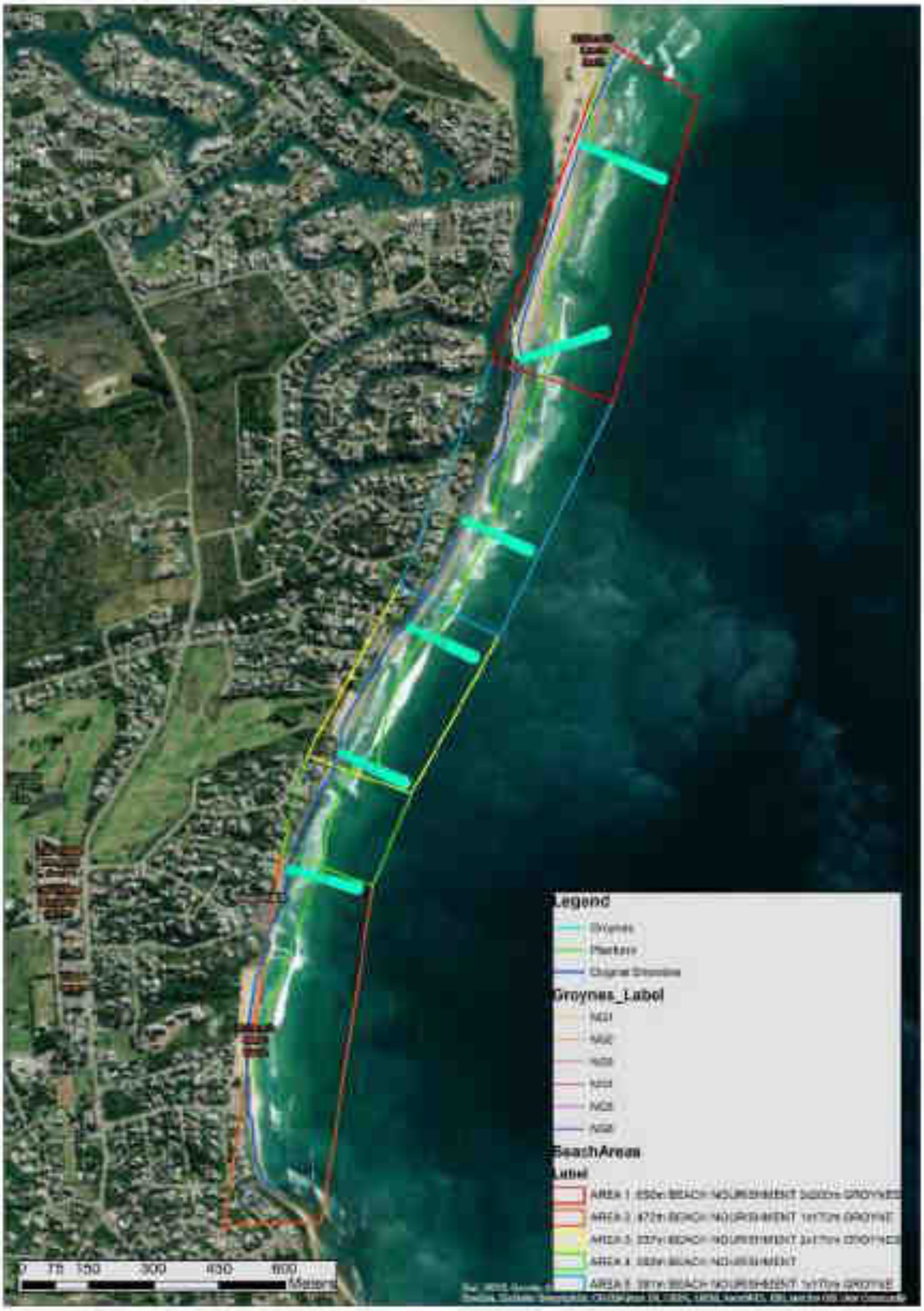

Figure 2.3: General layout for the stub groynes.

A phased implementation will be required due to financial constraints. It is estimated that the total construction period without phasing will be approximately twenty-three (23) months (from start to finish). The phased implementation which will be implemented is based on five (5) areas along St Francis Bay beach (Figure 2.3). Area 1 will consist of a 650 m length of beach which will undergo beach nourishment as well as the construction of two 200 m long groynes, one at each end. Area 2 will consist of a 472 m long beach with one 170 m groyne, while Area 3 will consist of a 337 m length of beach and two groynes which are 170 m in length. No groynes will be constructed in Area 4 , but one groyne of 170 m in length is required for Area 5, and the proposed length of the beaches are 282 m and 391 m respectively.

3 METHODOLOGY

3.1 Desktop Assessment

A literature review was conducted using the available information on the Kromme Estuary and the coastline, as well as relevant legislation in South Africa (please refer to the references at the end of this report). There is a wealth of data available on the Kromme River Estuary. A comprehensive reserve determination was conducted for the Kromme Estuary by Ninham Shand and Coastal and Environmental Services from 2003 to 2006, this included an ecological water requirement report (completed in 2005) and estuarine surveys and specialist workshops which took place between September 2004 and February 2005. The literature used to compile this report ranges from 1983-2017 (refer to reference list).

The information presented in the Advisian reports, and especially the St Francis Bay Beach Long-term Coastal Protection Phase 2 report of 2018 was used to describe the dune and beach system. Further information from the Supplementary Shoreline Modelling Report (Advisian, 2020) was used to update the report, as well as comments received from IAPs on the previous version.

3.2 Mapping

The base map for the Estuarine Functional Zone of the Kromme Estuary was obtained from the National Estuaries (2012) vector geospatial data set obtained from BGIS (www.bgis.sanbi.org). The data set contains information on 299 South African estuarine systems that was digitised using Spot 5 imagery (2008) and Google Earth. The lateral boundaries include all the associated wetlands, intertidal mud and sand flats, beaches and foreshore environments that are affected by riverine or tidal flood events (Edgar, 1999). The 5 m topographical contour (obtained from Chief Directorate Surveys and Mapping) was used as the boundary to delineate the floodplains. From this delineation spatial data such as area, length and perimeter (estuary coastline) and distance to next system could be inferred. The estuarine vegetation within the estuarine functional zone (as determine by BGIS) was delineated using the most recent aerial imagery available on Google Earth Pro in order to determine any changes in vegetation communities over time.

3.3 CES Methodology for Assessing the Significance of Impacts

The identified impacts have been assessed against the following criteria:

- → Temporal scale (Table 3.1);
- → Spatial scale (Table 3.1);
- → Likelihood or risk (Table 3.1);
- → Severity or benefits (Table 3.2); and the
- → Overall significance rating (Table 3.3).

The relationship of the issue to the temporal scale, spatial scale and the severity are combined to describe the overall importance rating, namely the significance of the impact.

Table 3.1 Significance Rating Table.

TEMPORAL SCALE *(DURATION OF THE IMPACT)*

Short term	Less than 5 years (Many construction phase impacts are of a short duration).
Medium term	Between 5 and 20 years.
Long term	Between 20 and 40 years (From a human perspective almost permanent).
Permanent	Over 40 years or resulting in a permanent and lasting change that will always be there.
SPATIAL SCALE *(AREA IN WHICH ANY IMPACT WILL HAVE AN AFFECT)*	
Localised	Impacts affect a small area of a few hectares in extent. Often only a portion of the project area.
Study area	The proposed site and its immediate surroundings.
Municipal	Impacts affect the municipality, or any towns within the municipality.
Regional	Impacts affect the wider area or the province as a whole.
National	Impacts affect the entire country.
International/Global	Impacts affect other countries or have a global influence.
LIKELIHOOD *(CONFIDENCE WITH WHICH ONE HAS PREDICTED THE SIGNIFICANCE OF AN IMPACT)*	
Definite	More than 90% sure of a particular fact. Should have substantial supportive data.
Probable	Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Only over 40% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure/Unlikely	Less than 40% sure of a particular fact, or of the likelihood of an impact occurring.

Table 3.2: Impact Severity Rating.

IMPACT SEVERITY *(SEVERITY OF NEGATIVE IMPACTS, OR HOW BENEFICIAL POSITIVE IMPACTS WOULD BE ON A PARTICULAR AFFECTED SYSTEM OR AFFECTED PARTY)*	
Very severe	Very beneficial
An irreversible and permanent change to the affected system(s) or party (ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party (ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.
Severe	Beneficial
Long term impacts on the affected system(s) or party (ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.	A long-term impact and substantial benefit to the affected system(s) or party (ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.
Moderately severe	Moderately beneficial
Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated. For example constructing a sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party (ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.
Slightly severe	Slightly beneficial
Medium- or short-term impacts on the affected system(s) or party (ies). Mitigation is very easy,	A short to medium term impact and negligible benefit to the affected system(s) or party (ies).

cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.
No effect	Unknown
The system(s) or party (ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.

Table 3.3: Overall Significance Rating.

OVERALL SIGNIFICANCE *(COMBINATION OF ALL THE ABOVE CRITERIA AS AN OVERALL SIGNIFICANCE)*	
VERY HIGH NEGATIVE (-)	**VERY BENEFICIAL (+)**
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects.	
HIGH NEGATIVE (-)	**BENEFICIAL (+)**
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long-term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light.	
MODERATE NEGATIVE (-)	**SOME BENEFITS (+)**
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium-term change to the (natural and/or social) environment. These impacts are real but not substantial.	
LOW NEGATIVE (-)	**FEW BENEFITS (+)**
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short-term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect.	
NO SIGNIFICANCE	
There are no primary or secondary effects at all that are important to scientists or the public.	
UNKNOWN	
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information.	

4 DESCRIPTION OF THE ESTUARY

4.1 Climate

St Francis Bay is characterised by a warm, temperate climate, with average temperatures ranging between 18.5 °C in July to 24 °C in February. The coldest temperatures are experienced during July, where average temperatures may drop to a low of 8.2 °C. The warmest months include January and February (Figure 4.1). Rainfall in St Francis occurs throughout the year, averaging around 525 mm per annum. The highest rainfall occurs during August, averaging around 62 mm, while the lowest rainfall occurs during January (26 mm).

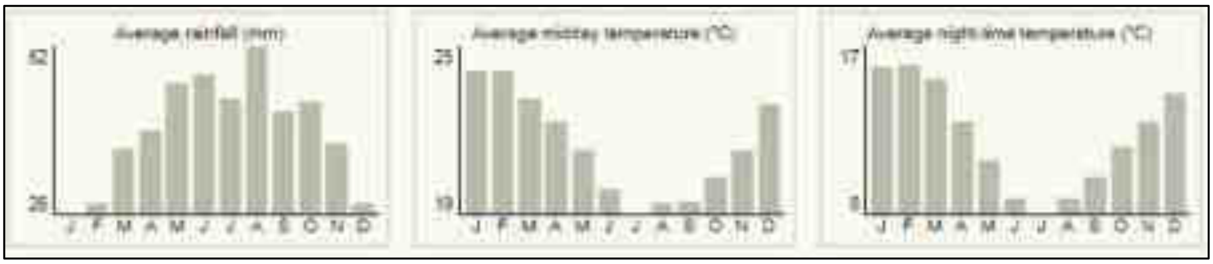

Figure 4.1 Average rainfall, midday temperatures and night-time temperatures for St Francis Bay (SA Explorer, 2017).

4.2 Hydrology

The Proposed Coastal Protection Scheme is located in Water Management Area seven (WMA 7): Mzimvubu-Tsitsikamma in Primary Drainage Region K, Quaternary Catchment K90E.

The Kromme River is approximately 95 km long (Scharler and Baird, 2000) and has many unnamed, small ephemeral tributaries that support dense pockets of indigenous vegetation. The main tributary is the Geelhoutboom River, which originates south of Humansdorp, and joins the Kromme Estuary about 8 km upstream of the mouth. Other tributaries are the Dwars River (8 km downstream of the source of the Kromme River), the Diep River (downstream of the Churchill Dam), the Klein River (11.6 km upstream of the mouth), the Boskloof River (5.2 km upstream of the mouth), the Sand River (2 km upstream of the mouth) and the Huis River (1 km upstream of the mouth) (Baird et al., 1992).

Under natural conditions the Geelhoutboom tributary, on average, is estimated to have contributed less than 5 % of the freshwater inflow into the estuary throughout the year. Under current conditions this contribution is less than 1 % in mid- to late summer, but typically between 10 to 30 % during the remainder of the year (i.e. the peak contribution is during the early part of the wet season). Under current conditions, during dry years the Geelhoutboom tributary contribution is negligible in terms of freshwater inflow to the Kromme Estuary in the dry summer months, but typically 15 to 20 % during the remainder of the year. During wet years the freshwater contribution from the Geelhoutboom ranges between 5 to 10% during the rainy season in late winter to early spring to approximately 20 % during the dry months in mid to late summer. The contribution from the Sand River is considered to be negligible (Coastal and Environmental Services, 2006).

The flow pattern of the Kromme River has been modified by two large dams, i.e. the Churchill Dam (built in 1943; capacity of 33 x 10^6 m^3) and the Mpofu Dam (built in 1983; capacity of 107 x 10^6 m^3) (Bickerton and Pierce, 1988; Bate and Adams, 2000). Both dams have the combined capacity of storing ca 133 % of the mean annual run-off of the Kromme River catchment (Bate and Adams, 2000; Scharler and Baird, 2000). The dams in the catchment are considered to attenuate all floods with a return period of less than 1 in 30 years (Bickerton and Pierce, 1988).

Model simulations, carried out by Advisian in 2020, concluded that the flow in the estuary is mainly tide dominated under normal conditions (Figure 4.2). During high river discharge conditions, the flow is dominated by river discharge (Figure 4.3). The maximum current speeds at the river mouth range from 1.8 m/s to 2.4 m/s during lean and high discharge conditions respectively. The current speed inside the main estuary and river is usually less than 0.3m/s.

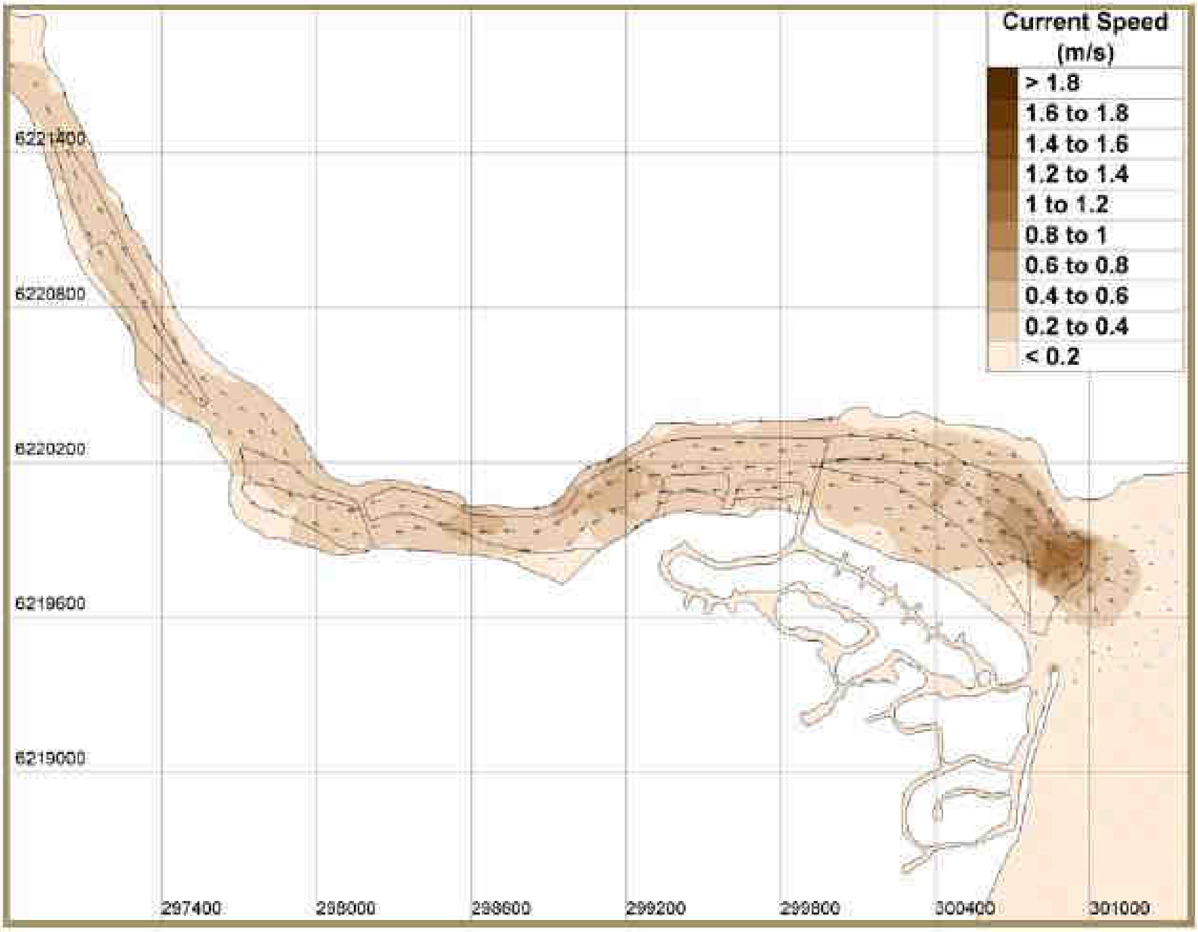

Figure 4.2 Spatial variation of currents during normal conditions. Higher current speeds are at the mouth (Advisian, 2020)

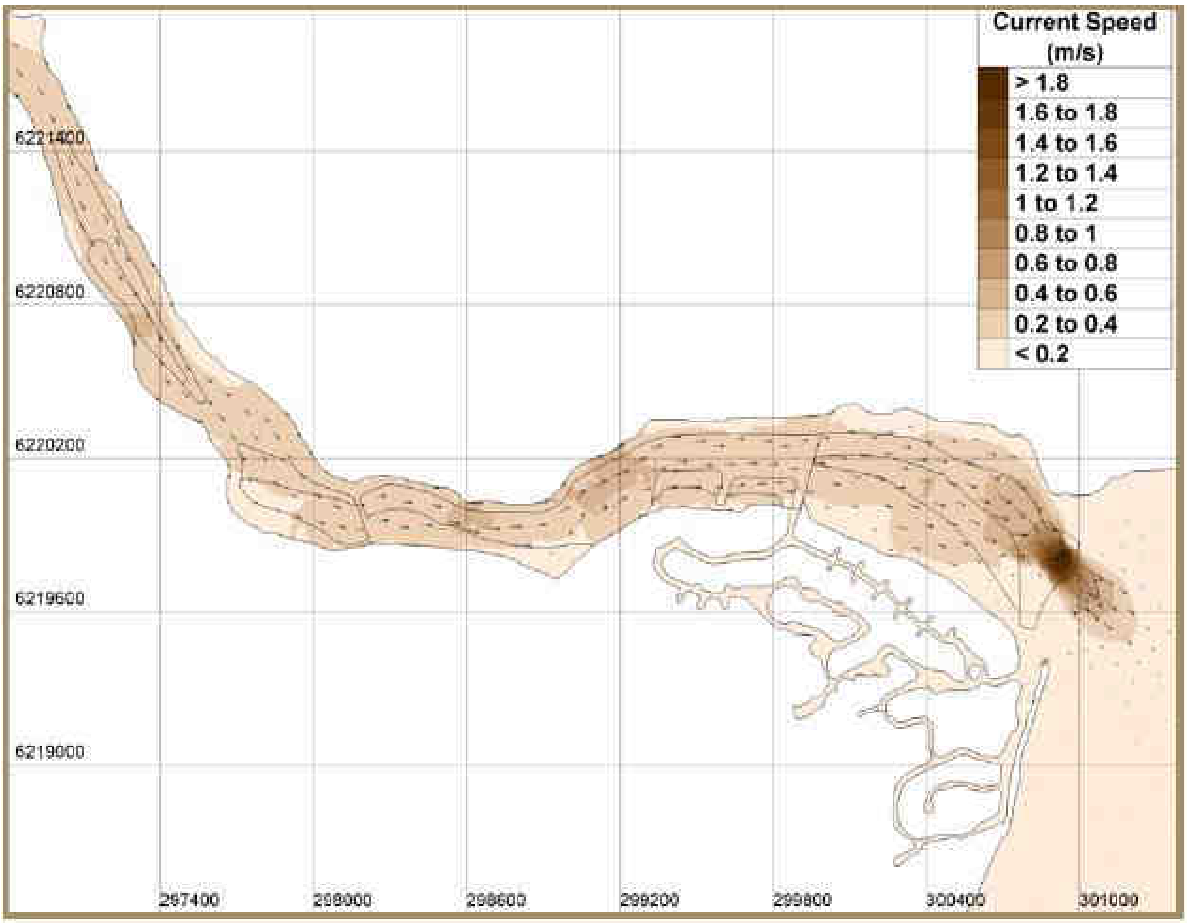

Figure 4.3 Spatial variation of currents during high flow conditions (Advisian, 2020)

4.3 Ecological Condition

The Present Ecological State (PES), the Ecological Importance (EI) and the Ecological Sensitivity (ES) of the Kromme and Geelhoutboom Rivers and their tributaries are presented in Table 4.1 below (Department of Water and Sanitation, 2014). These rivers define the upper boundary of the tidal influence, or the extent of saline intrusion upstream, of the Kromme Estuary.

Table 4.1 Environmental Sensitivity of the Kromme and Geelhoutboom

RIVER		PRESENT ECOLOGICAL STATE (PES)	ECOLOGICAL IMPORTANCE (EI)	ECOLOGICAL SENSITIVITY (ES)
1.	**Kromme River**	PES **D**: Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred	High	High
2.	**Geelhoutboom River**	PES **D**: Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred	Moderate	High

4.4 Estuarine Functional Zone

As discussed in Section 3.2 above, the base map for the Estuarine Functional Zone of the Kromme Estuary was obtained from the National Estuaries (2012) vector geospatial data set obtained from

BGIS (www.bgis.sanbi.org). The estuarine vegetation within the estuarine functional zone (as determine by BGIS) was delineated using the most recent aerial imagery available on Google Earth Pro in order to determine if there have been any changes in the extent of vegetation communities over time. The estuarine functional zone includes open water, estuarine habitat and the floodplain, and the results of the mapping exercise are presented in Figure 4.4 a & b. According to BGIS, the 5m contour has the following biodiversity and planning advantages:

- *"The 5m contour encapsulates most dynamic areas influenced by long-term estuarine sediment processes, i.e. sediment stored or eroded during floods, changes in channel configuration, aeolian transport processes and changes due to coastal storms. Allowing for natural variability is important as these are some of the key physical processes that drive biodiversity along the coastline.*
- *The 5m contour encompasses the floodplain and estuarine vegetation that contribute detritus (food) and provides refuge to the systems. Note: salt-marsh vegetation can occur further than 500m away at a number of the larger estuaries. Most estuarine-associated biota occur under the 5m contour, as this is as far as the influence of the ocean can be detected on land.*
- *Temporarily open/closed estuaries can close at levels of between 2.5 and 4.5m. The 5m contour allows for water-level increases due to back-flooding under closed mouth conditions or wave action from wind.*
- *In most cases, the 5m contour allows for the inclusion of a buffer zone of terrestrial vegetation that represents the transition between terrestrial and coastal ecosystems.*
- *The 5m contour should provide a buffer zone that can allow an estuary to retreat in the future in the event of sea-level rise due to climate change. It also allows for the inclusion of some terrestrial fringe vegetation that contributes detritus to the system and refuge areas during floods.*
- *Flood lines (1:50/1:100) for estuaries are often inaccurately determined under open mouth conditions, which leads to underestimation of flood heights. In the absence of long-term berm height data (which can vary substantially under different climatic conditions) the 5m contour provides the best protection against natural hazards such as floods and storms.*
- *The 5m contour minimizes the risk of pollution to estuaries. Septic tanks are sunk about 2 m into the ground. During closed mouth conditions (and very high tides) density differences between fresh and salt water cause drainage problems or infrastructure damage if tanks are not situated above the 5m contour.*
- *Water resources development and land-use change in the catchment can lead to the changes in mouth behaviour, i.e. change estuary type from permanently open to temporarily open."*

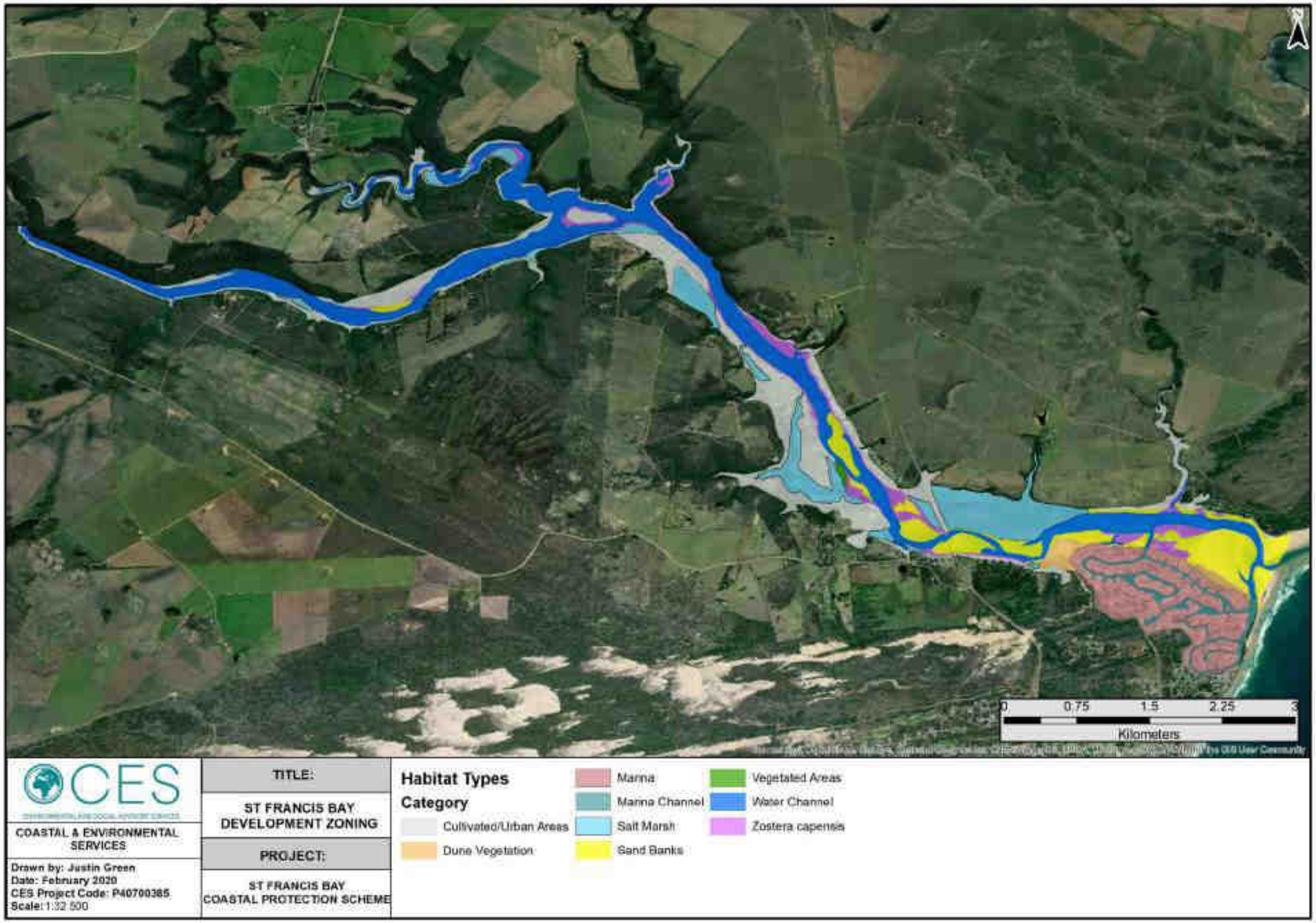

Figure 4.4a: The Kromme Estuary Functional Zone and Habitat Map.

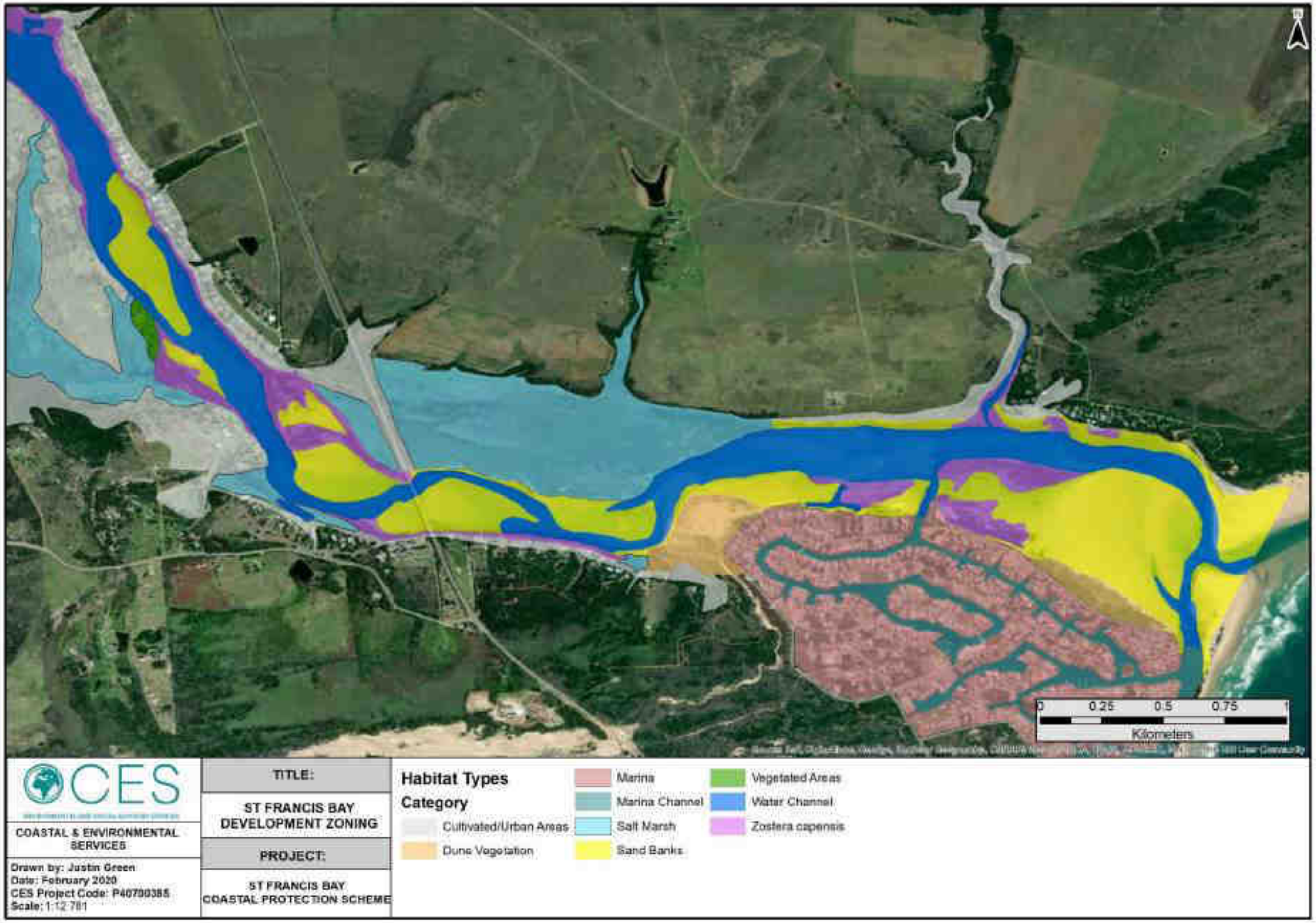

Figure 4.4b: The Kromme Estuary Functional Zone and Habitat Map (Lower Estuary).

4.5 Physical Characteristics of the Functional Zone

The Kromme Estuary is a permanently open estuary that is situated in a warm temperate biogeographical region. According to Whitfield (1992), some of the characteristics of permanently open estuaries are as follows:

→ Moderate tidal prisms;
→ Tidal/riverine mixing process;
→ Average salinity ranges from 10 to less than 35 ppt;
→ Longitudinal salinity gradient with possible vertical stratification, depending on the bathymetry and tidal cycle and river inflow;
→ Catchments typically >500 km^2;
→ Under natural conditions rivers have perennial flow;
→ Linkages to coastal lakes;
→ Presence of wetlands and/or mangroves;
→ Both marine and estuarine biota dominant;

The Kromme Estuary is tidal for approximately 14 km (Bickerton and Pierce, 1988). A massive sandspit of about half a kilometre long extends from the south bank of the estuary mouth and tends to push the mouth channel northwards. In the lower reaches of the estuary (up to about 5 km from the mouth) channel depths are around 1.5 m, characterised by a sandy bottom substrate. Further upstream, the estuary becomes deeper (3 to 5 m). In the upper reaches current velocities are usually lower than 0.3 $m.s^{-1}$, while current velocities of 1 $m.s^{-1}$ are common near the mouth. Extensive salt marshes cover the banks of the estuary in the middle and lower reaches, while the channel meanders between vegetated cliffs in the upper reaches. A marina has been developed on the west bank near the mouth (Coastal and Environmental Services, 2006). The mouth of the Kromme Estuary is flood tide dominated resulting in the ingress of marine sediment in its lower reaches (Bickerton and Pierce, 1988).

As mentioned above, the natural runoff from the Kromme River catchment area has been severely restricted by impoundments with storage capacities exceeding the mean annual runoff (MAR). Daily average discharge data was available for the location K9H003 from 1983 to 2020 with a gap in data from November 1996 to February 1998 (Advisian, 2020). The data showed very low daily average discharges – less than 1 m^3/s most of the time, with one high discharge maxima of up to 313 m^3/s recorded in 2006. There were two peaks of more than 200 m^3/s in 2011 and one other high flow event (100 m^3/s) in 2014. All of these would be related to high rainfall events.

The nutrient status in the estuary is fairly stable. The annual allocation of storage water to the estuary (2×10^6 m^3) was released from the Mpofu Dam as a single release in 1999 and the impact on various physio-chemical parameters as well as inorganic dissolved nutrients (phosphate, nitrate, nitrite, ammonia) in the estuary was investigated with regards to the magnitude, persistence and management of future releases. This was initiated with the aim of understanding how the system would respond to the freshwater input in order to inform future releases from the dam for ecological purposes. The impact on dissolved nutrient concentrations was short-lived (less than 7 days), and pre-release concentrations were quickly re-established (Sharler and Baird, 2000). The release raised especially nitrate and nitrite concentrations temporarily, because of elevated concentrations in the storage water (i.e. from agricultural practices), but phosphate concentrations in the estuary were slightly diluted. The research showed no long-lasting effect on the physical conditions of the estuary in terms of inorganic dissolved nutrients from the freshwater release. Natural runoff reaching the estuary appears to be more beneficial, especially in terms of phosphate.

A direct impact of the extensive water abstraction in the catchment is the presence of high salinity levels in the water column throughout the year, and the occasional occurrence of hypersaline conditions in the upper reaches. Several studies have characterised the estuary as freshwater-starved (e.g. Marais, 1983; Hanekom and Baird, 1984; Emmerson and Erasmus, 1987; Adams et al., 1992; Newman, 1993; Jerling and Wooldridge, 1994). This is largely because the Sand and Geelhoutboom Rivers, the biggest tributaries to the Kromme system, are not viable freshwater contributors to the estuary, based on studies over the last 25 years (Scharler et al., 1997). Salinity values above 35 ppt dominate at the tidal head of the estuary (i.e. 14km upstream), whereas lower salinity values (< 35 ppt) were only measured occasionally near the surface in the upper reaches of the estuary (i.e. closer to the Mpofu Dam) (Scharler et al., 1997). Based on this, the Kromme estuary is essentially a marine system and creates habitats for marine vegetation and species.

Reduction in freshwater flow also results in marine sediments moving upstream due to tidal flow (sediment enters from the tidal head and inlet). Since the construction of the Churchill and Mpofu dams on the Kromme River, the upstream migration of marine sand has increased (Reddering and Esterhuysen, 1983). In an unmodified system, the net long-term rate of sediment build-up is relatively slow because periodic freshwater floods scour the channels and remove accumulated sediment out to sea. The sediment balance in the estuary has thus been disrupted through artificial modification (specifically a reduction in freshwater inflow) resulting in limited scouring (there are still occasional floods of freshwater to the sea, but because of the large sizes of the impoundments, these are very irregular), which consequently results in continuous sediment built-up in the system (Lee et al., 2014). Another source of sediment for the Kromme River Estuary is the Sand River (approximately 2 km upstream from the mouth). This tributary deposits a small amount of sand into the estuary on the southern bank, which is then spread upstream and downstream in the estuary by the tidal currents.

The mouth of the estuary experiences regular tidal inflow and outflow, which is sufficient to maintain a tidal inlet. Consequently, the flood-tidal delta of the Kromme is well-developed and extends 4-5 km upstream of the mouth where it produces large intertidal sand flats, which are densely colonised by burrowing infauna (mainly *Callianassa* spp.). The open connection with the sea and strong tidal currents permit both active and passive migration of biota and enable the maintenance of “typical” estuarine water level fluctuations, creating extensive sandy intertidal areas and salt marshes, which are important habitats for the estuarine biota (Harrison et al., 1996a; Harrison et al., 1996b).

The aerial imagery in Figure 4.5 shows the relative stability and persistence of the sand banks in the lower parts of the estuary (near the mouth) extending up to the R330 road bridge. The images show that very little change has taken place with regards to development along the estuary and the vegetation seems similar at this scale.

The Kromme is considered a permanently open estuary with all images showing the mouth open to the sea and in a similar position year on year.

The analysis of the sediment and its particle size suggest that the sediment in the lower reaches of the estuary are considered to be medium sand according to the Udden-Wentworth scale. The distribution of this sediment is uniform throughout the lower reaches. It is anticipated that upstream from the R330 road bridge the particles become finer.

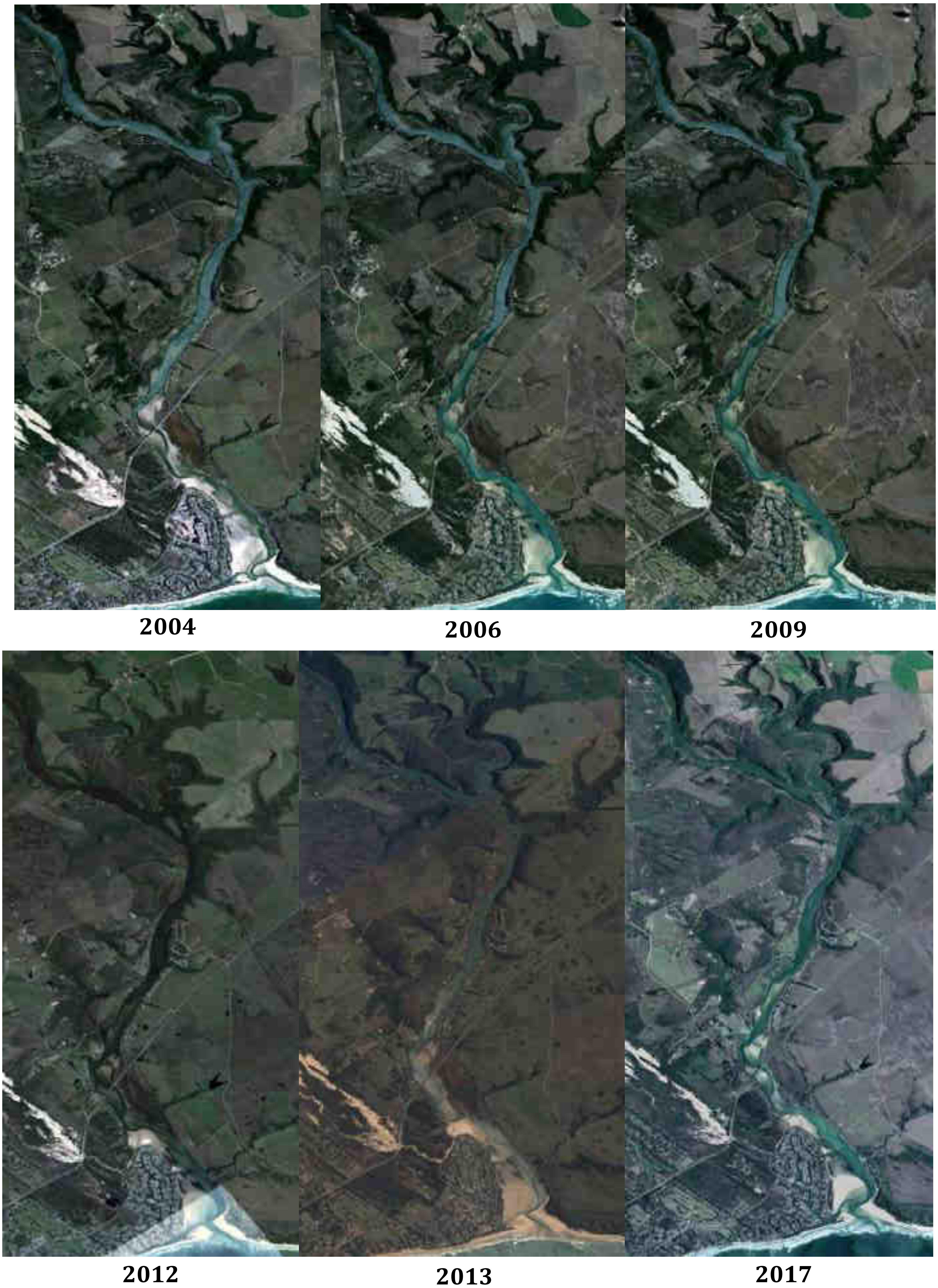

Figure 4.5 Aerial Imagery of the Kromme Estuary during the period of 2004 – 2017.

4.6 Flora Of The Functional Zone

Vegetation in the Kromme Estuary can be divided into four (4) distinct groups:

→ <u>Submerged Macrophytes</u>: Dominated by *Zostera capensis*;
→ <u>Intertidal Salt Marsh</u>: Dominated by salt marsh species such as *Sarcocornia decumbens, Triglochin striata, Triglochin bulbosa, Bassia diffusa, Sporobolus virginicus, Limonium linifoloium, Spartina maritima* and *Salicornia meyeriana*;
→ <u>Supratidal Salt Marsh</u>: Dominated by *Sarcocornia pillansii*; and
→ <u>Reeds and Sedges</u>: Dominated by *Phragmites australis*

Plate 4.1 below shows three (3) of the typical vegetation/habitat types at the Kromme Estuary. Given the state of the tide (rising) images of submerged macrophytes were not taken.

	
a) Dune vegetation (sedges) coverage on the southern bank of the estuary looking upstream, recently established following the 2012 Sand River flood.	b) Image of the mouth of the estuary on the rising tide looking south.
	
c) Southern bank of the estuary in the lower reaches showing bare intertidal area and vegetated supra-tidal areas.	d) Stable dune covered in reeds and sedges located at the entrance to the Sand River, recently established following the 2012 Sand River flood.

e) Dune vegetation covering the southern bank of the estuary near the R330 road bridge, recently established following the 2012 Sand River flood.

f) Sand bank upstream of the R330 road bridge looking north.

g) Southern bank of the estuary downstream of the R330 road bridge showing intertidal sand bank and supra-tidal saltmarsh vegetation.

h) Inter/supra-tidal saltmarsh species (*Sarcocornia pillansii*.) common to South African estuaries.

Plate 4.1: Kromme Estuary photographs.

4.6.1 *Submerged Macrophytes*

Submerged macrophytes are primary colonizers of mudflats and sandflats. They are those angiosperms that are rooted in soft subtidal and low intertidal substrata (Day, 1981). The plants‟ leaves and stems are completely submerged for most states of tide. They vary in abundance in water ranging from polyhaline (above 30 PSU) to fresh (0 PSU) (Day, 1981). The polyhaline species have a worldwide distribution in sheltered bays and estuaries. *Zostera, Halophila, Ruppia, Potamogeton* and *Zannichellia* are the common temperate genera (Day, 1981). *Zostera capensis* Setch. is the most common submerged macrophyte in permanently open South African estuaries (Edgecumbe, 1980; Lubke and van Wijk, 1988).

Submerged macrophytes help to oxygenate the hypolimnion, i.e. the layer of water in a thermally stratified lake that lies below the thermocline, is noncirculating, and remains perpetually cold (Titus et al., 2004), and increase the depth of the oxidized microzone at the sediment surface (thus reducing phosphate and ammonia release). Submerged macrophytes also play an essential role in nutrient trapping and recycling (Cacador et al., 2000; Titus and Pagano, 2002; Riis et al., 2004; Titus et al., 2004; Lillebo et al., 2006; Figueiredo da Silva et al., 2009). They reduce water movement on the estuary bottom, preventing resuspension of the sediments (Adams et al., 1999; Noges et al., 2003; James et al., 2004b; Riis et al., 2004) therefore reducing the release of phosphorus (Sondergaard et al., 2003). Numerous studies have shown that high loading of phosphorus leads to high phytoplankton biomass, turbid water and often undesired biological changes (Sondergaard et al., 2003; James et al., 2004a; James et al., 2004b). The latter includes loss of biodiversity, disappearance of submerged macrophytes, fish stock changes and decreasing top-down control by zooplankton on phytoplankton (Sondergaard et al., 2003; Schutten et al., 2004). Hughes and Paramor (2004) reported that the loss of *Zostera* from the Stour Estuary, England, caused the erosion of 15x 10^6 m^3 of sediment and increased its tidal volume by 30 %.

Submerged macrophytes are also an important habitat for invertebrates, fish and birds (Noordhuis et al., 2002; Van den Berg et al., 2003; Booth, 2009; Henninger et al., 2009). *Zostera* beds provide shelter for juvenile fish and protect them from predators. Submerged macrophytes can be grazed directly, but food for consumer organisms is mostly provided indirectly through their feeding on epiphytic algae growing on plant surfaces (Thayer et al., 1975; Larkum and West, 1990; Walker and McComb, 1992; Adams et al., 1999; Titus et al., 2004; Rolon and Maltchik, 2006; Henninger et al., 2009).

Freshwater impoundment generally reduces the frequency of floods and sedimentary disturbances (Whitfield and Bate, 2007). Den Hartog (1977) has shown that plants such as submerged macrophytes cannot develop or colonize areas where the substrate is constantly being modified by water currents. Therefore, reduced freshwater input into an estuary, and slower current velocity favours submerged macrophyte growth and dominance, as there is a decrease in turbidity and water velocities resulting in a more stable substrate.

The reduction of freshwater inflow into the Kromme Estuary over the past decade has led to an increase in *Zostera capensis* biomass and its area of distribution (Adams and Talbot, 1992; Wooldridge, 2007). Bezuidenhout (2011), showed, that there has been a steady increase in the area covered by *Zostera capensis* since 1942 (10.8 ha), 1980 (13.7 ha), 1989 (21.7 ha) and up to 30.98 ha mapped from aerial photographs from 2000. This is a three-fold increase in Zostera. Based on mapping conducted for this study (2017 google earth imagery), the area colonised by *Zostera capensis* has increased by a further 17 ha in the last 17 years, resulting in an increase from 10.8ha in 1942 to 48ha today, but importantly the increase between 1942 and 2000 (58 years) was 20ha (0,35ha per annum), but the increase in the past 17 years is 17ha (1ha per annum). These more rapid increases in recent times can be attributed to various anthropogenic factors, but most notably reduced flows (which results in a lack of scouring and sedimentary disturbance) a more stable salinity regime, and reduced turbidity. The changes to these physical processes are a result of the construction of the bridge, a reduction in sand input from the Sand River tributary, and the construction of the Mpofu Dam.

Zostera capensis is listed on the South African Red Data List (2017) as Least Concern. According to SANBI "*Zostera capensis is locally extinct in Durban Bay as a result of habitat loss due to harbour construction, reclamation and dredging, and at St Lucia due to natural disasters as a result of prolonged drought and closed mouth conditions. It has also been lost from a number of small KwaZulu-Natal estuaries due to coastal development, freshwater abstraction and catchment disturbance which has led to mouth closure and loss of intertidal habitat. Eutrophication of rivers is also a severe threat, leading to increased algal growth, shading and outcompeting this species.*"

In addition, *Zostera capensis* is listed as vulnerable by the IUCN which states that current populations of this species are decreasing, mainly as a result of climate change, pollution and development. This is ironic given the rapid colonisation of the Kromme system by Zostera, which is spreading at a pace akin to an invasive species.

4.6.2 *Salt Marsh*

Salt marshes comprise emergent herbs, grasses or low shrubs that occur in soils that are inundated and drained by tidal action (Nybakken, 2001). They are highly productive ecosystems and have primary productivity rates comparable with coral reefs and tropical forests in certain areas (Silliman and Bortolus, 2003; Bromberg and Bertness, 2005). Salt marshes occur along the south-eastern, southern and western coasts of South Africa in estuaries, dry river beds and embayments. Species diversity of salt marshes is poor, mostly because of the specialised environment and high salt conditions which create an uninhabitable environment (Nybakken, 2001). Although salt marsh plants are generally associated with euhaline (i.e. fully saline; seawater with a salinity of greater than 30 ppt) conditions, high salinity is not physiologically optimal for them.

Salt marsh plants occur in distinct zones along an elevation and tidal inundation gradient (Davy, 2000; Rogel et al., 2000; Rogel et al., 2001; Bockelmann et al., 2002; Costa et al., 2003; Ursino et al., 2004; Hughes and Paramor, 2004; Perry and Atkinson, 2009). In areas above the normal spring tide is the supratidal zone, which is only inundated with water on an occasional basis. Here slightly salt-tolerant grasses such as *Stenotaphrum secundatum* (H. Walter) Kuntze and *Cynodon dactylon* (L.) Pers. co-exist with *Sporobolus virginicus* (Day, 1981; O‟ Callaghan, 1994; Adams et al., 1992). *Sarcocornia pillansii* (Moss) A.J.Scott, is also found in this zone together with *Disphyma crassifolium* (L.) L.Bolus and *Plantago crassifolia* Forssk.

The upper intertidal salt marsh zone is found from the extreme high water spring tide level to the mean high water spring level, the vegetation consists of a mixed zone of generally typical salt marsh species: *Sarcocornia decumbens* (Tölken) A.J.Scott, *Limonium scabrum* (Thunb.) Kuntze and *Bassia diffusa* (Thunb.) Kuntze (O‟ Callaghan, 1994). The lower intertidal salt marsh zone is found between the mean high-water spring and the mean high water neap level, and is characterised by *Sarcocornia perennis* (Mill.) A.J.Scott and *Triglochin bulbosa* L. (Day, 1981; O‟ Callaghan, 1994). *Spartina maritima* (Curtis) Fernald is found from the bottom of this zone to below mean sea level, which is normally inundated. *Zostera capensis* Setch. grows below mean sea level and thus marks the end of the salt marsh species extent.

Salt marsh plants are important inorganic and organic nutrient sources for estuarine ecosystems (Sousa et al., 2008), although the extent of tidal flushing is important in determining how much of the nutrient is released to the water column (Teal and Howes, 2000). Bacteria and other microorganisms break down the plant material and the “filter-feeders” sieve out the fine organic particles as a food source (Teal and Howes, 2000; Galvan, 2008). In this way the plants offer feeding opportunities to a broad spectrum of animal life, thus playing an essential role in the functioning of the estuarine food web.

Salt marshes and wetlands are important habitats, and their loss can have significant ecological and economic implications. For example, salt marshes provide a critical habitat for resident and migrating wildlife (Montalto and Steenhuis, 2004) and a unique niche for some crustacean and mollusc invertebrates (Bromberg and Bertness, 2005). These organisms are specifically adapted to marshes, and are not found in other parts of the estuary. Salt marsh areas provide feeding areas for fish during flood tides as they enter the marsh creeks to feed off the substrate, or prey on abundant mudprawn (Montalto and Steenhuis, 2004; Bromberg and Bertness, 2005; Rozas et al., 2005).

Salt marsh macrophytes promote sedimentation by reducing velocities and increasing sheet flow. *Spartina* has been known for stabilizing and building up mudflats (Chung et al., 2004). Salt marsh is also important in coastal flood defence (Bromberg and Bertness, 2005), as it offers some protection from wave action.

The ecological function and physical stability of marshes are easily disrupted by, for example, interference with the tidal exchange of water, reclamation or infilling, pollution, dredging or trampling by vehicles or animals (Chapman, 1960; Ungar, 1962; Tolken, 1967; Ungar, 1978; Gray, 1986; Baird et al., 1992; Naidoo and Mundree, 1993; Adams and Bate, 1995).

The large intertidal salt marsh areas within the Kromme Estuary are particularly important, as only 18 % of South African estuaries are permanently open, which is conducive to the establishment of salt marsh habitat, and consequently the Kromme salt marshes are considered to be rare (Colloty, 2000). The largest section of salt marsh occurs on the seaward side of the road bridge on the eastern bank (Figure 4.4a & b), approximately 2 km from the mouth. Small isolated salt marshes also occur further upstream on the west bank (4 km from the mouth) and on the east bank about 2 km from the head of the estuary. Salt marshes extend into the middle-upper reaches of the Geelhoutboom tributary.

The loss of salt marsh in the system can mainly be attributed to development on the floodplain i.e. along the edge of the estuary in the middle reaches. There was also some evidence of salt marsh erosion in the middle reaches of the estuary (at the Sand River delta where additional sand shifted the river channel and is now actively eroding the river bank). In addition, boat activity as well as waves caused by easterly and westerly winds also have a wake effect that has led to bank collapse. In addition, lack of freshwater input into the Kromme Estuary has resulted in increased water column salinity that has caused salt accumulation in the intertidal marshes (Adams *et al.*, 1992). This has resulted in large areas of bare ground in the upper intertidal areas due to hypersaline conditions. These bare patches are only colonized by the highly stress tolerant *Salicornia meyeriana.* When an increase in rainfall flushes some of the excess salt from these bare patches during winter there is a decrease in the cover of *Salicornia* and an increase in other salt marsh species.

Other saltmarsh species present in the Kromme Estuary include:

→ *Triglochin striata,*
→ *Triglochin bulbosa,*
→ *Bassia diffusa,*
→ *Sporobolus virginicus,*
→ *Liminium linifolium,*
→ *Disphyma crassifoilium,* and
→ *Spartina maritima*

The conservation status of these species is outlined in Table 4.2 below.

Table 4.2: Conservation Status of salt marsh species present in the Kromme River Estuary according to the South African and International Union for Conservation of Nature (IUCN) Red Data Books

SPECIES	SOUTH AFRICAN RED DATA LIST	IUCN	COMMENTS
Sarcocornia decumbens	Least Concern	-	This taxon was not selected in any one of four screening processes for highlighting potential taxa of conservation concern for detailed assessment and was hence given an automated status of Least Concern.
Sarcocornia pillansii	Least Concern	-	
Salicornia meyeriana	Least Concern	-	
Triglochin striata	Least Concern	-	
Triglochin bulbosa	Vulnerable	Least Concern	There are four subspecies of *Triglochin bulbosa* listed on the South African Red Data List, *Triglochin bulbosa* L. subsp. *bulbosa* (Least Concern), *Triglochin bulbosa* L. subsp. calcicola Mering, Köcke & Kadereit (Near Threatened), *Triglochin bulbosa* L. subsp. quarcicola Mering, Köcke & Kadereit (Vulnerable), *Triglochin bulbosa* L. subsp. tenuifolia (Adamson) Horn (Vulnerable). Due to the fact that the sub-species occurring in the Kromme Estuary is currently unknown, the precautionary approach has been applied.
Bassia diffusa	Least Concern	-	This taxon was not selected in any one of four screening processes for highlighting potential taxa of conservation concern for detailed assessment and was hence given an automated status of Least Concern.
Sporobolus virginicus	Least Concern	-	
Limonium linifolium	Near Threatened	-	Many estuaries within the known range of this species are in poor condition (Driver et al. 2012), as a result of infrastructure development, pollution, and upstream damming of rivers, and estuarine ecosystems are poorly protected.
Disphyma crassifolium	Least Concern	-	Population trend is considered to be stable.
Spartina maritima	Least Concern	Near Threatened	Threats are generally from the construction of tourist areas and dams.

4.6.3 *Reeds and Sedges*

Extensive reed and sedge communities are found at freshwater seeps and at the head of estuaries, where there is greater freshwater influence. The dominant plants in this community are rushes such as *Juncus*, or sedges such as *Scirpus*. Mats or swards of grasses, such as *Sporobolus virginicus* (L.) Kunth or *Stenotaphrum secundatum* (H. Walter) Kuntze are common on raised banks or at the edge of reed swamp or salt marshes in South Africa (Lubke and van Wijk, 1988). *Phragmites australis* (Cav.) Trin. Ex Steud. is a common estuarine reed that may also be associated with disturbed areas where the normal saltwater flushing has been arrested (Clark, 1977; Lubke and van Wijk, 1988). It can, however, tolerate salinities close to seawater, unlike plants such as *Typha, Scirpus* and *Cyperus*. Salinity restricts the distribution of reed and sedge communities in estuaries, although groundwater seepage can play an important role in influencing salinity in marginal reedbeds (Adams and Bate 1999).

Reed and sedge communities serve the valuable ecological function of protecting banks from erosion. Destruction of *Phragmites australis* (common reed) stands by boating and swimming activities in Europe has been shown to result in costly shore rehabilitation programmes (Weisser and Howard-Williams, 1982). *Phragmites*-dominated marshes provide a habitat for many birds, invertebrates and fish species (Haslam, 1971). They can remove large quantities of nutrients from the water column and are so effective that they are used as water purification systems in artificial wastewater treatment systems (Wolverton, 1982; Hoffman, 1990; Brix, 1993; Adams et al., 1999; Nemeth and Lakner, 2002; Meers et al., 2005; Tian et al., 2009; Ruiz and Velasco, 2009). Todorovics et al. (2005) showed that reedbed waste water treatment systems have an organic removal efficiency rate similar to that of the conventional activated sludge treatment, plus a higher nutrient retention ability, and are therefore beneficial against eutrophication. Reed and sedge communities have an important utilitarian value, particularly in the rural areas of KwaZulu-Natal (Begg, 1986). The sedge, *Juncus kraussii* Hochst. is used for the construction of sleeping mats and numerous craftwork products. Hut-building and thatching material is obtained from *Phragmites* (Adams et al., 1999).

According to Bezuidenhout (2011) a large area (7.2 ha) of *Phragmites australis* near the village of St. Francis Bay was lost as a result of development. Ignoring the loss of this inland reed bed, there was actually an increase of over 6 ha in the estuary itself. This increase in cover of the reedbeds resulted from an increase in sedimentation due to decreased freshwater input (Adams and Talbot, 1992). Reed beds occur upstream of the road bridge on the south bank, and in small streams and tributaries feeding the estuary in the middle-upper reaches. Reeds can survive tidal inundation with saline water as long as their roots and rhizomes are located in brackish to fresh water (Adams and Bate, 1999). The upper reaches of the Kromme Estuary are rocky and extensive reed beds do not occur there naturally. However, reeds were probably more extensive in the Geelhoutboom tributary prior to the construction of farm dams when the water column salinity was lower (< 15 PSU).

Phragmites australis is listed on both the South African Red Data List (2017) and the IUCN as Least Concern.

4.7 Fauna of The Functional Zone

There is a significant lack of recent literature concerning the ichthyofaunal composition of the Kromme Estuary. However, according to Hanekom and Baird (1984), a total of 24 species have been recorded in this estuary (Table 6.2). Of these 24 species, 7 species occur throughout the estuary, namely *Cajjrogobius multifasciatus* (Smith), *GiJchristeUa aestuarius* (Gilchrist), *Gkmogobius giurus* (Hamilton-Buchanan), *Hepsetia breviceps* (Cuvier), *Liza dumerili* (Steindachner), *Liza richardsoni* (Smith) and *Rhabdosargus holubi* (Steindachner). The Species *Monodactylus jalcijonnis* (Lacepede) and *Rhabdosargus holubi* occur predominantly in Zostera beds, while the species *Diplodus cervinus* (Valenciennes), *Lithognathus lithognathus* (Cuvier), *Spondyliosoma emarginatum* (Cuvier) *Gilchristella aestuarius*, *Liza dumerili, Liza richardsoni* and *Pomadasys olivaceum* usually dominate areas outside of Zostera beds. Species occurring in the highest abundance include *L. dumerili, G. giurus*, and *G. aestuarius.*

The conservation status of these species is outlined in Table 4.3 below.

Table 4.3: Conservation Status of fish species recorded in the Kromme River Estuary

SPECIES	IUCN
Clinus superciliosus	Least Concern
Caffrogobius multifaciatus	-
Diplodus cervinus	Least Concern
Diplodus sargus	Least Concern
Gilchristella aestuarius	Least Concern
Glossogobius giurus	Least Concern
Hepsetia breviceps	Not Evaluated
Heteromycetes capensis	Not Evaluated
Lichia amia	Least Concern
Lithognathus	Endangered
Chelon dumerili	Data Deficient
Chelon richardsonii	-
Chelon tricuspidens	-
Monodactylus falciformis	Least Concern
Mugil cephalus	Least Concern
Myxus capensis	Least Concern
Pomadasys commersonni	Not Evaluated
Pomadasys o/ivaceum	-
Psammogobius knysnaensis	-
Rhabdosargus holubi	Least Concern
Solea bleekeri	-
Spondyliosoma emarginatum	Least Concern
Syngnathus acus	Least Concern
Tachysurus jeliceps	-
Syngnathus watermeyeri	-

Although the Western Cape's endemic seahorse species *Hippocampus capensis*, commonly referred to as the Knysna Seahorse, historically occurred in the Kromme Estuary, sightings of this species have not been recorded for many years. This endangered species now only inhabits three estuarine systems along the South African coast, namely the Swartvlei Estuary, Keurbooms Estuary and the Knysna Estuary (Harding, 2017).

One of South Africa's two Sygnathus species, *S. acus* (commonly known as the Longsnout Pipefish), can also be found occurring in low abundance within the coastal and estuarine regions of the Kromme Estuary (Mwale et al., 2014). This unique species generally occurs in warm to cool temperate estuarine systems along the South African Coast and plays an important ecological function in the community structures of vegetated habitats, such as Zostera beds. Most species of Sygnathus are susceptible to human disturbance due to their restricted distribution, low mobility, and reproductive rate.

The macrobenthic communities of estuarine substrate are divided into two main groups: suspension- and deposit feeders. The presence/absence of these types of species is strongly related to sediment type. The communities are dominated by crustaceans, *Cleistostoma edwardsii*, *C. algoense*, *Upogebia africana, Sesarma catenata* and *Uca urvillei* and the bivalve *Solen cylindraceus.* Other species include: *Glycera tridactyla*, *Tellina gilchristi* and *Macoma ordinaria*. The sediment of the estuary also contains bait species including: the sandprawn, *Callianassa kraussi*, the pencil bait, *Solen capensis* and the bloodworm, *Arenicola loveni*.

According to South African Birding (2008), within just a few hours of bird watching, anywhere between 80 to 160 regularly occurring bird species can be spotted in and around the St Francis Bay area. Commonly spotted species include the African fish eagle (*Haliaeetus vocifer*); African Marsh-Harrier (*Circus ranivorus*); Osprey (*Pandion haliaetus*); Cape Gannet (Morus Capensis); African Black Oyster

Catcher (*Haematopus moquini*); Goliath Heron (*Ardea goliath)*; African Spoonbill (*Platalea alba*); Black-winged Stilt (*Himantopus himantopus*); Blue Crane (*Anthropoides paradiseus*); Denham's Bustard (*Neotis denhami*), Olive Bush-Shrike *(Chlorophoneus olivaceus)*; Southern Tchagra *(Tchagra tchagra)*; Cape Longclaw (*Macronyx capensis)*, Cape Grassbird (*Sphenoeacus afer*), 5 species of kingfisher (family *Alcedinidae*); 3 species of sunbird (family *Nectariniidae*) and African Stonechat (*Saxicola torquatus*).

The conservation status of the above listed species are listed in table 4.4 below.

Table 4.4: Conservation Status of bird species recorded in the Kromme River Estuary

SPECIES	IUCN
Haliaeetus vocifer	Least Concern
Circus ranivorus	Least Concern
Pandion haliaetus	Least Concern
Morus Capensis	Vulnerable
Haematopus moquini	Near Threatened
Ardea goliath	Least Concern
Platalea alba	Least Concern
Himantopus	Least Concern
Anthropoides paradiseus	Vulnerable
Neotis denhami	Near Threatened
Chlorophoneus olivaceus	Least Concern
Tchagra	Least Concern
Macronyx capensis	Least Concern
Sphenoeacus afer	Least Concern
Saxicola torquatus	Least Concern

4.8 Socio-Economic Importance Of The Kromme Estuary

The open water of the Kromme Estuary is listed as 125 ha (Sowman and Fuggle, 1987). The Kromme Estuary supports many recreational activities including fishing, birding, bait collection, waterskiing, canoeing, boat cruisers, hiking and swimming (Adams, 2001). Tourism is viewed as an important income generator in the area (Davies, 2009 in Sale et al., 2009). There is considerable concern that the recreational capacity of the Kromme River estuary is being exceeded. In 1992, the estimated increase of recreational activities on the river in peak holiday periods was ~400 %. Calculations were done using international safe space standards and it was determined that the carrying capacity of the river in terms of power boating and sailing activities is exceeded in peak holiday times. This implies that the river becomes unsafe for public use in these times (ARSC Kromme River Structure Plan, 1992).

Turpie (2006) undertook a more comprehensive hedonic valuation study at the Kromme and Seekoei estuaries in the Eastern Cape, in which data were collected from door-to door surveys. At the Kromme Estuary, there was at the time of the survey a total of 4,584 erven and 2,555 properties in the Cape St Francis to Kromme River area, of which 45% were occupied by permanent residents. Most households had boats and made use of the estuary. Distance to the estuary was a significant factor determining property prices in the area. Based on the property price premium associated with river-front property, the overall property value contributed by the estuary was conservatively estimated as R578 million. The total property premium for the Kromme Estuary was converted to annual turnover in the real estate sector based on estimated turnover rates of property and the commission accruing to the property sector. In the Kromme study (Turpie, 2006) the R578 million property premium translated to about R17.7 million in terms of direct value added to national income in the real estate sector per annum. As a result, the Kromme Estuary is rated 5th on the list of temperate estuaries in terms of property value attributable to an estuary (Turpie and Clark, 2007).

4.9 Protected Areas

The application area does not fall within any formally protected areas or within any delineated National Protected Areas Expansion Strategy (NPAES) Focus Areas (Figure 6.7). The closest National Park to the application area is the Tsitsikamma National Park (62 km west of the application site) and the Addo Elephant National Park (103 km north east of the application site). The closest protected areas are the Kromme River Mouth Private Nature Reserve (380 m North); the Rebelsrus Private Nature Reserve (6.3 km south west); and lastly the Erma Booysen Florareservaat Local Authority Nature reserve and Seal Bay Local Authority Nature Reserve (both located approximately 3 km south of the application site). In addition, the Kromme Estuary is identified as an 'estuarine' wetland as defined by the National Freshwater Ecosystem Priority Areas (NFEPA). The NFEPA database also defines a number of smaller artificial and natural wetlands which are located around the estuary (Figure 4.6).

The Eastern Cape Biodiversity Conservation Plan (ECBCP, 2019) replaces the ECBCP (2007) in its entirety and provides a map of important biodiversity areas, outside of the Protected Areas network, which must be used to inform land use and resource-use planning and decision making.

The aim of the ECBCP (2019) was to map biodiversity priority areas through a systematic conservation planning process. The main outputs of the ECBCP include Protected Areas (PA), Critical Biodiversity Areas (CBA), Ecological Support Areas (ESA), Other Natural Areas (ONA) and No Natural Habitat Remaining (NNR) for both terrestrial and aquatic ecosystems.

According to the ECBCP the application site falls within a terrestrial and aquatic CBA1 (Table 4.5 and Figure 4.7).

Table 4.5: Description of the CBA designations

CBA area	Desired State	Management requirements
CBA1	Natural	Maintain in a natural state (or near-natural state if this is the current condition of the site) that secures the retention of biodiversity pattern and ecological processes: For areas classified as CBA1, the following objectives must apply: • Ecosystem and species must remain intact and undisturbed; • Since these areas demonstrate high irreplaceability, if disturbed or lost, biodiversity targets will not be met; • Important: these biodiversity features are at, or beyond, their limits of acceptable change. If land use activities are unavoidable in these areas, and depending on expert opinion of the condition of the site, a Biodiversity Offset must be designed and implemented.

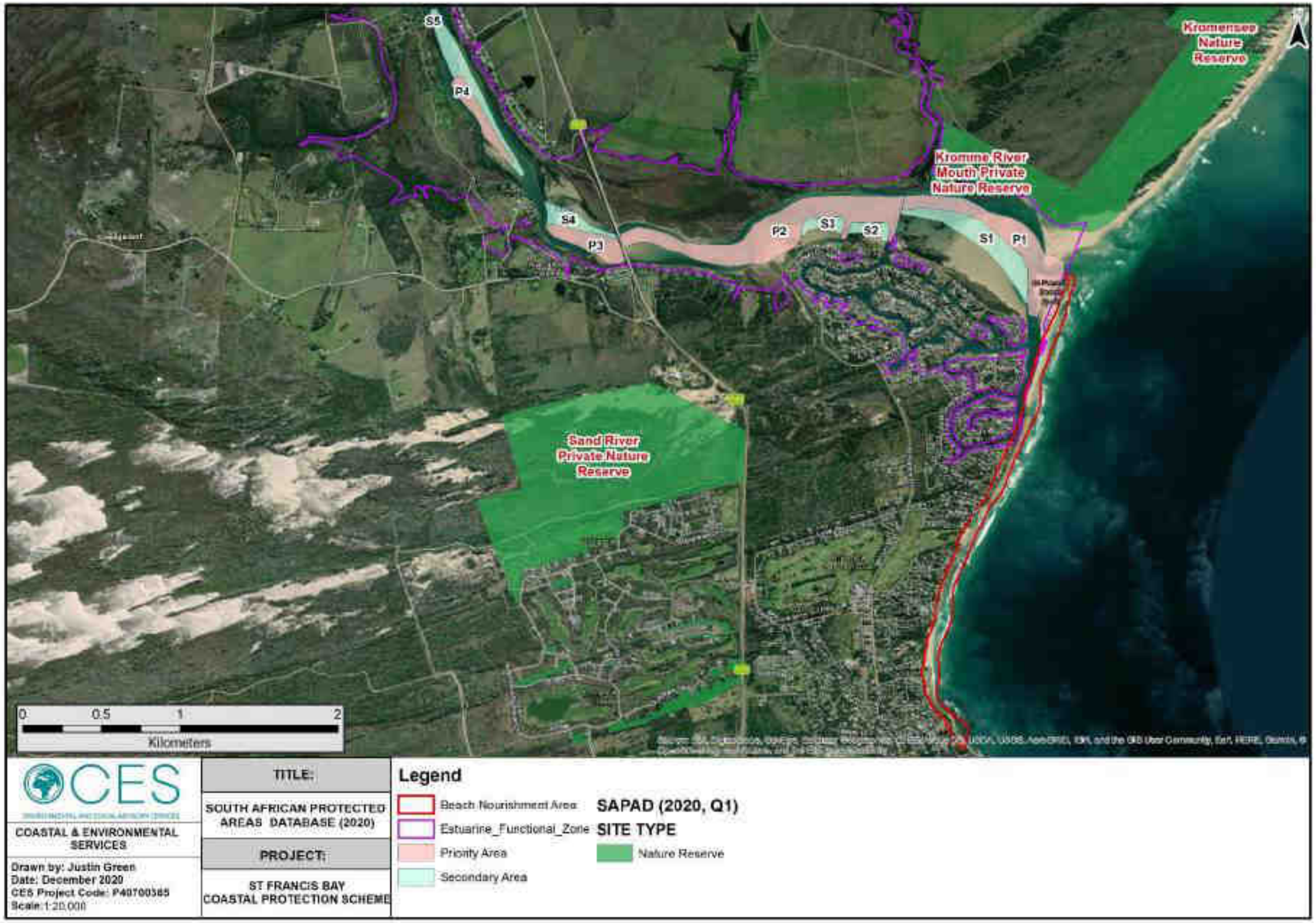

Figure 4.6 Critical Biodiversity Areas of St Francis Bay.

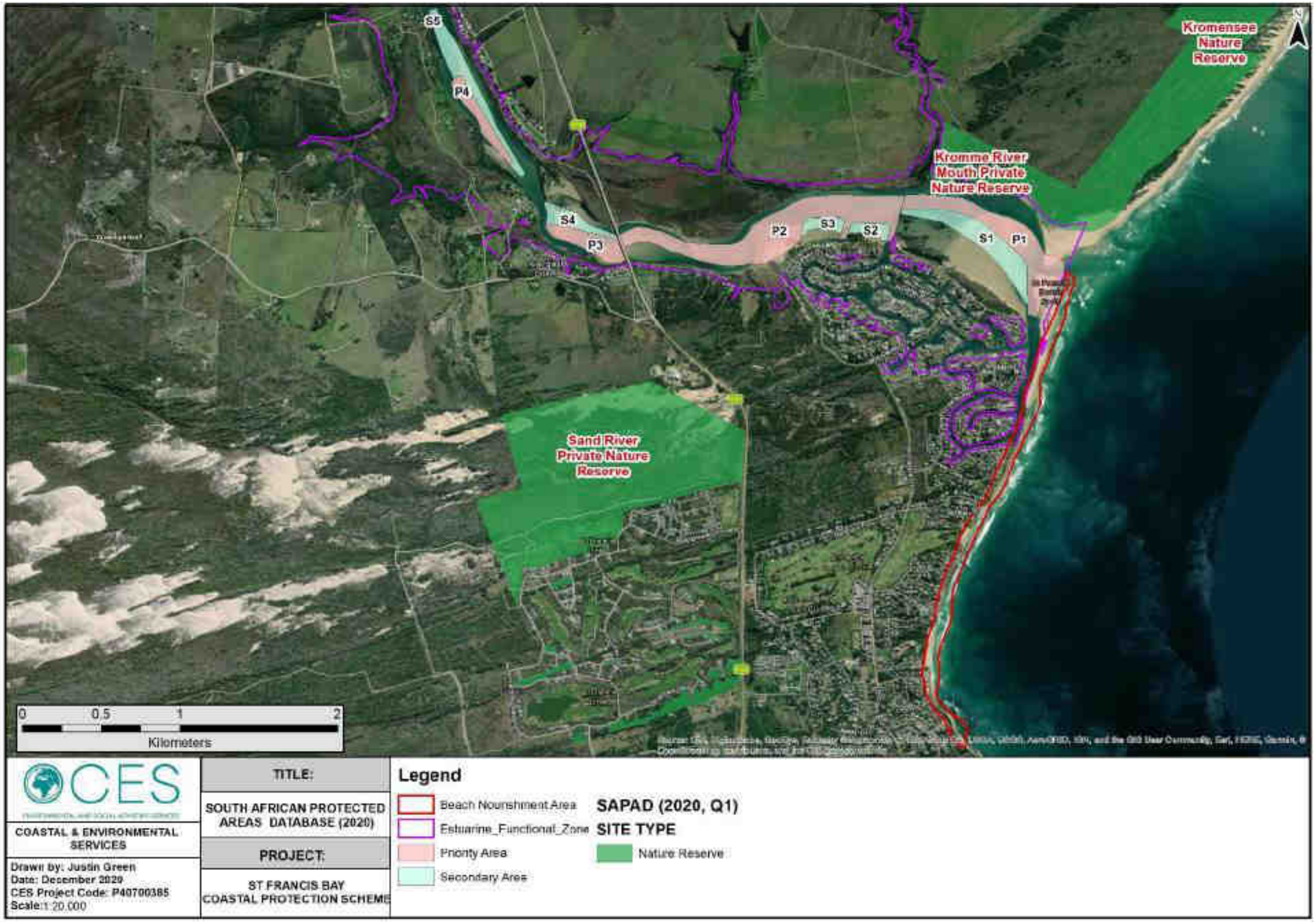

Figure 4.7 NEMBA threatened ecosystems in the broader St Francis Bay area

5 PHYSICAL MARINE ENVIRONMENT AND HYDRODYNAMIC CONDITIONS

The south-east coast of South Africa is characterised by a particularly dynamic marine environment. The south-east coast of South Africa is a region with relatively high-energy shores, dominated by waves from the south-westerly quarter. The relatively exposed nature of St Francis Bay, together with the complex interaction between coastal and estuarine processes, has resulted in the drastic removal of sediment and the consequent beach erosion observed over the last two decades. Waves along this stretch of coast typically approach from the west-southwest, as a consequence of the prevailing wind, reaching maximum heights of up to 12 m. Variation in wave frequency and intensity is observed during cold fronts which occur on average every three to five days during winter months. The dominant winds approach from the west to south-west, however easterly winds are a common occurrence. Sea surface water temperatures are generally warm, ranging from 22-25°C in February to 18-20°C degrees in August. Deviations from the norm are observed during periods of sporadic upwelling, when sea surface water temperatures may drop to a low of 8°C. Tides are classified as semidiurnal, with the maximum tidal range rarely exceeding 2 m.

The south east orientation of St Francis Bay results in significantly lower and more variable wave energy regimes than the exposed southern oriented coastlines of South Africa (Figure 5.1). This is principally due to this beach being sheltered from the persistent waves and swells generated by west and southwest winds. The predominant south westerly waves, which occur approximately 80% of the time, must angle themselves around the Cape St Francis headland in order to enter the bay, which results in waves that approach the beach at an angle and drive alongshore currents to the east along much of this coast. These wave-driven currents also transport sand in an easterly direction, and in the absence of a sand supply, result in net erosion. Easterly wave events are often generated relatively locally, resulting in short period high waves (known as steep waves) that result in direct erosion of sand off the beach face and into deeper water. Thus, sediment is 'zigzagged' up the coast, away from St Francis Bay. This combination of wave events and the lack of a constant sand supply must be addressed in order to provide long-term coastal protection, and reinstate the wide sandy beach that first attracted people to the area (ASR Ltd, 2006).

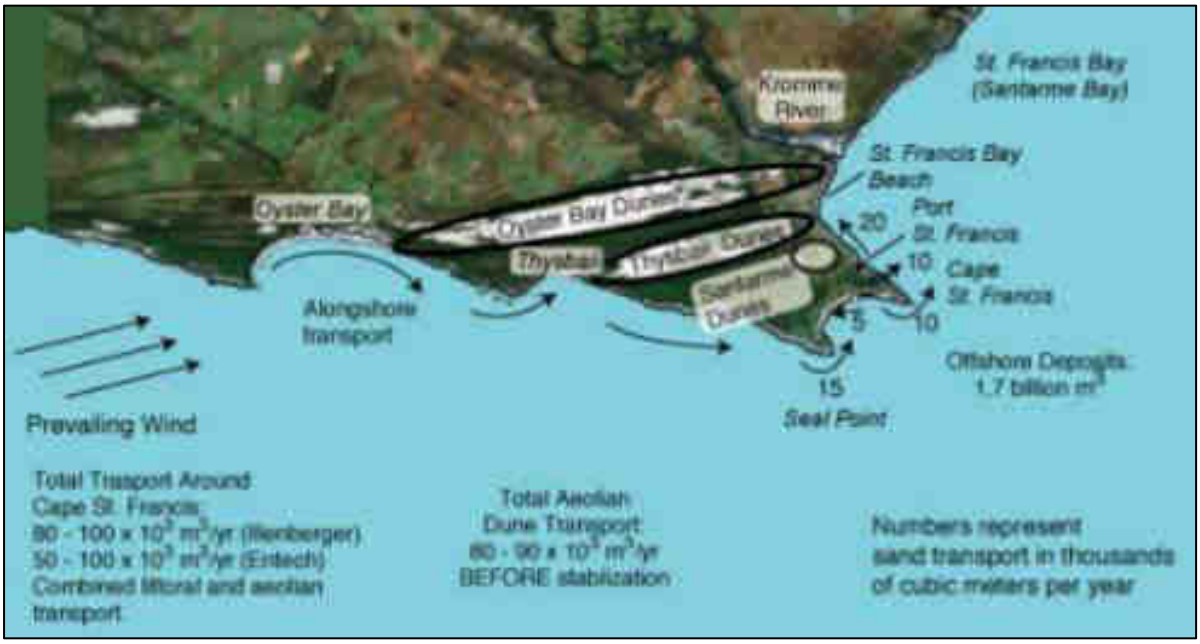

Figure 5.1: Sediment movement around St Francis Bay area (from ASR Ltd, 2006).

Estimates for the total amount of sediment moving around Cape St. Francis from west to east vary between 50 and 100 thousand cubic meters per year. Illenberger (2001) estimates a range of 80 – 100,000 m3 per year while the Entech (2002) report gives a wider range of 50 – 100,000 m3 per year. Of this total amount, the transport is divided between wave driven littoral transport along the coast and around the headland, and wind driven (aeolian) transport across Cape St Francis through the headland bypass dune systems. It is believed that the largest fraction of the total sediment transport across the region is through aeolian processes moving sand through the dune fields (ASR Ltd, 2006).

The net shoreline retreat along the St Francis Bay beach has been approximately 30 m to 50 m over the past 30 years. This is a shoreline retreat of between 1m and 1,5m per annum, and is regarded as very significant. This has resulted from increased sediment-carrying capacity within the lower reaches of the Kromme Estuary, resulting in less sediment available to accumulate on the St Francis Bay beach. The increased sedimentation potential of the lower reaches of the river is a direct result of the construction of several dams further upstream, which act as sediment traps.

In 2020, Advisian revised the numerical wave and shoreline modelling to assess the proposed changes to the overall groyne layout of the St. Francis Bay coastal protection scheme. The model was updated using updated bathymetric and topographic data and as a result, more accurate nearshore wave climates were established to assess the shoreline evolution along the project site due to the construction of the coastal protection scheme.

The wave climate in St Francis Bay is considered relatively mild since most of the offshore swell wave energy is substantially reduced in wave height due to the shelter offered by Cape St. Francis, as well as refraction and diffraction effects (Figure 5.2). However, local strong winds can generate strong short-period waves throughout St Francis Bay which enhances the harshness of the coastal environment (Figure 5. 3) (Advisian, 2020).

The reductions in wave heights in the nearshore are due to the combined effects of offshore shoals, refraction, diffraction, bed friction losses and wave breaking.

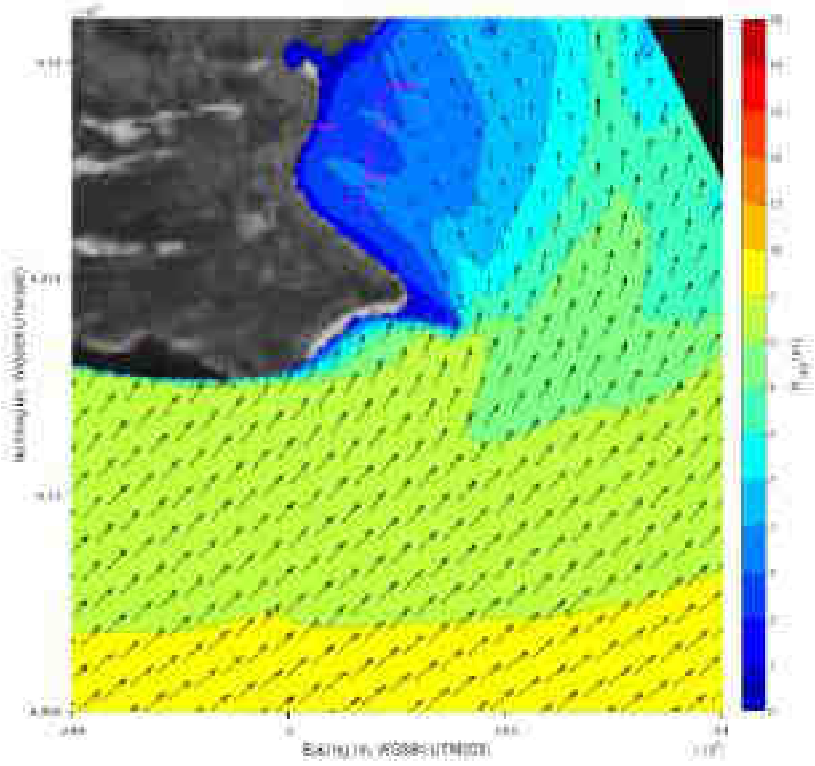

Figure 5.2 Extreme wave condition and direction illustrating sheltering effects of Cape St Francis. Arrows show the direction of the waves

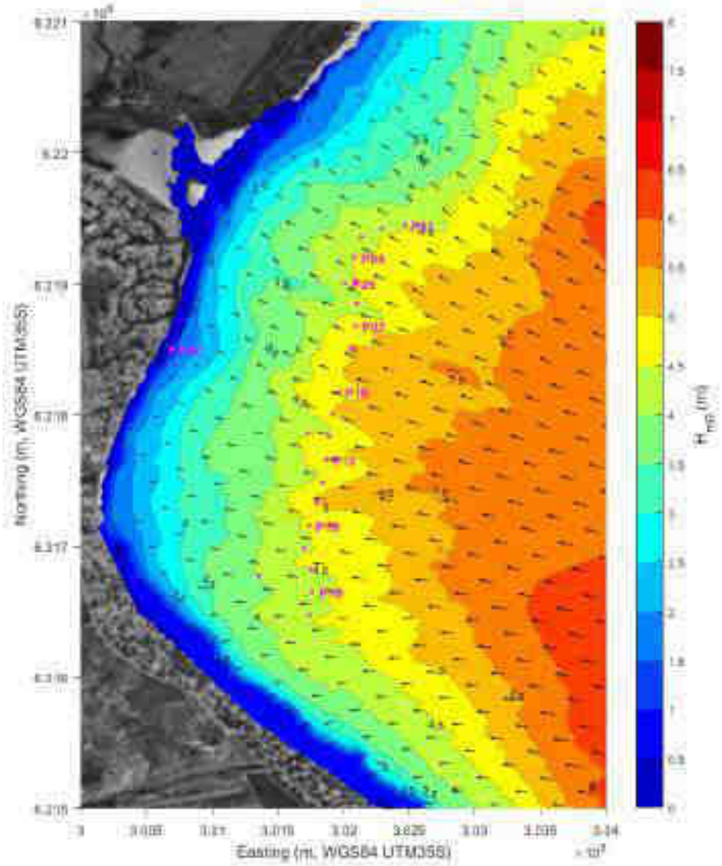

Figure 5.3 Simulated wave condition and direction for the strongest easterly wind and swell conditions. Arrows show the direction of the waves

The sediment transport along the coast is defined by the angle of incidence of the dominant wave direction and the energy in the waves. In order to validate the modelling the shoreline evolution was run for a 45 year modelling period (1975 – 2020) and compared to the current situation (Figure 5.4). The model for St Francis reproduces the historical shoreline changes due to the reduction of available sand supply (damming of the Kromme river and stabilization of Santereme dunes) over the past decades and the effect of the constructed rock revetments sufficiently well to allow its application in the assessment of the proposed coastal protection scheme.

Figure 5.5 illustrates the long-term shoreline evolution (with and without nourishment) in response to the installation of the groynes. The model shows that the construction of the long-term coastal protection scheme will have an impact on the northern coast in terms of creating an erosional environment. However, this effect is considered relatively limited as the length of the groynes do not extend sufficiently far offshore to fully block the entire littoral drift.

In addition, the existing and future imported sand will still travel towards this northern beach area due to longshore processes as long as maintenance nourishment of 6,000 m3/year for the embayments south of the spit and 10,000 m3/year for the remaining embayment at the spit takes place on a regular basis.

The proposed groyne scheme in combination with beach maintenance will provide a continuous supply of sediment of approx. 28,000m3 per year that will be transported towards the northern coastline when the complete solution is implemented. This is considered to be more beneficial to the northern coastline than the current situation (no-go scenario) _allowing the St Frances Beach to erode to the extent where negligible sediment transport can occur which would result in the northern beaches experiencing accelerated erosion.

Figure 54 provides the shoreline evolution of St. Francis Bay beach for the 45-year modelling period considered (1975 – 2020)

Figure 5.5 Long term shoreline planform, with the groynes installed, with and without nourishment (2020 – 2045

6 DESCRIPTION OF THE DUNE AND BEACH SYSTEM

6.1 Beach and Frontal Dune System

On the south bank of the estuary mouth is a sand spit that extends for approximately 900m, and this spit tends to push the mouth channel northwards. For most of its length the sand spit is well vegetated with typical pioneer woody species such as *Chrysanthemoides monolifera* (Bitou), but the most dominant species is the invasive Acacia, *Acacia cyclops* (Rooikrans). It is likely that this species was used to stabilise the sand spit, owing to its important function of protecting the seaward canal of the marina (Plate 6.1). It is only about 15m to 25m wide, and on average 6m high.

Plate 6.1 Sand spit to the south of the history mouth vegetated with Rooikrans (2019). Note the canal for the marina to the left

Plate 6.2 Eroded sand spit and foredune in the vicinity of the marina (2019). Note to the small erosion cliff at the base of the foredune. This is a clear indication an eroding shoreline.

The beach in front of the sand spit system has eroded, and the toe of the foredune is cliffed, and a typical pioneer zone with incipient foredunes is absent (Plate 6.2).

A foredune is entirely absent from the back-beach area due to the severe erosion that has taken place. Rock revetments have been placed immediately above the high-water mark to prevent further shoreline erosion. Aside from two small pocket beaches located at George road and Mary Crescent, where some foredune vegetation is present in the back-beach area behind the HWM, at high tide there is no beach, and wave run-up occurs across the length of the beach face, with the rock revetments dissipating the wave energy (Plate 6.3).

Plate 6.3 Shoreline in the vicinity of Ralph Road, with rock revetments along the HWM (2019). Note the entire absence of a foredune, and wave run-up to the toe of the revetments, due to complete erosion of the foredune and back-beach.

A more natural shoreline is found to the north of the estuary mouth. A relatively large transverse dune system to the north (150m wide, 500m long) defines the northern bank of the estuary. Behind this, and to the north-east is a well vegetated dune cordon of 300m wide, with a small foredune and vegetated transverse dunes. There appears to be very little erosion in these areas.

The erosion of the beaches at St Francis was monitored by Allen Nicolson between January 2017 and March 2018. These surveys provided evidence that the northern part of the sand spit experiences continuous erosion, but that the southern portion showed signs of recovery. Drawing on this information, and numerous older surveys, Advisian analysed the fluctuations in beach profiles over time. By fitting linear trendlines through the data points they determined that there is a long-term erosion trend of between 10 and 20 m over 11 years, indicating an average erosion of between 1,5 and 2 m per year (Advisian, 2018).

The spit has subsequently breached on four occasions in 2020, with the KLM required to implement emergency procedures to close the breach and secure the spit. The images below (Plates 6.4 to 6.9) show and describe the breaches, the repair work (including the completed revetment structure) and the condition of the remaining dune habitat.

Plate 6.4 A breach in the spit showing the loss of vegetation and sand material. The remaining dune habitat is also severely compromised following the storm event (SFPO NPC)

Plate 6.5 Front end loaders reworking the beach material to repair the breach in the spit (SFPO NPC)

Plate 6.6 A repair of the spit in progress with beach material used for the repair (SFPO NPC)

Plate 6.7 The dune spit is now a very narrow strip of habitat with a low cover of vegetation (SFPO NPC)

Plate 6.8 Spit repair with sand material and initial rock protection (SFPO NPC)

Plate 6.9 Completed revetment along 600 m of the Spit (SFPO NPC)

6.2 Sand River Dune System

The mouth of the Sand River is located 2km upstream of the mouth, on the south bank of the river. The Sand River's contribution to the freshwater inflow into the Kromme system is negligible. The dominant flow within the Sand River is subterranean, but reduced flows both in the system as well as the Kromme has resulted in a substantial accumulation of sand along this 250m of river bank. The sand mass is approximately 180m wide and 300m long, and has become stabilised by pioneer dune and salt marsh vegetation. Further east the sand has not yet become vegetated, as it is still inundated at high tide. Over time, and with ongoing sand accumulation it is expected that this sand will also become stabilised with dune vegetation (Plate 6.4).

Plate 6.10 – Google Earth image of the sand dune system at the mouth of the Sand River

The dune system at the Sand river has become well vegetated say with typical saltmarsh species closer to the river's edge, giving way to dune slack species in the depressions (Plate 6.5). Further inland woody pioneer species such as *Metalasia muricate* and *Stoebe plumosa* are present (Plate 6.6). There is a clear successional gradient away from the water's edge, where the vegetation has become well established over time. In some locations the freshwater reed, *Phragmites australis* is present, indicating a source of freshwater close to the surface (Plate 6.11).

Plate 6.11 In the forground are typical salt marsh species such as *Sarcostemme vimenale* and in the background dune slack species such as *Juncus krausii.*

Plate 6.12 – Pioneer woody dune vegetation, with Phragmites in the foreground.

7 SITE SENSITIVITY

The sensitivity map was developed by identifying areas of high, medium and low sensitivity using the following to guide the decision-making process (Figure 7.1).

Areas of **high sensitivity** include:

- Areas covered by salt marsh vegetation; and
- Areas classified as threatened ecosystems.

Areas of **moderate sensitivity** include:

- Areas covered by *Zostera capensis.* Although it is acknowledged that based on literature areas colonised by *Zostera capensis* is considered to be of high sensitivity, the extent of this species have increased by almost 40 ha over a period of approximately 80 years as a result of water abstraction upstream of the Kromme Estuary, which has resulted in additional suitable habitat for *Zostera.* This has very likely resulted in the displacement of species such as sand prawns and hermit crabs which generally occupy sand banks within these systems. As a result, it is determined that some loss of this vegetation type within this system would be acceptable;
- Areas covered by reeds and sedges;

Areas of **low sensitivity** include:

- Cultivated land;
- Built-up area; and
- Unvegetated sand banks.

The proposed project must avoid all areas of high sensitivity. Areas considered to be of moderate sensitivity could withstand some loss, however this should be avoided as far as practical.

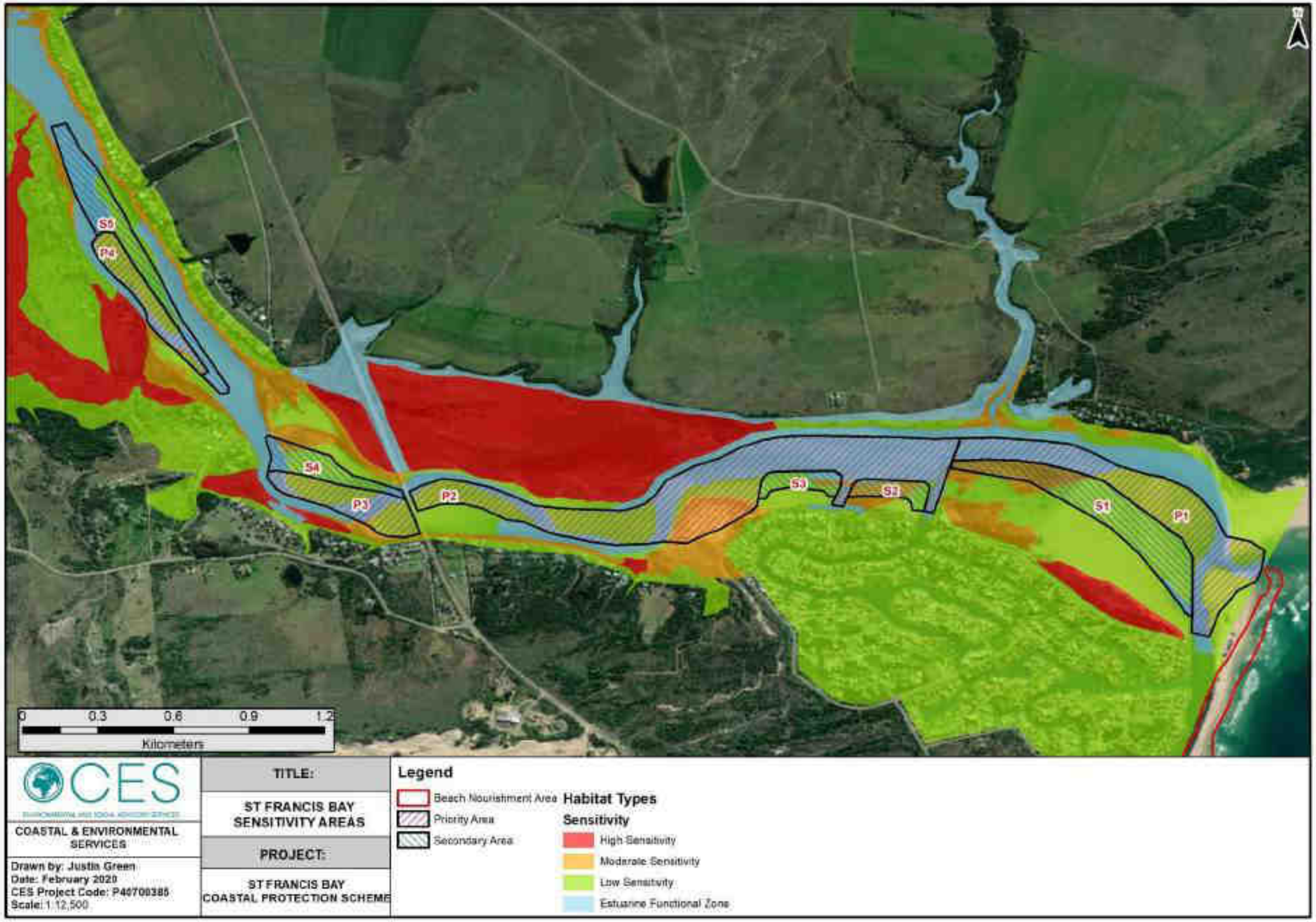

Figure 7.1: Sensitivity Map of the Kromme Estuary.

8 ESTUARINE IMPACTS

8.1 Estuarine Impact Assessment

The proposed project will impact on the Kromme Estuary. It should be noted that this project does not have a clear construction and operational phase and thus the impacts for these two phases have been combined. The section below assesses the impacts associated with the development of the proposed coastal protection scheme.

In addition, recommended mitigation measures have been included for the construction and operational phases to minimise negative impacts, or increase the potential benefits, associated with the proposed development.

8.1.1 *Existing Impacts*

EXISTING IMPACT 1: INCREASED ESTUARY BANK EROSION

Cause and Comment

The Kromme Estuary supports many recreational activities including fishing, birding, bait collection, waterskiing, canoeing, boat cruisers, hiking and swimming and as such tourism is viewed as an important income generator in the area.

The banks of the estuary have been eroded in areas, particularly in the middle reaches of the estuary. This can be attributed to boat activity as well as waves caused by easterly and westerly winds.
While the evidence of erosion is upstream from the proposed dredging area, it is important to understand that boat traffic does lead to impacts on the estuarine system downstream.

Significance Statement

EXISTING IMPACT 1: ESTUARY BANK EROSION					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Existing Impact	Long Term	Study Area	Moderate	Probable	MODERATE-

EXISTING IMPACT 2: INCREASED SILTATION

Cause and Comment

It is well documented that approximately 130% of the MAR for the system is abstracted in 2 large upstream dams resulting in a reduction in natural flushing of the system. This has led to an increase in sedimentation in the lower reaches of the estuary, which has subsequently been colonised by reeds and sedges and submerged macrophytes. It is understood that occasional freshwater releases from the Mpofu Dam do occur, but it is unlikely that these events result in a significant “flushing” of the estuary.

Significance Statement

EXISTING IMPACT 2: INCREASED SILTATION					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Existing Impact	Long Term	Study Area	Severe	Definite	HIGH-

EXISTING IMPACT 3: DETERIORATION IN WATER QUALITY

Cause and Comment

Water quality issues are mainly related to nutrient status and possible fluctuating temperature and oxygen levels downstream of dams. The estuary is highly regulated by the Churchill and Impofu dams, with no or little environmental releases being made to maintain riverine and estuarine function. According to (Sharler and Baird, 2000) the water quality within the estuary reverts to "normal" following any freshwater input.

Investigations in 1992 (Baird and Pereyra-Lago, 1992) revealed that the water in the canals does not adversely affect the estuarine water quality even though, during the holiday season, there are slightly elevated nutrient levels.

The reduction of freshwater inflow has resulted in the estuarine system becoming marine dominant, with the open mouth regulating the water quality through constant exchange with the marine environment.

Significance Statement

EXISTING IMPACT 3: DETERIORATION IN WATER QUALITY					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Existing Impact	Long Term	Study Area	Low	May Occur	LOW-

EXISTING IMPACT 4: INCREASED SALINITY

Cause and Comment

The estuary is considered to have a mouth status of permanently open which facilitates regular interaction with marine waters. This, in tandem with the reduced freshwater input results in the estuary being dominated by mostly marine habitats.

This situation has resulted in hypersaline conditions in certain areas of saltmarsh, resulting in a species composition more representative of species more tolerant to elevated salinity levels (i.e. *Salicornia sp*.). During periods of higher freshwater input other saltmarsh species do return. However, without constant freshwater the system reverts to its elevated status quo. This is similar for benthic faunal species which are marine dominant.

Significance Statement

EXISTING IMPACT 4: INCREASED SALINITY			
IMPACT	EFFECT		

	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT	RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
Existing Impact	Long Term	Estuary	Severe	Definite	HIGH-

EXISTING IMPACT 5: IMPACT ON SUBMERGED MACROPHYTES

Cause and Comment

The abundance and distribution of *Zostera capensis* within the system has increased over time from approximately 13.7 ha in 1980 to 47.8 ha in 2017. This can be attributed to the construction of the Mpofu and Churchill Dams and the resultant decrease in freshwater input and increased sedimentation. Prior to the construction of the dams the total area covered by *Zostera capensis* was only 10.8 ha.

Therefore, while the system has been modified, the increase in *Zostera* and the ecosystem services it provides has been considered to be a positive impact. Conversely sand habitat for benthic species has been lost.

Significance Statement

EXISTING IMPACT 5: IMPACT ON SUBMERGED MACROPHYTES					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Existing Impact	Long Term	Estuary	Beneficial	Definite	**MODERATE+**

EXISTING IMPACT 6: IMPACT ON SALT MARSHES

Cause and Comment

The areas of saltmarsh habitat within the Kromme Estuary have diminished over time. It is anticipated that this is due to development on the floodplain along with evidence of salt marsh erosion in the middle reaches of the estuary due to boat activity as well as waves caused by easterly and westerly winds. In addition, lack of freshwater input into the Kromme Estuary has resulted in increased water column salinity that has caused salt accumulation in the intertidal marshes (Adams *et al.*, 1992), which has resulted in large areas of bare ground in the upper intertidal areas due to hypersaline conditions. These bare patches are only colonized by the highly stress tolerant *Salicornia meyeriana.* When an increase in rainfall flushes some of the excess salt from these bare patches during winter there is a decrease in the cover of *Salicornia* and an increase in other salt marsh species.

Therefore, the existing impacts are expected to adversely affect the salt marsh.

Significance Statement

EXISTING IMPACT 6: IMPACT ON SUBMERGED SALT MARSH					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Existing Impact	Long Term	Study Area	Moderate	Probable	MODERATE-

EXISTING IMPACT 7: IMPACT ON FAUNA

Cause and Comment

The impact on fauna is determined to be both positive and negative.

Positive because, as mentioned earlier, the distribution of submerged macrophytes and the increase in sandbank habitat has resulted in an increase in faunal abundance and diversity of species suitable to these types of habitat, such as *Callianassa* spp.

However, as there has been a shift in the system to that of a marine dominated one it is likely that some species have been lost. One such species is the seahorse (*Hippocampus sp.*) which was historically recorded in the Kromme Estuary but is now only recorded in the Swartvlei, Keurbooms and Knysna Estuaries. It is likely that there were many factors leading to the disappearance of the species and not one particular activity or change in the system.

Significance Statement

EXISTING IMPACT 7: IMPACT ON FAUNA					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Existing Impact: Increase in sandbank habitat as a result of the impoundments upstream	Long Term	Study Area	Beneficial	Definite	**MODERATE+**
Existing Impact: Shift to a marine dominated system	Long Term	Study Area	Moderate	Definite	**HIGH-**

EXISTING IMPACT 8: SOCIO-ECONOMIC IMPACTS

Cause and Comment: Social amenities

The Kromme Estuary supports many recreational activities including fishing, birding, bait collection, waterskiing, canoeing, boat cruisers, hiking and swimming (Adams, 2001). As a result, tourism is viewed as an important income generator in the area (Davies, 2009 in Sale et al., 2009).

Cause and Comment: Ecosystem Goods and Services

Estuaries are valuable national assets that provide essential ecosystem services. The ecosystem services provided by estuaries (specifically the Kromme Estuary) include, but are not limited to:

- Inflow of freshwater and nutrients from the rivers upstream to the marine environment;
- Fish nursery habitats for marine fish and invertebrates;
- Regulation of greenhouse gases and opportunities for carbon sequestration;
- A significant buffer against floods as well as sea storms;
- Recreational and tourism areas (e.g. sports fishing, boating, bathing and scenic views);
- Resources for food (e.g. bait harvesting and subsistence fishing);
- Unique and diverse habitats to microalgae, macrophytes, benthic invertebrates and fish; and
- Bird feeding and roosting areas.

Significance Statement

EXISTING IMPACT 8: SOCIO-ECONOMIC IMPACTS					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Existing Impact: Social Amenities	Long Term	Study Area	Beneficial	Definite	**MODERATE+**

Existing Impact: Ecosystem goods and services	Long Term	Study Area	Beneficial	Definite	**LOW +**

8.1.2 *Construction and Operational Phase Impacts*

As mentioned previously the construction phase is considered to include the dredging associated with the capital works (i.e. the sediment required for the initial beach nourishment).

The operational phase is considered to be when capital material is not being extracted (i.e. no dredging) or when dredging for maintenance purposes is taking place. It is anticipated that maintenance dredging will be of significantly smaller scale than that employed during construction.

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 1: INCREASE IN SEDIMENTATION AND TURBIDITY

<u>Cause and Comment</u>

During both construction and operation it is likely that there will be suspended sediment (turbidity) in the water column as a result of the dredging activity. Suspended sediment is directly related to the size of the particles where smaller particles remain suspended for longer than particles that are larger. Given that smaller particles remain in suspension for longer it is likely that those particles will be transported further from the source location.

The classification of the sediment in the estuary and particularly those areas identified as being suitable for dredging is considered to be fine to medium sand. The plume generated by the dredging activity is dependent on a number of factors. Those are the volume of finer material (i.e. silt), current speed and the state of the tide. Given that the silt content of the samples taken as part of the sand sourcing study are relatively low and current speeds are low the plume is expected to be limited in its extent. Furthermore the plume will be further limited during low states of the tide and downstream of the R330 road bridge.

Suspended sediment in itself is not necessarily a problem. Estuaries by their nature are systems that have high turbidity from time to time (i.e. flooding events). Similarly, the habitats and species within the estuary are adapted to periods of inundation or periods of high turbidity.

For example many benthic species have adapted to rapid changes in environment. The majority of benthic species are mobile and migrate throughout the sandy substrate. Consequently these species are often also colonisers of newly established areas of suitable habitat as is expected during the development of this project.

Where it might result in an adverse impact is where excessive amounts of finer material settle in areas that limit the ability of the species in those areas to flourish, resulting in a decline in populations.

High levels of suspended sediment reduce the ability of faunal species to hunt/graze as a result of poor visibility. This is particularly relevant for fish species. In addition to high turbidity, high levels of sediment settling may smother vegetation and benthic faunal species.

The following factors were considered when assessing this impact:

- Dredging will require sediment with a fairly large particle size, reducing the potential for this material to remain suspended in the water column for long enough to be distributed a large distance from the dredging area (i.e. < 1000 m);

- The larger particle size also means that the sediment will settle close to the source, and hence the adjacent habitats will remain similar to those habitats were the dredge sand is being sourced; and
- Estuarine species are able to adapt to short periods of inundation and high turbidity, as this occurs naturally in these systems.

Of the faunal species identified as occurring within the Kromme Estuary, only *Lithognathus lithognathus* (White Steenbras) has been listed as endangered by the IUCN. Listed floral species include *Zostera capensis* (sea grass), *Triglochin bulbosa, Limonium linifolium* and *Spartina maritima.*

A significant increase in sedimentation and turbidity may have an adverse effect on vegetation within the estuary and particular the submerged macrophyte, *Zostera capensis*. High deposition of material would smother the plant while high turbidity in the water column would reduce its ability to photosynthesize. A reduction in the distribution of this species, with 5 ha of the 48 ha, is unlikely to be significant as only a small percentage (10%) of their overall coverage is present within the areas targeted to be dredged.

Consequently, this impact is considered to be moderate negative before mitigation.

<u>Mitigation Measures</u>

Mitigation will be considered in the design of the project in the following ways:

- Only the correct size material (course) will be dredged for beach nourishment; and
- Sensitive habitats will be identified and avoided where possible.

Monitoring of sensitive habitats in close proximity to dredging activities must be implemented during both the construction and operational phases of the project. This will reduce impact significance to low negative.

<u>Significance Statement</u>

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 1: INCREASE IN SEDIMENTATION AND TURBIDITY					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without Mitigation	Long Term	Study Area	Moderate	Possible	MODERATE-
With Mitigation	Long Term	Study Area	Slight	May Occur	LOW-

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 2: IMPACTS ON ESTUARINE VEGETATION COMMUNITIES

<u>Cause and Comment</u>

There are two main causes for the loss of habitat in the estuary. A direct impact will result from the physical removal of sand from the banks and bottom of the river, which could result in the loss of sand banks and the estuarine habitat this provides. An indirect impact will result from the modification of the physical parameters within the estuary (hydrodynamics) which would in turn cause the potential loss of estuarine habitat, especially intertidal habitats.

The lower reaches of the Kromme Estuary are dominated by salt marsh, submerged macrophytes (*Zostera*) and reed and sedge vegetation communities.

It is likely that the submerged marcophyte and reed and sedge communities will be affected directly by the dredging. This will be through the physical removal of this vegetation either prior to dredging or as a result of the dredging activity. The main species associated with the submerged macrophyte community is *Zostera capensis* which is present in abundance throughout the estuary. Those areas of Zostera that will be lost through dredging are expected to be 10% of the overall distribution of the species.

None of the reed and sedge community are expected to be lost and the expected reduction of intertidal areas is 16%.

Indirect impacts to vegetation habitats may occur through the modification of the hydrodynamics of the lower reaches of the estuary. A hydrodynamic study was carried out to investigate the existing flow conditions (pre-dredging) inside the Kromme River estuary and possible variations in flow post-dredging (Advisian, 2020). The findings suggest that the variation in current speed inside the estuary and along the riverbanks due to dredging would be generally very small. The estuary mouth showed the greatest change in current velocity, a decrease of up to 1.3 m/s and 1.6 m/s for normal river discharge conditions and high river discharge conditions, respectively. These variations in current velocity are expected to be a temporary phenomenon until the bathymetry of the estuary mouth is smoothed out by natural hydrodynamics and morphological evolution over time. Thereafter, the current velocity is expected to return to pre-dredge velocities.

These physical conditions could favour the development of *Zostera* beds should the particle size of the sediment at the mouth be compatible, *Zostera* prefer finer material. However, given the dynamic nature of the mouth it is unlikely that sandbanks will remain stable for long enough to allow Zostera to colonise.

In addition, the dredging of the river, and in particular the area around the river mouth has the effect of allowing the water to drain out more effectively, which lowers the low water level (with respect to MSL). Therefore, a reduction in water depth would be observed in the non-dredged areas as a result of the dredging. This may lead to exposure of shallow non-dredged areas inside the estuary during low tides. This is likely to result in an increased intertidal area which would facilitate the development of intertidal habitats, possibly compensating for those lost directly as a result of dredging.

The banks along the middle reaches of the estuary are classified as a threatened ecosystem (Albany Alluvial Vegetation) as legislated by NEM:BA (refer to Figure 4.7). The maximum tidal current outside the main channel (i.e. near to the banks) and in particular on the northern bank close to the river mouth are low (up to 0.2 m/s). The modelling suggested that the dredging would not lead to any significant change in the currents in this area.

Overall, there will only be a 10% reduction in Zostera habitat, and a 16% reduction in intertidal areas. In the context of this estuary, and for the region, these losses are expected to result in an impact of LOW significance after mitigation.

Mitigation Measures

The direct loss of vegetation habitats is expected to be minimised through the discreet identification of areas suitable for dredging. It is anticipated that those suitable areas would avoid sensitive habitats (i.e. *Zostera*).

The following mitigation measures must be considered in the design of the project:

- Only the correct size material (course) will be dredged for beach nourishment;
- Sensitive *Zostera* habitats will be avoided where possible;
- Only the required volume of sediment will be dredged;

- Associated equipment will be placed in areas of low sensitivity only; and
- Monitoring of sensitive habitats in close proximity to dredging activities must be implemented during both the construction and operational phases of the project.

Significance Statement

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 2: LOSS OF ESTUARINE VEGETATION COMMUNITIES					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without Mitigation	Medium Term	Study Area	Moderate	Definite	MODERATE-
With Mitigation	Medium Term	Study Area	Slight	Possible	LOW-

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 3: IMPACTS ON ESTUARINE FAUNAL COMMUNITIES

Cause and comment

Similarly to the impacts on the vegetation communities, faunal communities will be affected directly by the project as well as indirectly.

Direct losses are expected for species associated with the sandbanks and channels. Important species in this habitat include sand prawn (*Callianassa kraussi)*, pencil bait *Solen capensis* and bloodworm *Arenicola loveni*.

Direct physical loss would be attributed to the removal of material directly by dredging. Given the type of material required for the project the habitat lost would be that associated with a sandy benthic substrate. This would be a habitat colonised by species adapted to coarse grained sediment - mostly molluscs, crustaceans and polychaetes. Locally important bait species such as mud sand prawn (*Callianassa kraussi*), pencil bait (*Solen capensis*) and the bloodworm (*Arenicola loveni*) populations are likely to decrease as a direct result of the dredging activity. It is not possible to accurately quantify the loss of individuals directly from dredging. However, if one considers the area available for colonisation prior to- and post dredging activity then an assessment can be made. At present 33% of sandbank habitat is expected to be included within the area designated for dredging.

This would only result in a temporary reduction in biomass as these species are expected to return to those areas that have been dredged fairly quickly.

The design of the dredging footprint will be to ensure that some of the habitat for faunal species remains intact. In addition, there are areas within the estuary which contain the faunal species which are not intended to be dredged. Therefore, while there may be an initial reduction in the biomass of benthic species, there will be areas within the estuary with these species that will remain.
Those faunal species (birds and fish) who would subsequently feed on these organisms may also be negatively affected. However, there are alternative areas within the estuary in which birds and fish can feed.

Subsequently, prior to mitigation, the impact is anticipated to be moderate negative.

Mitigation Measures

The following mitigation measures must be considered in the design of the project:

- Only the correct size material (course) will be dredged for beach nourishment;
- Only the required volume of sediment will be dredged;
- Associated equipment will be placed in areas of low sensitivity only; and

- Monitoring of sand bank habitats in close proximity to dredging activities must be implemented during both the construction and operational phases of the project.

Significance Statement

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 3: LOSS OF ESTUARINE FAUNAL COMMUNITIES					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without Mitigation	Medium Term	Study Area	Moderate	Definite	**MODERATE-**
With Mitigation	Medium Term	Study Area	Moderate	Possible	**LOW-**

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 4: OVERALL IMPACTS ON THE ESTUARINE FUNCTIONAL ZONE

Cause and Comment

The estuarine functional zone (EFZ) includes the lateral boundaries of an estuary up to the 5 m contour, with the downstream boundary taken as the estuary mouth and the upstream boundary taken as the limits of tidal variation or salinity penetration, whichever penetrates furthest. Protection/rehabilitation of the estuarine functional zone is considered essential for protection of estuarine biodiversity and associated ecological processes. The proposed project is likely to impact on the estuarine functional zone both directly and indirectly:

Direct and indirect impacts include but are not limited to the following:

- The loss of habitat (direct removal of *Zostera capensis,* sandbanks and benthic habitat)
- Increases in turbidity (direct impact) which may result in further loss of habitat as a result of smothering (indirect impact).
- Altering the nutrient dynamics of the system as a result of releasing trapped nutrient from sediments. Previous authors who have studied water quality in the Kromme have concluded that due to the influence and constant flushing of the system through the tidal cycle, water quality is generally good.

Mitigation Measures

Mitigation is similar to that suggested for the loss of vegetation and faunal communities:

- Only the correct size material (course) will be dredged for beach nourishment allowing;
- Sensitive *Zostera* habitats will be avoided where possible; and
- Only the required volume of sediment will be dredged.

Significance Statement

Overall, there will be a 10% reduction in Zostera habitat, a 16% reduction in intertidal areas, and a 33% reduction of sandbank habitat. The combined effect of these changes context are expected to result in an impact of MODERATE significance after mitigation.

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 4: IMPACTS ON THE ESTUARINE FUNCTIONAL ZONE					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without Mitigation	Medium Term	Study Area	Moderate	Definite	**MODERATE-**
With Mitigation	Medium Term	Study Area	Moderate	Definite	**MODERATE-**

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 5: IMPROVEMENTS TO THE RECREATIONAL AMENITIES OFFERED BY THE KROMME

Cause and Comment

The Kromme Estuary supports many recreational activities including fishing, birding, bait collection, waterskiing, canoeing, boat cruisers, hiking and swimming (Adams, 2001) with tourism viewed as an important income generator in the area (Davies, 2009 in Sale et al., 2009). St Francis Bay has over 45 tourist establishments offering visitors differing levels of accommodation ranging from 5 Star Guest Lodges to basic Bed & Breakfasts. The St. Francis Golf Links includes a Jack Nicklaus designed golf course and housing estate with over 450 individual housing units. All the above factors combine to make St. Francis Bay a highly attractive beach destination. The various types of tourist accommodation and restaurants provide employment for a large number of individuals with varying levels of skills. Many of the properties in St. Francis Bay are holiday homes, with peak visitation during the December-January period where the population increases to about 20 000. A large number of extra job opportunities are available during this time.

The lower reaches would facilitate more than one activity since each activity could be segregated (i.e. boating lanes, swimming area, etc). This would increase the Kromme's capacity for water-based activity, improving the recreational amenity of the estuary, and safety of water users.

In addition to the improvement of the amenity created by the dredging activity, the nourishment of the beach would restore the beach amenity. This would promote use of the beach throughout all states of the tide and ensure that beach tourism remains the driver for employment in St Francis Bay.

Although increasing the capacity of the estuary for water-based activity could create conflict between various users, in general this improvement is viewed as a positive impact.

Mitigation measures

The mitigation measures are not only to reduce the potential conflict between various user groups but to enhance the experience for those using the estuary.

A detailed management plan for water based recreational activities should be drafted, implemented and monitored to ensure safety and inclusivity.

Significance statement

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 5: IMPROVEMENTS TO THE RECREATIONAL AMENITIES OFFERED BY THE KROMME					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without Mitigation	Medium Term	Study Area	Positive	Probable	**MODERATE+**
With Mitigation	Medium Term	Study Area	Positive	Definite	**HIGH+**

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 6: LOSS OF ACCESS TO PARTICULAR SITES AND RESTRICTIONS ON THE USE OF THE ESTUARY DURING DREDGING OPERATION.

Cause and comment:

The current surface area of sand bank amenity (i.e. the area of sand banks exposed at low tide) is 52 ha. Following the dredging activity (assuming the full extent of the dredging takes place at once) the remaining sand bank area would equate to 51 ha resulting in a net loss of 1 ha. The loss of sand banks, used by both locals and tourists (dog walking, bait collection, etc.) would reduce the area available for these activities. The recent increase in the use of the sandbanks close to the mouth of the estuary is likely as a result of the loss of beach along the frontage. Where dog walkers may have used the beach previously, they are now using the estuary. The dredging and nourishment of the beach would support this activity again, with the appreciation that there may be short term impacts in availability of space for recreation.

The dredging of the Kromme is likely to result in impacts to those users. The presence of dredging equipment (vehicles, vessels, pumps and pipes) would result in certain areas being designated as off limits. This would reduce the area available for recreational activities. However, this is expected to be limited to the direct working areas which would move as the activities progress. The activities would also be relatively temporary in nature.

Prior to mitigation the impact is expected to be LOW negative.

Mitigation measures

No mitigation measures are required since the impact is deemed to be low. However, the following should be considered as best practice:

- Development and publication of the intended work programme including exclusion areas if any;
- Ensure that recreational areas are available during the works;
- Consider improvement of access to an alternative walking route along the length of the frontage along the beach and estuary; and
- Clear signage of walking routes / recreational areas.

Significance statement

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 6: LOSS OF ACCESS TO PARTICULAR SITES AND RESTRICTIONS ON THE USE OF THE ESTUARY DURING DREDGING OPERATION					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without Mitigation	Medium Term	Study Area	Slight	Possible	**LOW-**
With Mitigation	Medium Term	Study Area	Slight	Possible	**LOW-**

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 7: A REDUCTION / LOSS OF SANDBANKS SUPPORTING FAUNA

Cause and comment

As detailed in Impact 3: Impact on Faunal Communities, there will be a loss of benthic species directly as a result of the dredging. The dredging, depending on the design, may also reduce the access to some of the sandbank features at certain states of the tide. The dredging is likely to reduce the level of the sandbank which may result in it becoming a subtidal feature while also exposing previous sub-tidal areas. The net loss of intertidal sandbanks for the length of the study area is 1 ha.

Given that the benthic species present are likely to colonise the newly dredged areas fairly quickly, it is not anticipated that these species will not be available to bait collectors, but that the window of opportunity for collection may be reduced.

This impact is only relevant to those areas that are included in the dredging footprint. It is understood that certain sandbank features will remain intact and accessible for bait collection.

Therefore, this is considered to be a low negative impact prior to mitigation. Since this is a low impact no mitigation is required.

Significance statement

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 7: A REDUCTION / LOSS OF SANDBANKS SUPPORTING FAUNA					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without Mitigation	Medium Term	Study Area	Slight	Possible	LOW-
With Mitigation	Medium Term	Study Area	Slight	Possible	LOW-

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 8: VISUAL INSTRUSION OF DREDGING EQUIPMENT, PIPELINES AND GROYNES

Other adverse impacts potentially affecting local communities are the visual impacts associated with the dredging activity. Visually, the presence of vessels on the estuary are unlikely to be considered to be out of the ordinary. However, should the preferred method be via excavator then this may not fit with the current expectation of "normal" activity on the estuary. The presences of pumps and pipes may also not be considered to be "normal". However, their visibility is expected to be of low significance and will likely only be visible to those in close proximity to dredging activities.

In some cases and based on previous experience the activity attracts spectators.

Similarly, the groynes are infrastructure that could alter the setting of the beach frontage. However, it is not anticipated that the groynes will disrupt the seascape or be visual impediments. There may be restricted views from limited viewpoints (i.e. in the water looking up/down the beach).

Given that part of the appeal of the estuary and beach frontage is its setting and land/seascape this impact is anticipated to be moderate negative prior to mitigation.

Mitigation Measures

The mitigation measures will depend on the equipment identified by the contractor for the work. These would include:

- Only absolutely necessary equipment required for the dredging to be at the work site. All other equipment to be stored in an area less intrusive;
- Pumps and pipe placement should take visual disturbance into account for placement during the works;
- Where possible ensure the design of the groynes does not impede the open seascapes view; and
- Where possible ensure the design of the groynes are compatible and blend in.

Significance Statement

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 8: VISUAL INTRUSION OF DREDGING EQUIPMENT AND PIPELINES					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without Mitigation	Medium Term	Study Area	Moderate	Definite	MODERATE-
With Mitigation	Medium Term	Study Area	Moderate	Possible	LOW-

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 9: NOISE DISTURBANCE IMPACTS

Cause and comment

It can be expected that there will be an increase in noise levels during the site preparation and construction phase of the project. The increase in noise will be associated with the operation of construction vehicles, dredging and other equipment and labourers.

The noise level associated with the dredging and nourishment activity is expected to be approx. 80 dB at source. Depending on the size of the booster pumps, noise levels are expected to be 92 dB at source, reducing down to 60 dB at 500 m (ICF Jones and Stokes, 2008). To provide context normal conversation is about 60 dB, a lawn mower is about 90 dB, and a loud concert is about 120 dB.

Prior to mitigation a moderate negative impact is anticipated.

Mitigation Measures

- All construction vehicles and equipment to be properly serviced in order to meet the necessary noise level requirements;
- Restriction of work to daylight hours;
- Programming of works close to noise sensitive residential properties should considered to avoid holiday periods
- Restriction of any unnecessary noise e.g. portable radios, vehicle radios, whistles etc.;
- Machinery should be fitted with the required mufflers to reduce noise to acceptable, and notice given to surrounding residents prior to the commencement of construction;
- Adhering to the municipal by-laws regarding noise.

Significance Statement

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 9: NOISE DISTURBANCE IMPACTS					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without Mitigation	Medium Term	Study Area	Moderate	Definite	**MODERATE-**
With Mitigation	Medium Term	Study Area	Moderate	Possible	**LOW-**

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 10: IMPACT ON NAVIGATION AND BOATING SAFETY

Cause and comment

The dredging of the estuary and the channels within the estuary would result in larger and deeper channels. This would facilitate vessel navigation of the estuary not only during high tide but during low tide as well. This is considered to be a beneficial impact due to the number of boat owners in the area and tourists who also make use of the estuary for boating.

It is recognised that an increase in vessel traffic may lead to other impacts (i.e. safety, erosion of estuarine banks, etc.).

Mitigation measures

- Enforcement of the management of boating activities and restrictions in place (i.e. no wake zones, etc);
- Identification and publication of buffer areas/safety zones around dredging equipment;
- Development of a dredging programme that takes navigation and peak times into account;

- Development and publication of water safety procedures and enforcement to ensure safety to all users of the estuary.
- Clear channel marking where necessary; and
- Ensure boating activity areas are clearly demarcated.

Significance statement

CONSTRUCTION AND OPERATIONAL PHASE IMPACT 10: IMPACT ON NAVIGATION AND BOATING SAFETY					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without Mitigation	Medium Term	Study Area	Positive	Probable	**MODERATE+**
With Mitigation	Medium Term	Study Area	Positive	Definite	**MODERATE+**

8.1.3 *Decommissioning Phase Impacts*

Given the nature of the project there will be no decommissioning phase.

8.1.4 *Cumulative Impacts*

There are no other known plans or projects in the local area that are likely to contribute to additional impacts as a result.

The impacts described below are those existing impacts that are deemed to have a high negative significance. The cumulative assessment assesses the impact of the project on these.

CUMULATIVE IMPACT 1: INCREASED ESTUARY BANK EROSION

Cause and Comment

The Kromme Estuary supports many recreational activities including fishing, birding, bait collection, waterskiing, canoeing, boat cruisers, hiking and swimming and as such tourism is viewed as an important income generator in the area. The banks of the estuary have been eroded in areas, particularly in the middle reaches of the estuary. This can mainly be attributed to boat activity as well as waves caused by easterly and westerly winds.

While the evidence of erosion is upstream from the proposed dredging area, increasing the area available for boat activity in the lower reaches could lead to additional erosion in the lower and middle reaches of the estuary due to increased boats and duration of boating through more states of the tide. Although the wake generated by boats is potentially less than that which is generated by the easterly and westerly winds, it may contribute to further bank erosion.

Mitigation measures:

- Enforcement of the management of boating activities and restrictions in place (i.e. no wake zones, etc);
- Design dredging areas that leave the bank of the estuary intact as far as possible;
- Clear channel marking where necessary; and
- Ensure boating activity areas are clearly demarcated.

Significance Statement

CUMULATIVE IMPACT 1: INCREASED ESTUARY BANK EROSION					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without mitigation	Long Term	Study Area	Moderate	Probable	MODERATE-
With mitigation	Long Term	Study Area	Moderate	Possible	LOW-

9 DUNE AND BEACH IMPACT ASSESSMENT

9.1 Introduction

The ecological value of dune systems has been described in Section 1.3, and the concerns relating to the erosion of the beach and associated dune system was discussed in the scoping report and in the report titled "The St Francis Bay Beach Long-term Coastal Protection Phase 2 report of 2018 (Advisian, 2018). The dune ecosystem was described in Chapter 6.

Although the primary motivation for the project is to improve the dune and beach ecosystems, which would result in a number of positive impacts, the project will also have some negative consequences. These are all discussed below.

9.1.1 *Existing Impacts*

EXISTING IMPACT 1: ONGOING EROSION LEADING TO SPIT BREACH IMPACTS

Cause and Comment:

In 2020 the spit breached four times, resulting in property and marina infrastructure being exposed directly to the waves and storm surges. This resulted in damage to property in the marinas. This was a natural consequence of the long-term erosion of the beach. The fact that it occurred four times in one year indicates that breaching will continue, and that exceptionally high seas or strong wave attack is no longer required to cause a breach. Spring tides and slightly higher waves is all that is now required to breach the sand spit.

The breaches in the spit were as a result of erosion of the foredune habitat and associated loss of vegetation which is now no longer present in certain areas.

The Kouga municipality repaired the breaches in the spit through the placement of sand material from other areas along the beach and the construction of revetments along parts of the frontage to provide additional protection.

Significance Statement

EXISTING IMPACT 1: ONGOING EROSION LEADING TO SPIT BREACH IMPACTS					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Existing Impact	Long Term	Study Area	Severe	Definite	HIGH-

EXISTING IMPACT 2: ONGOING EROSION TO THE BEACHES TO THE NORTH

Cause and Comment:

The reduction of sediment into St Francis Bay has resulted in significant erosion, to the point that in 2020 the spit breached and the beaches have all but disappeared. It has been established that the longshore drift, which transports sediment, is in a northerly direction. With no further introduction of sediment (i.e. very little remaining on the beaches) into the system it is expected that erosion will continue and possibly accelerate along the beaches to the north.

Erosion to the beaches to the north will result in a reduced beach width and the loss of dune habitat. There is limited infrastructure immediately north of the Kromme River. Ecologically the dune ecology is intact and forms part of the Kromensee Nature Reserve resulting in a MODERATE negative impact.

Significance Statement

EXISTING IMPACT 2: ONGOING EROSION TO THE BEACHES TO THE NORTH					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Existing Impact	Long Term	Study Area	Moderately severe	Probable	**MODERATE-**

9.1.2 *Construction Phase Impacts*

CONSTRUCTION PHASE IMPACT 1: LOSS OF DUNE VEGETATION ON THE VEGETATED SAND BANK AT THE SAND RIVER MOUTH

Cause and Comment

The Sand River flows under the surface of the dune system, and reduced flows from this system has resulted in the steady build-up of a now vegetated dune system on the west bank of the Kromme Estuary. This area will be used as a source of sand, and this will necessitate the removal of this pioneer dune vegetation. Eventually this will result in a sand bank similar to the one at the mouth.

It is evident from aerial photographs (Figure 4.5) that this sand bank has been present since 2004 (and probably earlier) and that vegetation cover has steadily increased over time. This is supported by the observed development of a pioneer dune scrub community. However, it is postulated that under normal flow conditions this sand bank would not have been as aggressively colonised by dune species as has occurred, due to reduced flows and infrequent flooding resulting in a more stable habitat.

Since this vegetation is indigenous, and exhibits a clear successional gradient, its loss will result in an impact of MODERATE significance, despite the fact that it has established as a result of altered flow regimes in the Kromme. It is not possible to mitigate this impact.

Significance Statement

CONSTRUCTION PHASE IMPACT 1: LOSS OF DUNE VEGETATION ON THE VEGETATED SAND BANK AT THE SAND RIVER MOUTH					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without mitigation	Long Term	Study Area	Moderate	Probable	**MODERATE-**
With mitigation	Long Term	Study Area	Moderate	Probable	**MODERATE -**

CONSTRUCTION PHASE IMPACT 2: DISTURBANCE TO DUNE VEGETATION ON THE SAND SPIT AND OTHER FOREDUNES DURING CONSTRUCTION.

Cause and Comment

The south bank of the estuary mouth has a sand spit that forms a narrow barrier dune between the sea, the estuary and the marina canal. For most of its length it is well vegetated with typical pioneer woody species such as *Chrysanthemoides monolifera* (Bitou), but the most dominant species is the invasive Acacia, *Acacia cyclops* (Rooikrans).

An access road has already been constructed between the Aldabara parking area and the beach in front of the spit by the municipality, which enabled them to carry out emergency repairs when the spit breached. It was used for access for construction equipment and the delivery of rock used in the emergency revetment. This access road will be retained and can be used during construction of the long term solution.

Since much of this vegetation is not indigenous, and the areas disturbed are likely to be localised, The impact of construction on the sand spit will be LOW before and after mitigation, as the breaching of the spit, and the activities required to repair the breach have already resulted in the loss of foredune vegetation and habitat.

Mitigation measures

- Enforcement all provisions contained in the Construction EMP
- Do not allow any laydown areas within the sensitive foredune area.
- Limit access across the foredunes to four access points in total, where each groyne will be located. The access point where the sand spit starts (possibly at the Aldabara Road parking area) will need to serve the first two groynes. The second two will require access from Peter Crescent and at George road; and the final one at the Ralph Road parking area. These parking areas must also be used as laydown areas.
- Limit pedestrian access to these same points.
- Disallow workers from accessing the foredune areas.

Significance Statement

CONSTRUCTION PHASE IMPACT 2: DISTURBANCE TO DUNE VEGETATION ON THE SAND SPIT AND OTHER FOREDUNES DURING CONSTRUCTION.					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without mitigation	Short Term	Study Area	Slight	Probable	**LOW-**
With mitigation	Short Term	Study Area	Slight	Probable	**LOW -**

CONSTRUCTION PHASE IMPACT 3: EFFECTS OF GROYNE CONSTRUCTION ON THE BEACH AND NEARSHORE AREA.

Cause and Comment

Groynes will be constructed from above the high-water mark, and into the nearshore area below the low tide mark. They will be 170 to 200m in length. There is no detail yet on the method of construction, but it is likely that the groynes will be constructed by placing rock fill at the start of the groyne, and advancing seaward. This construction approach will be disruptive to both the beach and nearshore area, and will require vehicle access along the beach.

During the construction phase ecological impacts on the beach and nearshore areas is likely to be significant, and will be difficult to mitigate. However, since the beach and nearshore ecosystems are resilient to nature perturbations, the impact is considered to be of MODERATE significance, both before and after mitigation, as effective mitigation will be difficult.

Mitigation measures

- Enforcement all provisions contained in the Construction EMP;
- Implement all mitigation measures mentioned above; and
- Do not allow any laydown areas within the sensitive foredune area.

Significance Statement

CONSTRUCTION PHASE IMPACT 3: EFFECTS OF GROYNE CONSTRUCTION ON THE BEACH AND NEARSHORE AREA.					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without mitigation	Short Term	Study Area	Moderate	Probable	**MODERATE-**
With mitigation	Short Term	Study Area	Moderate	Probable	**MODERATE -**

9.1.3 *Operational Phase Impacts*

OPERATIONAL PHASE IMPACT 1: ACCRETION AND RESULTANT WIDENING OF THE BEACHES AS A RESULT OF BEACH NOURISHMENT SCHEME

Cause and Comment

The construction of groynes, coupled with sand nourishment will increase the width of the beach, and to some extent restore the habitat to what it was previously. This is regarded as an ecological impact of MODERATE positive significance, and equates to habitat restoration. The social benefit of this is regarded as being of HIGH positive significance. No mitigation is required.

Significance Statement

OPERATIONAL PHASE IMPACT 1: ACCRETION AND RESULTANT WIDENING OF THE BEACHES AS A RESULT OF BEACH NOURISHMENT SCHEME					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Ecological benefit: Without and with mitigation	Permanent	Study Area	Moderate	Probable	**MODERATE+**

Social benefit: Without and with mitigation	Permanent	Study Area	High	Probable	**HIGH+**

OPERATIONAL PHASE IMPACT 2: STABILISATION OF THE SHORELINE AND PROTECTION FROM STORM SURGES AND SEA-LEVEL RISE.

Cause and Comment

The construction of groynes, coupled with sand nourishment will increase the width of the beach and will stabilise the shoreline and protect the foredunes from wave attack from storm surges, and reduce the current undercutting and collapse of the foredune ridge. It will also protect associated social infrastructure. This is regarded as a social impact of HIGH positive significance, especially since the spit breached on four occasions during 2020.

No mitigation is required.

Significance Statement

OPERATIONAL PHASE IMPACT 2: STABILISATION OF THE SHORELINE AND PROTECTION FROM STORM SURGES AND SEA-LEVEL RISE.					
IMPACT	**EFFECT**			**RISK OR LIKELIHOOD**	**OVERALL SIGNIFICANCE**
	TEMPORAL SCALE	**SPATIAL SCALE**	**SEVERITY OF IMPACT**		
Without and with mitigation	Permanent	Study Area	Beneficial	Probable	[redacted]

OPERATIONAL PHASE IMPACT 3: LONG-TERM IMPROVEMENT TO RECREATIONAL AMENITIES OFFERED BY THE BEACHES

Cause and Comment

The construction of groynes, coupled with sand nourishment will increase the width of the beach, and this result in a significant improvement to the recreational amenities in a coastal town where the focus is on sea, beach and river activities. There is also likely to be resultant economic benefits. This is regarded as a social impact of HIGH positive significance. No mitigation is required.

Significance Statement

OPERATIONAL PHASE IMPACT 3: LONG TERM IMPROVEMENT TO RECREATIONAL AMENITIES OFFERED BY THE BEACHES					
IMPACT	**EFFECT**			**RISK OR LIKELIHOOD**	**OVERALL SIGNIFICANCE**
	TEMPORAL SCALE	**SPATIAL SCALE**	**SEVERITY OF IMPACT**		
Without and with mitigation	Permanent	Study Area	Beneficial	Probable	[redacted]

OPERATIONAL PHASE IMPACT 4: ACCELERATION OF EROSION AS A RESULT OF THE GROYNES

Cause and Comment

Development of the groynes will alter the hydrodynamic regime through the refraction of waves and altering of local currents, potentially leading to accelerated erosion of the northern bank of the estuary mouth. This impact is expected to be limited to the area immediately north of the northern-most groyne. The design of the beach nourishment is to nourish this area as part of the maintenance activity. Similarly, the short groyne does not extend sufficiently into the marine environment to have an effect on the northern bank.

Therefore, this impact is expected to have an impact of LOW negative significance since the mitigation for any erosion anticipated in built into the design.

Mitigation measures

- Place sand material immediately north of the northern most groyne to act as sacrificial material.
- Ensure that the adaptive management plan is developed to recognise and mitigate for any accelerated erosion.

Significance Statement

OPERATIONAL PHASE IMPACT 4: ACCELERATION OF EROSION AS A RESULT OF THE GROYNES					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without mitigation	Permanent	Study Area	Moderately severe	May Occur	**MODERATE-**
With mitigation	Permanent	Study Area	Slight	May Occur	**LOW-**

OPERATIONAL PHASE IMPACT 5: RESTRICTION OF SEDIMENT TRANSPORT TO THE NORTH

Cause and Comment

Development of the groynes will restrict the longshore drift that transports sediment to the north. However, even with the restriction at least 50% of the material (approximately 28 000 m^3 per annum) will pass through the scheme. In addition, the beach nourishment and maintenance introduces and new source of sediment which is able to be transported to the north supplying those beaches with sediment.

While the groynes are designed to restrict the movement of sediment and have a negative impact on sediment movement, these stub groynes will allow sediment to move in a northerly direction. The beach nourishment and maintenance will provide the system with a sediment source which is expected to reduce the erosion to the northern beaches under the no-go scenario. Therefore, this impact is considered to result in a negative impact of LOW significance.

Mitigation measures

- Maintain nourishment of at least 6,000 m^3/year for the embayments south of the spit and 10,000 m^3/year for the remaining embayment at the spit on a regular basis.
- Ensure that the adaptive management plan is developed to recognise and mitigate for any accelerated erosion.

Significance Statement

OPERATIONAL PHASE IMPACT 5: RESTRICTION OF SEDIMENT TRANSPORT OT THE NORTH					
IMPACT	EFFECT			RISK OR LIKELIHOOD	OVERALL SIGNIFICANCE
	TEMPORAL SCALE	SPATIAL SCALE	SEVERITY OF IMPACT		
Without mitigation	Permanent	Study Area	Moderately severe	May Occur	**MODERATE-**

With mitigation	Permanent	Study Area	Slight	May Occur	**LOW-**

10 MONITORING

10.1 Baseline Data

The objective of baseline data collection is to provide a statistically robust baseline data set that adequately describes the ambient water quality, water flow, water levels and sediment dynamics of the estuary. This data set can be used for comparative purposes during the future phases of the project. The baseline data for estuary must be collected over a period of at least one year (twice during the dry season (beginning and end) and once during the wet season).

Baseline data needs to be collected prior to construction. This includes:

- Sediment contaminant testing – while it is anticipated that the sediment suitable for dredging is unlikely to contain harmful contaminants testing of the sediment is required to establish this. Having collected data prior to construction sediment tested during the dredging would allow comparison to a pre-dredge condition. It is anticipated that samples be taken from those areas earmarked to be dredged. A sample of surface and depth should be taken and analysed for *E. coli* and heavy metals. This is anticipated to be carried out by the dredging contractor periodically throughout the dredging process.
- Bathymetry – the bathymetry data collected in 2020 is likely to be updated by the contractor prior to dredging commencing (i.e. construction phase). This would facilitate the monitoring of the dredging progress and provide a baseline against which the dredging works could be compared. Changes to bathymetry could be analysed should any significant changes to the hydrodynamics of the system be observed during and/or post construction. The bathymetry should cover the mouth area and extend as far upstream as the extent of the extraction.
- Ground truthing the distribution of the habitats identified as part of this study should be considered. Following this, monitoring the sensitive habitats in close proximity to the dredging activities should be carried out to determine die-back as a result of smothering, dredging, loss of habitat. Should these areas be determined to be reducing correction measure should be implemented. This should be carried out by a suitably qualified specialist with the emphasis being on the ability to accurately replicate the activity during the construction phase.

10.2 Construction And Operational Phase Monitoring Parameters

<u>Sediment contaminant testing</u>

To be carried out throughout the construction period to ensure that contaminants are not entering or being released into the water column.

<u>Bathymetry</u>

It is understood that a dredging contractor would collect bathymetry data during the works. However, data should be provided to a suitably qualified and experienced ecological/environmental expert, in a format that can be easily interpreted, to be able to verify the impacts. It is recommended that this monitoring takes place at least annually.

<u>Habitat distribution</u>

Similarly to the bathymetric surveys, habitat distribution should be monitored during construction. Initially, monitoring should be fairly regular (i.e. once every 2 months) to ensure that any suspended sediment that may be settling is not settling in sensitive habitats (i.e. Zostera) at a rate unsustainable for the continuation of that particular habitat. This should be done through the collection of fixed-point photographs and updated distribution mapping.

The outcome of the monitoring should be compiled into an annual monitoring report comparing the monitoring against the baseline data that was collected prior to construction. In addition, there should be comment on the observations and whether they are in line with the impacts identified during the EIA. Should the impacts observed through the monitoring differ from that of the EIA and particularly if adverse, additional mitigation measures should be implemented.

11 CONCLUSIONS & RECOMMENDATIONS

11.1 Conclusions

Table 11.1 provides a summary of the existing and the potential impacts associated with the proposed project.

Table 11.1: Summary of the Existing & Potential Impacts.

PHASES OF DEVELOPMENT & POTENTIAL IMPACTS	SIGNIFICANCE	
	WITHOUT MITIGATION	WITH MITIGATION
EXISTING IMPACTS		
Estuary Bank Erosion	MODERATE-	*NOT APPLICABLE*
Increased Siltation	HIGH-	
Deterioration in Water Quality	LOW-	
Increased Salinity	HIGH-	
Impact on Submerged Macrophytes	MODERATE+	
Impact on Submerged Salt Marsh	MODERATE-	
Impact on fauna - increase in sandbank habitat as a result of the impoundments upstream	MODERATE+	
Impact on fauna - shift to a marine dominated system	HIGH-	
Impact on Social Amenities	MODERATE+	
Impact on Ecosystem goods and services	LOW-	
Impact on infrastructure and dune habitat as a result of a breach in the spit	HIGH-	
Ongoing erosion to the beaches to the north	MODERATE-	
CONSTRUCTION AND OPERATIONAL PHASE		
Increase in Sedimentation and Turbidity	MODERATE-	LOW-
Loss of Estuarine Vegetation Communities	MODERATE-	LOW-
Loss of Estuarine Faunal Communities	MODERATE-	LOW-
Impacts on the Estuarine Functional Zone	MODERATE-	MODERATE-
Improvements to the Recreational Amenities Offered by the Kromme	MODERATE+	HIGH+
Loss of Access to Particular Sites and Restrictions on the use of the Estuary during Dredging Operation	LOW-	LOW-
A Reduction / Loss of Sandbanks Supporting Fauna	LOW-	LOW-
Visual Intrusion of Dredging Equipment and Pipelines	MODERATE-	LOW-
Noise Disturbance Impacts	MODERATE-	LOW-
Impact on Navigation and Boating Safety	MODERATE+	MODERATE+
Loss of Dune Vegetation on The Vegetated Sand Bank at The Sand River Mouth	MODERATE-	MODERATE-
Disturbance to dune vegetation on the sand spit and other foredunes during construction	LOW-	LOW-

Effects of Groyne Construction on The Beach and Nearshore Area	**MODERATE-**	**MODERATE-**
Accretion and Resultant Widening of The Beaches as A Result of Beach Nourishment Scheme	**MODERATE-**	**HIGH+**
Stabilisation of The Shoreline and Protection from Storm Surges and Sea-Level Rise		
Long to Improvement to Recreational Amenities Offered by The Beaches		
Acceleration of erosion as a result of the groynes	**MODERATE-**	**LOW-**
Restriction of Sediment Transport to the North	**MODERATE-**	**LOW-**
DECOMMISSIONING PHASE		
None	-	-
CUMULTIVE IMPACTS		
Increased Estuary Bank Erosion	**MODERATE-**	**LOW-**

The dredging of the Kromme Estuary may result in significant negative impacts. However, with considered mitigation those impacts can be reduced to as low as reasonably practicable. While there are sensitive habitats with species deemed vulnerable and near threatened the loss of these species is anticipated to be a small area of their overall distribution within the Kromme Estuary and even smaller proportions regionally. The species that will be directly lost (benthic organisms) as a result of the dredging activity are not sensitive species and while their abundance may be reduced initially it is expected that these species will return and inhabit newly dredged areas. Alternative locations for birds and fish are available throughout the estuary system, since there is similar habitats upstream and along the beach in St Francis Bay.

Changes in the hydrodynamic environment are expected. The dredging of the river, and in particular the area around the river mouth has the effect of allowing the water to drain out more effectively, which lowers the low water level (with respect to MSL). It is assumed that this low water level will be a variable phenomenon in any case given the dynamic nature of the river mouth which will govern this low tide level. However, this may lead to exposure of shallow non-dredged areas within the estuary during low tides. The sandbanks exposed under existing conditions is calculated at 52 ha. Following the dredging activity (assuming the full extraction volume) the exposed sandbanks equate to 51 ha (See the Sand Sourcing Specialist Report for more information).

In addition, the maximum tidal current velocity throughout the simulation period confirm that the currents outside the main channel (i.e. near to the banks) and in particular on the northern bank close to the river mouth are low (up to 0.2m/s) and that the dredging would not lead to any significant change in the currents in this area. Similarly, based on the strong flow (maximum current speed of 1.8m/s at the estuary mouth observed from the model studies) the estuary mouth is not expected to close.

The estuarine functionality, while impacted, will remain intact. In order to ensure this impact is monitored CES have recommended regular bathymetry surveys. In addition to the surveys, CES recommend the development of an adaptive management plan. This plan would outline the environmental monitoring required during the construction and operational phases of the project and recommend appropriate mitigation measures depending on the results of the monitoring and the impacts observed.

Those areas of sand bank that are vegetated with dune vegetation (i.e. Sand River) do occur within the estuary and within those areas expected to be dredged. Since this vegetation is indigenous, and exhibits a clear successional gradient, its loss will result, despite the fact that it has established as a result of altered flow regimes in the Kromme. However, it is postulated that under normal flow conditions this sand bank would not have been as aggressively colonised by dune species as has occurred, due to reduced flows and infrequent flooding resulting in a more stable habitat.

The construction of the groynes, as well as activities associated with beach nourishment will require access over the foredunes in selected areas, and damage to the foredunes and the loss of some vegetation is inevitable. During 2020 the spit has breached a number of times and the Kouga Municipality have had to implement their emergency procedures which have required repair of the breach through closing the breaches with sand and the construction of an emergency revetment. Therefore, since the areas are mostly disturbed and likely to be localised, the impacts are not expected to be significant.

The nourishment of the beach along the St Francis Bay frontage will provide additional habitat for the development of dune species. It will also stabilise the shoreline and protect the foredunes from wave attack from storm surges. These are seen as beneficial impacts.

From a socio-economic perspective the restoration of the beach amenity and additional area within the lower reaches of the estuary are seen as beneficial impacts of the dredging. The visual and noise disturbance impacts as a result of the dredging and potential pumping of sediment can be suitably mitigated to reduce the impacts that may arise from the dredging activity.

Based on this assessment there are no fatal flaws.

11.2 Recommendations

It is recommended that the following Construction Phase and Operation Phase mitigation measures are included in the Environmental Management Programme (EMPr):

Table 11.2: Mitigation measures for inclusion in the EMPr and EA.

MITIGATION MEASURES
Only the correct size material (course) will be dredged for beach nourishment.
Sensitive habitats will be identified and avoided.
Only the required volume of sediment will be dredged.
Associated equipment will be placed in areas that are deemed not to be sensitive.
Development and publication of the intended programme of works including work areas.
Identification and publication of buffer areas/safety zones around dredging equipment.
Development of a dredging programme that takes navigation and peak times into account.
Noise attenuation of pumps/pipes associated with the transport of material.
Consideration of operating dredging equipment during daylight hours only.
Consider improvement of access to an alternative walking route along the length of the frontage along the beach and estuary.
Development and publication of water safety procedures and enforcement to ensure safety to all users of the estuary.
Development of an adaptive management plan.
Enforcement all provisions contained in the Construction EMP
Do not allow any laydown areas within the sensitive foredune area.
Limit access across the foredunes to four access points in total, where each groyne will be located. The access points will need to serve the groynes in proximity. From North to South, they are

expected to be the Aldabara Road parking area, Peter Crescent, George road and Ralph Road parking area. These parking areas must also be used as laydown areas.

Limit pedestrian access to these same points.

Disallow workers from accessing the remaining and intact foredune areas.

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APPENDIX 1: CURICULUM VITAE

Nicole Wienand
Curriculum Vitae

CONTACT DETAILS

Name of Company	**Coastal and Environmental Services (Pty) Ltd trading as CES**
Designation	Port Elizabeth Branch
Profession	Environmental Consultant / Junior Ecological Specialist
Years with firm	One (1) Year
E-mail	n.wienand@cesnet.co.za nicole.wienand@eoh.com
Office number	+27 (0)41 045 0496 +27 (0)41 393 0700
Nationality	South African
Key areas of expertise	➢ Environmental and Ecological Impact Assessments ➢ Botanical Specialist Studies ➢ Environmental Auditing/Compliance Monitoring ➢ GIS Mapping

PROFILE

Ms Nicole Wienand

Ms Nicole Wienand is an Environmental Consultant based in the Port Elizabeth branch. Nicole obtained her BSc Honours in Botany (Environmental Management) from Nelson Mandela University (NMU) in December 2018. She also holds a BSc Degree in Environmental Management (Cum Laude) from NMU. Nicole's honours project focused on the composition of subtidal marine benthic communities on warm temperate reefs off the coast of Port Elizabeth and for her undergraduate project she investigated dune movement in Sardinia Bay. Nicole's key interests include marine ecology, botanical specialist assessments, GIS Mapping, the general EIA process, Public Participation Process (PPP) and Ecological Impact Assessments. Since her appointment with CES in January 2019, Nicole has undertaken a number of Ecological Impact Assessments under the guidance of Dr Greer Hawley and Tarryn Martin.

EMPLOYMENT EXPERIENCE

Environmental Consultant, CES
07 January 2019 – Present

- Basic Assessment Reports
- Ecological Impact Assessments
- Environmental Audit/Compliance Monitoring
- GIS Mapping
- Public Participation

ACADEMIC QUALIFICATIONS

Nelson Mandela University, Port Elizabeth
BSc Honours Botany (Environmental Management)
2018

Nelson Mandela Metropolitan University, Port Elizabeth
BSc Environmental Sciences
2015-2017

CONSULTING EXPERIENCE

Basic Assessments
- Duyker Island Prospecting Right, North West Province – Assisting Report Writing
- ZMY Steel Traders (Pty) Ltd. Steel Recycling Plant, Zone 5 of the Coega SEZ, Eastern Cape Province – Basic Assessment Report;
- Fairview Sand Mine near Port Alfred, Eastern Cape Province – Basic Assessment Report;
- Kareekrans Boerdery Agricultural Development near Kirkwood, Eastern Cape Province – Report Writing; and
- Sitrusrand Dwarsleegte Farm Citrus Development near Kirkwood, Eastern Cape Province – Report Writing.

Ecological Assessments
- ZMY Steel Traders (Pty) Ltd., Steel Recycling Plant, Zone 5 of the Coega SEZ, Eastern Cape Province;
- Kareekrans Boerdery Agricultural Development near Kirkwood Eastern Cape Province, Ecological Impact Assessment and Report Writing;
- Sitrusrand Dwarsleegte Farm Citrus Development near Kirkwood, Eastern Cape Province – Ecological Impact Assessment and Report Writing;
- Uitsig Boerdery Trust Citrus Development near Kirkwood, Eastern Cape Province – Ecological Impact Assessment and Report Writing;
- Mosselbankfontein Coastal Dune and Ecological Impact Assessment near Witsand, Western Cape Province – Ecological Impact Assessment and Report Writing;
- Nomzamo Citrus Farm Development near Kirkwood, Eastern Cape Province – Ecological Impact Assessment and Report Writing; and
- Mangrove Forest Survey for the Kenmare Biodiversity Management Plan, Topuito, Mozambique.

Environmental Auditing
- Khayamnandi Extension on Erven 114, 609, 590 and 24337, Bethelsdorp, within the Nelson Mandela Bay Municipality;

- Aberdeen Bulk Water Supply Phase 2, Dr Beyers Naude Local Municipality, Eastern Cape Province, South Africa;
- The Milkwoods Integrated Residential Development, Remainder Erf 1953, Victoria Drive, Walmer, Nelson Mandela Bay Municipality, Eastern Cape Province;
- Fishwater Flats Wastewater Treatment Works Refurbishment, Nelson Mandela Bay Municipality, Eastern Cape Province;
- The Refurbishment of the Kwanobuhle Wastewater Treatment Plant, Nelson Mandela Bay Municipality, Eastern Cape Province, South Africa; and
- Driftsands Sewer Collector Augmentation (Phase Ii), Within the Nelson Mandela Bay Municipality, Eastern Cape Province.

Geographical Information Systems (GIS)

- ZMY Steel Traders – Basic Assessment Report and Biophysical Mapping;
- Duyker Island – Prospecting Area Mapping & Biophysical Mapping;
- Fairview Sand Mine near Port Alfred, Eastern Cape Province – Biophysical and Layout Mapping;
- St Francis Coastal Protection Scheme – Kromme Estuary Functional Zone Mapping; Biophysical Mapping; and Sand Source Area Mapping;
- Kareekrans Boerdery Agricultural Development – Biophysical and Layout Mapping;
- Nomzamo Citrus Farm Development near Kirkwood, Eastern Cape Province - Biophysical and Layout Mapping;
- Siyahluma Citrus Farm Development near Addo, Eastern Cape Province – Biophysical and Layout Mapping; and
- Sitrusrand Dwarsleegte Farm Citrus Development – Biophysical and Layout Mapping.

Public Participation process

- Duyker Island Prospecting Right, North West Province St Francis Coastal Protection Scheme;
- Fairview Sand Mine near Port Alfred, Eastern Cape Province;
- Kareekrans Boerdery Agricultural Development near Kirkwood Eastern Cape Province;
- Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province; and
- Sitrusrand Dwarsleegte Farm Citrus Development near Kirkwood, Eastern Cape Province.

Social Auditing

- Malawi Millennium Development Trust – Resettlement Action Plan Implementation Auditing.

CERTIFICATION

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes me, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Nicole Wienand **Date: January 2020**

APPENDIX 2: SPECIALIST DECLARATIONS

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST IN TERMS OF REGULATIONS 12 AND 13 OF THE AMENDMENTS TO THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014 AS AMENDED.

	(For official use only)
File Reference Number:	
NEAS Reference Number:	
Date Received:	

Application for environmental authorization in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Amendments to the Environmental Impact Assessment Regulations, 2014. This form is valid as of 6 January 2021

PROJECT TITLE

COASTAL PROTECTION SHCEME, ST FRANCIS BAY, KOUGA MUNICIPALITY EASTERN CAPE PROVINCE

SPECIALIST:	Mr Gregory Shaw		
Contact person:	Mr Gregory Shaw		
Postal address:	67 African Street, Grahamstown		
Postal code:	6139	Cell:	+27 606 715 914
Telephone:	046 622 2364	Fax:	
E-mail:	g.shaw@cesnet.co.za		
Professional affiliation(s) (if any)			

Project Consultant	CES		
Contact person:	Mr Gregory Shaw		
Postal address:	67 African Street, Grahamstown		
	6139	Cell:	+27 606 715 914
Postal code:			
Telephone:	046 622 2364	Fax:	
E-mail:	g.shaw@cesnet.co.za		

4.2 The SPECIALIST

I, Gregory Shaw , declare that –

General declaration:

- I act as the independent Specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting environmental impact assessments, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in regulation 8 of the regulations when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority, and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application
- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by

interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;

- I will keep a register of all interested and affected parties that participated in a public participation process; and
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- all the particulars furnished by me in this form are true and correct;
- will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I realise that a false declaration is an offence and is punishable in terms of section 24F of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Amendments to Environmental Impact Assessment Regulations, 2014 as amended
- ~~I have a vested interest in the proposed activity proceeding, such vested interest being:~~

Shaw

Signature of the environmental assessment practitioner:

Coastal and Environmental Services (Pty) Ltd

Name of company:

4th February 2021

Date:

Signature of the Commissioner of Oaths:

04TH February 2021

Date:

Commissioner of Oaths

Designation:

Curriculum Vitae (CV) attached

Official stamp (below):

LYNN SMIT
COMMISSIONER OF OATHS
REFERENCE NUMBER: 9/1/8/2 EAST LONDON
15 TECOMA STREET, BEREA
EAST LONDON, 5214

Annexure 1

CV

GREGORY SHAW

Curriculum Vitae

CONTACT DETAILS

Name of Company	**CES**
Designation	Grahamstown Branch
Profession	Principal Environmental Consultant
Years with firm	3 Years
E-mail	g.shaw@csenet.co.za
Office number	+27 (0)46 622 2364
Nationality	South African
Professional Body	SACNASP, South African Council for Natural Scientific Profession, Professional (Pending)
Key areas of expertise	➢ Marine Ecology ➢ Environmental and Social Impact Assessment (ESIA) ➢ Environmental Management and Monitoring ➢ Project Management

PROFILE

Mr Gregory Shaw

Greg is a principal environmental consultant with more than 10 years' experience, who has carried out ESIAs for a variety of infrastructure developments in Africa and Europe. His experience is with development projects where there is creation or modification of infrastructure, via capital works and complex logistics.

He is able to engage with the full portfolio of diverse stakeholder groups and regulators via meetings, written material, face-to-face workshops, presentation events, negotiation and discussion to achieve mutually agreeable mitigation measures and solutions. As part of many of the ESIAs he has been involved in or managed he has been responsible for the development and execution of environmental surveys (and subsequent monitoring programmes), sub-contractor management (including contracting), report writing and project management. In addition, he has been responsible for developing and auditing plans associated with managing large infrastructure projects e.g. Environmental Management Plans (EMP).

Greg forms strong relationships and ensure that the team works together in an integrated way towards the clear common goal, making effective use of time and resources.

EMPLOYMENT EXPERIENCE

November 2016 - Present:
Principal Consultant (EOH Coastal & Environmental Services)
Grahamstown, South Africa

January 2008 – October 2016:
Senior Consultant (Royal HaskoningDHV)
Peterborough, United Kingdom

January 2004 – January 2007:
Part-time consultant (Public Process Consultants)
Port Elizabeth, South Africa

ACADEMIC QUALIFICATIONS

Nelson Mandela Metropolitan University, Port Elizabeth
MSc (Botany)
2005 – 2007

Nelson Mandela Metropolitan University, Port Elizabeth
BSc (Hons) (Environmental Management)
2004

University of Port Elizabeth, Port Elizabeth
BSc (Natural Sciences)
2000 - 2003

COURSES

- 2013 Royal HaskoningDHV Accelerated Development Programme
- 2012 First Aid
- 2012 Handling Conflict
- 2011 Client Relationships
- 2011 Financial Management
- 2010 Report Writing
- 2010 Project Management
- 2010 Effective Communication
- 2010 Knowing Your Business
- 2010 Phase I Ecological Surveying Techniques and Taxonomy
- 2009 CIWEM Structured Training
- 2009 Project Management
- 2008 Sustainable Construction
- 2006 South African Association of Botanists - Annual Seminar
- 2005 Resource Directed Measures
- 2005 Training in Integrated Environmental Management
- 2005 Integrated Water Resource Management Workshop

CONSULTING EXPERIENCE

Environmental consulting experience as project manager or team member is broad and covers a number of key industry sectors (ports, nuclear, renewable energy). The majority of the international ESIAs were conducted in accordance with international standards including the IFC Performance Standards and have been reviewed by international Development Finance Institutions.

South Africa

- Nirove Paint Stripping Facility [Project manager]
- Wison Coal to Urea EIA [Project manager]
- St Francis Bay EIA [Project Manager, Marine specialist]
- EOH Powerstation Feasibility Assessment [Project manager]
- Richard's Bay breakwater refurbishment [Marine specialist]
- KBK Engineers (Sanral) Basic Assessment [Project manager]
- Bayview Wind Energy Facility [Project director]
- Rushmere Noach Attorneys [Project manager and marine specialist]
- TNPA East London Quay 3 Assessment [Environmental specialist]
- TNPA Ballast Water Management Plan [Environmental specialist]
- Fairwood Estate Environmental Authorisation [ESMP author]
- Environmental Scoping Report cc. Erf 2387, Port Elizabeth. Baobab Agencies. [Environmental specialist].
- Proposed Hybrid Residential Development Scoping Report, Port Elizabeth. [Environmental specialist].
- Ingleside Development, Port Elizabeth. [Specialist Review].
- Port of Ngqura Marine Biomonitoring Programme. Coega Development Corporation. [Surveyor / research assistant].
- Construction and Operation of the Deepwater Port of Ngqura EIA. Coega Development Corporation. [Specialist review].

Africa

- Kenmare Mangrove Baseline Assessment (Mozambique) [Lead surveyor]
- Sphinx Energy Solar PV Facilities in Guider & Maroua (Cameroon) [Project manager]
- Olam Cocoa Plantation ESIA (Tanzania) [Project manager, ESIA manager]
- MCA-Malawi RAP Audit [Project Manager, Lead Auditor]
- JCM Power ESMS [Project manager]
- JCM Power Solar Power Station ESIA [Project Manager, Report Author]
- Suni Resources Traffic Impact Assessment [Report author]
- NCCL Isanye Dam EPB (Zambia) [Project manager]
- NCCL Ngoli Dam EPB (Zambia) [Project manager]
- NCCL Kasama Dam ESIA (Zambia) [ESIA manager]
- JCM Power Solar PV ESIA (Cameroon) [ESIA manager]
- Tete Iron Ore Project ESIA (Mozambique) [ESMP]
- Triton Ancuabe ESIA (Mozambique) [Specialist coordination, ESMP]
- Badagry Greenfield Port Development ESIA including management plans (Nigeria) [ESIA and marine specialist]
- Saly Coastal Protection Project ESIA (Senegal) [Marine specialist]
- Port Mole Waterfront Development ESIA including management plans (Gabon) [ESIA manager and marine specialist]
- Bulk Handling Facility ESIA including management plans (Conakry Guinea) [ESIA manager and marine specialist]
- Kamsar Container Terminal ESIA including management plans (Conakry Guinea) [ESIA manager and marine specialist]

- Port of Ziguinchor ESIA including management plans (Senegal) [Marine specialist / Reviewer]
- Eko Atlantic Shoreline Protection ESIA including management plans (Nigeria) [Marine specialist]
- Eko Atlantic Topside Infrastructure ESIA (Nigeria) [ESIA manager]
- Construction of a Jetty Facilitating Transfer of Petroleum Products from Ship to Shore (Eritrea) [Environmental Clerk of Works]

United Kingdom

- Thamesport Phase IV Quay Extension EIA [Reviewer]
- East Lane, Bawdsey Coast Defence Works [Environmental Clerk of Works]
- Kilkeel Offshore Wind Farm Feasibility and Scoping Report [Project manager]
- Wells Channel Deepening and Jetty Construction EIA [EIA and marine specialist]
- Wells Channel Deepening and Jetty Construction Environmental Monitoring Programme (2010-2016) [Project manager and marine specialist]
- Trinity III Enhancement Monitoring Programme (2008 – 2011) ([Marine specialist]
- Trimley Ecological Monitoring Programme (2008 – 2011) [Marine specialist]
- SEAs for the Eastern England Shoreline, required for Shoreline Management Plans [Marine specialist]
- River Habitat Survey, Tributary of Car Dyke [Field work and report writing]
- Hinkley Point C Environmental Impact Assessment [EIA coordinator and marine specialist]
- Harwich Haven Annual Environmental Reporting (2009 – 2011) [Project manager and marine specialist]
- Environmental Monitoring and Mitigation Plan / Habitat Regulations Assessment East Lane [Project manager and marine specialist]
- Thanet Offshore Wind Farm [Environment Manager]
- The Wash Tide Gauge [Consent advisor and marine specialist]
- Dogger Bank Creyke Beck A&B, Teesside A&B EIA [Marine specialist]
- Kentish Flats Offshore Wind Farm Extension [Consent advisor / environment manager]
- Royal National Lifeboat Institute (RNLI) Feasibility [Project manager and marine specialist]
- Bacton Gas Terminal Coast Protection Works and Offshore Borrow Area EIA [Consent and marine specialist]
- Newhaven East Quay and Port Expansion Area EIA [Marine specialist]
- Sizewell C New Nuclear Build Habitats Regulations Assessment [Project manager]
- DNV Subsea Cable Installation Guidelines [Marine and Consenting expert]

CERTIFICATION

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes me, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

GREGORY SHAW Date: January 2020

Province of the
EASTERN CAPE
ECONOMIC DEVELOPMENT, ENVIRONMENTAL AFFAIRS & TOURISM

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST IN TERMS OF REGULATIONS 12 AND 13 OF THE AMENDMENTS TO THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014 AS AMENDED.

	(For official use only)
File Reference Number:	
NEAS Reference Number	
Date Received.	

Application for environmental authorization in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Amendments to the Environmental Impact Assessment Regulations, 2014. This form is valid as of 6 January 2021.

PROJECT TITLE

COASTAL PROTECTION SHCEME, ST FRANCIS BAY, KOUGA MUNICIPALITY, EASTERN CAPE PROVINCE

SPECIALIST [1]	Dr Chantel Bezuidenhout		
Contact person:	Mr Gregory Shaw		
Postal address	57 African Street, Grahamstonw		
Postal code:	6139	Cell:	+27 606 715 914
Telephone:	046 622 2364	Fax.	
E-mail:	g.shaw@cesnet.co.za		
Professional affiliation(s) (if any)			

Project Consultant:	CES		
Contact person:	Mr Gregory Shaw		
Postal address:	67 African Street, Grahamstown		
Postal code:	6139	Cell:	+27 606 716 914
Telephone:	046 622 2364	Fax:	
E-mail:	g.shaw@cesnet.co.za		

4.2 The SPECIALIST

I Chantel Bezuidenhout , declare that –

General declaration:

- I act as the independent Specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting environmental impact assessments, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in regulation 8 of the regulations when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by

interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;

- I will keep a register of all interested and affected parties that participated in a public participation process; and
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- all the particulars furnished by me in this form are true and correct;
- will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I realise that a false declaration is an offence and is punishable in terms of section 24F of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Amendments to Environmental Impact Assessment Regulations, 2014 as amended
- ~~I have a vested interest in the proposed activity proceeding, such vested interest being:~~

Signature of the environmental assessment practitioner:

Coastal and Environmental Services (Pty) Ltd.

Name of company:

04th February 2021

Date:

Signature of the Commissioner of Oaths

04th February 2021

Date:

Commissioner Of Oaths

Designation:

[1] Curriculum Vitae (CV) attached

Official stamp (below).

LYNN SMIT
COMMISSIONER OF OATHS
REFERENCE NUMBER: 3/1/6/2 EAST LONDON
20 TECOMA STREET, BEREA
EAST LONDON, 5214

Annexure 1

CV

CHANTEL BEZUIDENHOUT
Curriculum Vitae

CONTACT DETAILS

Name of Company	**CES – Environmental and Social Advisory Services**
Designation	Port Elizabeth Branch
Profession	Principal Environmental Consultant and Branch Manager
Years with firm	9 Years
E-mail	c.bezuidenhout@cesnet.co.za
Office number	+27 (0)41 585 1715
Nationality	South African
Key areas of expertise	• Environmental Impact Assessments (including stakeholder engagement such as focus group meetings, meetings with local government officials, etc.) • Environmental Management Programmes • Monitoring Programmes • High level GHG Emissions Assessments • Land and Natural Resource Use Assessment (liaising with local communities via focus group meetings in regard to land use, including agriculture, natural resources use, etc.) • Estuarine Assessments • Team Leader for land surveys completed for a RAP process in Mozambique • Rehabilitation Assessments • Mine Closure Reports

PROFILE

Dr Chantel Bezuidenhout

Dr Chantel Bezuidenhout holds MSc and PhD degrees in Botany (estuarine ecology) and a BSc degree in Botany and Geography from NMMU. Chantel has been an Environmental Consultant for approximately 11 years and as such has been focused on environmental management and impact assessment. Chantel is well versed in environmental legislation and has managed a number of environmental impact assessments and management plans for heavy mineral mining in South African and Madagascar, as well as a number of EIAs for open case mines (copper, nickel, graphite) in Zambia and Mozambique. These projects have been completed to international standards (IFC and World Bank), and have been granted authorisation by their host countries. Chantel is also well versed in stakeholder engagement and stakeholder processes, all EIAs that has been managed by Chantel has included community consultations and as such Chantel has been used for various forms of community engagement in rural African settings. Chantel has also been extensively involved in the data collection and report writing for land and natural resource use assessments in both Madagascar and Mozambique. The data gathering component involves expensive community meetings in order to establish land use (including agriculture) and natural resource use within the communities and wider regions. Chantel has recently completed an extensive land survey as part of a Resettlement process for a heavy minerals mine in Mozambique as well as in-kind compensation surveys in Tanzania. She is currently a principal consultant and Branch Manager of the Port Elizabeth Office of EOH CES.

EMPLOYMENT EXPERIENCE

Principal Environmental Consultant, Coastal and Environmental Services
October 2011-Present

- Project Management
- Report Production (EIR,BAR,EMPr)
- Public Participation, including community meetings, focus group meetings, liaison with government department, etc.
- Specialist Assessments (Estuarine, High Level GHG, Rehabilitation, Mine Closure & Land Natural Resource Use)
- Team Leader for Land Surveys undertaken as part of the Resettlement Process
- Quality Control

Environmental Consultant, CEN IEM Unit
February 2008 – September 2011

- Project Management
- Report Production (EIR, BAR, EMPr)
- Public Participation

ACADEMIC QUALIFICATIONS

- 2000 - BSc. NMMU Port Elizabeth
- 2001 - BSc. (Hons) NMMU Port Elizabeth
- 2003 – MSc. NMMU Port Elizabeth
- 2011 – PhD. NMMU Port Elizabeth

PUBLICATIONS

- Bornman, T.G., Adams, J.B. and Bezuidenhout, C. 2004. Present status of the Orange River mouth wetland and potential for rehabilitation. Prepares for Working for Wetlands, South African National Biodiversity Institute. Nelson Mandela Metropolitan University. IECM Research Report No. 43. 54pp.
- Bornman, T.G., Adams, J.B. and Bezuidenhout, C. 2004. Adaptations of salt march to semi-arid environments and management implications for the Orange River mouth. Transactions of the Royal Society of South Africa 59(2): 125-131.
- Adams, J.B., Bornman, T.G. and Bezuidenhout, C. 2005. Specialist Report: Macrophytes. Olifants / Doring catchment. Ecological Water Requirements study, Olifants Estuary. Report submitted to CSIR, Environmentek, Stellenbosch. 39pp.
- Bezuidenhout, C., J.B. Adams and Bornman, T.G. 2005. Specialist Report: Macrophytes. Kromme Estuary Resources Directed Measures Study. Report submitted to the CSIR on behalf of the Department of Water Affairs and Forestry. 61pp.
- Bornman, T.G., Adams, J.B. and Bezuidenhout, C. 2005. Salt march characteristics and freshwater requirements of a cool temperate versus a warm temperate estuary. 12th Southern African Marine Science Symposium. Durban, Kwazulu-Natal.

PROFESSIONAL EXPERIENCE

Consulting Experience (Selected Projects)

- CEN Integrated Environmental Management Unit: (2008) Basic Assessment for the proposed establishment of 2 jetties, improvement of the existing, licensed slipway and stabilization of the river banks on Portion 12 of the Farm Nocton 441 (Gamtoos ferry Hotel). (Port Elizabeth, Eastern Cape Province)
- CEN Integrated Environmental Management Unit: (2008) Basic Assessment for the proposed establishment of a Town Lodge Hotel on Erf2150, Summerstrand. (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2008) Basic Assessment for the proposed Rezoning and subdivision of Erf 10501 and the remainder of Erf 5023, Walmer, Nelson Mandela Metropolitan Municipality, for the purpose of establishing a residential development. (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2008) Basic Assessment for the proposed rezoning and the establishment of a hospital and associated infrastructure and facilities on a portion of the remainder of Erf 1226, Fairview, Port Elizabeth, Eastern Cape. (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2008) Basic Assessment for the proposed rezoning of Portion 1 of the Farm Bucklands (No. 108), the Farm SchrikwatersPoort (No. 109) and the remainder of the Farm Bucklands (No. 108) for the development of a Luxury Lodge, Makana Municipal Area, Eastern Cape. (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2008) Basic Assessment for the proposed subdivision of Erf 2686, Parsonsvlei for a Residential Development Port Elizabeth, Eastern Cape. (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2008) Basic Assessment for the proposed subdivision of Erf 2687, Parsonsvlei for a Residential Development Port Elizabeth, Eastern Cape. (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2008) Environmental Assessment for the proposed Rezoning and Subdivision of Portions 22 and 40 of the Farm Witteklip No 466, Nelson Mandela Bay Municipality. (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2009) Environmental Assessment for the proposed subdivision of the remainder of Erf 1226, Fairview, Port Elizabeth, Eastern Cape for a Residential Development. (Pot Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2009) Basic Assessment for the establishment of a new 2.5 Ml Kruisfontein Reservoir on Erf 2088 and a portion of the remainder of Erf 2, Humansdorp, Kouga Municipality, Eastern Cape. (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2009) Basic Assessment for the proposed extension of an existing 36m lattice mast to a 46m lattice mast on Erf 8917, Uitenhage, Nelson Mandela Bay Municipality, Eastern Cape. (Port Elizabeth, Eastern Cape)

- CEN Integrated Environmental Management Unit: (2009) Basic Assessment for the proposed extension of an existing 36m lattice mast to a 46m lattice mast of Erf 1296, Summerstrand, Port Elizabeth, Eastern Cape. (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2009) Basic Assessment for the proposed extension of an existing 36m lattice mast to a 56m lattice mast on Erf 1345, Walmer, Port Elizabeth, Eastern Cape. (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2009) Basic Assessment for the proposed rezoning and subdivision of a portion of Erf 1721, Aberdeen, Comdeboo Municipality, Eastern Cape to develop subsidized housing and related community facilities (Lotusville Extension). (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2009) Basic Assessment for the proposed rezoning and subdivision of a portion of Erf 1721, Aberdeen, Comdeboo Municipality, Eastern Cape to develop subsidized housing and related community facilities (Thembalesizwe Extension). (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2009) Basic Assessment for the proposed stabilization of the river banks on Portion 2 of the Farm Nocton 441 (Adjacent to the Gamtoos Ferry Hotel). (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2010) Environmental Impact Assessment for the proposed construction and upgrading of the new Glen Hurd Road as well as the construction of the Baakens River Bridge, Port Elizabeth, Eastern Cape. (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2010) Environmental Impact Assessment for the proposed subdivision of the remainder of Erf 982, Parsonsvlei, Port Elizabeth, Eastern Cape for a Residential development. (Port Elizabeth, Eastern Cape)
- CEN Integrated Environmental Management Unit: (2010) Environmental Impact Assessment for the proposed rezoning and subdivision of erven 1070, 409 and the remainder of Erf 385, Theescombe, Port Elizabeth, Eastern Cape for a residential development. (Port Elizabeth, Eastern Cape)
- Coastal and Environmental Services. Environmental Impact Assessment for the proposed residential development at the existing golf course in Grahamstown, Eastern Cape Province of South Africa (2012).
- Coastal and Environmental Services. Environmental Impact Assessment for the proposed golf course development at Belmont Valley, Grahamstown, Eastern Cape Province of South Africa (2012)
- Coastal and Environmental Services. Basic Assessment for the proposed development of a 13 MW Photovaltaic energy generating facility in the Coega Industrial Development Zone (Zone 12), Port Elizabeth, Eastern Cape Province. Authorization Received 29/02/12.
- Coastal and Environmental Services. Environmental Impact Assessment for the Mooi-Mgeni Transfer Scheme – Phase 2, KwaZulu-Natal Province, South Africa (2012)

- Coastal and Environmental Services. Environmental Impact Assessment for the proposed Peddie Wind Energy Project, Ngqushwa Local Municipality, Eastern Cape Province of South Africa (2012).
- Coastal and Environmental Services. Environmental Impact Assessment for the proposed Kamiesberg Heavy Mineral mine in Nomaqualand, Northern Cape Province (2014).

International:

- Environmental Impact Statement for a large scale copper mine in the North-Western Province of Zambia (2012).
- Environmental Impact Statement for a large scale nickel mine in the North-Western Province of Zambia (2014).
- Environmental and Social Impact Assessment for a heavy minerals mine in the Toliara Province, Madagascar (2014).
- Project Manager: Graphite Mine in Cabo-Delgado Province, Mozambique (2015).

Specialist Work:

- Land and Natural Mineral Resources Assessment for a heavy minerals mine in the Toliara Province, Madagascar (2013).
- Land and Natural Mineral Resources Assessment Iron ore mine in Tete Province, Mozambique (2015).
- Land and Natural Mineral Resources Assessment graphite mine in Cabo Delgado Province, Mozambique (Ancuabe) (2016).
- Land and Natural Mineral Resources Assessment graphite mine in Cabo Delgado Province, Mozambique (Nicanda Hills) (2016).
- Land and Natural Mineral Resources Assessment heavy minerals mine in Nampula Province, Mozambique (2018).
- High Level GHG Assessment for Kenmare Moma Heavy Minerals Mine, Mozambique (2016).
- High Level GHG Assessment for Ranobe Heavy Minerals Mine, Madagascar (2017).
- Rehabilitation Strategy for a heavy minerals mine in Mozambique (2018).
- Closure Report for graphite mine in Cabo Delgado Province, Mozambique (2018).
- Estuarine Assessment for a heavy minerals mine in Nampula Province Mozambique (2018).

Resettlement Work:

- Team Leader for large land survey undertaken as part of the resettlement process for a heavy minerals mine in Mozambique.
- In-Kind Compensation Surveys for bulk infrastructure in Tanzania.

Water use Licence Applications:

- Chantel compiled the Water Use Licence Application for the Zirco Heavy Minerals Mine. The WULA consisted of the following water uses:
  Section 21(a): Taking water from a water source (borehole);
  Section 21(b): Storing water (Flood attenuation dam);
  Section 21(c): Impeding or diverting the flow of water in a watercourse (pipeline and electrical servitude across the Groen River)
  Section 21(e): Engaging in a controlled activity (irrigation of an on-site nursery with treated effluent)
  Section 21(g): Disposing of waste in a manner which may detrimentally impact on a water resource (backfilling, brine disposal, dust suppression, run-off from HMC stockpiles, pollution control dam, process water dam, sewage infrastructure and tailings storage facility);
  Section 21(i): Altering the bed, banks, course of characteristics of a watercourse (pipeline and electrical servitude across the Groen River).

CERTIFICATION

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes me, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Chantel Bezuidenhout Date: 05 March 2020

PROPOSED COASTAL PROTECTION SCHEME,
ST FRANCIS BAY, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

DEDEAT REFERENCE NUMBER: EC08/C/LN2/M/01-2021

DRAFT

Prepared for	On behalf of
St Francis Property Owners NPC PO Box 18 St Francis Bay 6312	Kouga Local Municipality PO Box 21 Jeffreys Bay 6330

Prepared by

36 Pickering Street, Newton Park, Port Elizabeth, 6045

Also in Grahamstown, East London, Johannesburg, Cape Town and Maputo

www.cesnet.co.za

FEBRUARY 2020

REVISIONS TRACKING TABLE

This report should be cited as follows: Coastal & Environmental Services, February 2021: *Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province, Final Environmental Management Programme*. CES, Port Elizabeth.

CES Report Revision and Tracking Schedule		
Document Title	Draft Environment Management Programme: Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province.	
Client Name & Address	St Francis Property Owners NPC PO Box 18 St Francis Bay 6312 *On behalf of* Kouga Local Municipality PO Box 21 Jeffreys Bay 6330	
Document Reference	DEDEAT Ref: EC08/C/LN2/M/01-2021	
Status	**DRAFT**	
Issue Date	February 2021	
Authors	Mr Gregory Shaw Ms Nicole Wienand	Coastal & Environmental Services
Reviewers	Dr AM (Ted) Avis	Coastal & Environmental Services

CES

ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

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LIST OF ACRONYMS

CARA	Conservation of Agricultural Resources Act
CITES	Convention of International Trade in Endangered Species
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DEDEAT	Department of Economic Development, Environmental Affairs and Tourism
DEFF	Department of Environment, Forestry and Fisheries
DoL	Department of Labour
DoH	Department of Health
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
ECPHRA	Eastern Cape Provincial Heritage Resources Authority
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
EMS	Environmental Management System
ESO	Environmental Site Officer
GN	Government Notice
I&AP	Interested and/or Affected Party
IDP	Integrated Development Plan
KPIs	Key Performance Indicators
LM	Local Municipality
MS	Method Statements
MSDS	Material Safety Data Sheets
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
PNCO	Provincial Nature Conservation Ordinance
RE	Resident Engineer
S&EIR	Scoping and Environmental Impact Report
SABS	South African Bureau of Standards
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity institute
SBDM	Sarah Baartman District Municipality
SHE	Safety, Health, and Environment
SCC	Species of Conservation Concern
SDF	Spatial Development Framework
SFPO NPC	St Francis Property Owners Non-Profit Company
WULA	Water Use Licence Application

1. INTRODUCTION

This Environmental Management Programme (EMPr) Report has been compiled to provide mitigation, monitoring and institutional measures to be taken during the construction and operation of the St Francis Bay Coastal Protection Scheme Project. These measures aim to eliminate, offset and/or reduce adverse environmental and social impacts associated with the proposed project.

This EMPr informs all relevant parties, in this case, the Project Coordinator, the Contractor, the Environmental Control Officer (ECO) and all other staff employed by the Applicant at the site, as to their duties in the fulfilment of the legal requirements for the construction and operation of the St Francis Bay Coastal Protection Scheme, with particular reference to the prevention and mitigation of anticipated potential negative environmental impacts.

All parties should note that obligations imposed by the EMPr are legally binding in terms of the Environmental Authorisation (EA) granted by the relevant environmental permitting authority.

1.1. OBJECTIVES OF THE EMPr

The general objectives of the EMPr are to:

- Ensure compliance with the regulatory authority's stipulations and guidelines which could be local, provincial, national and/or international;
- Ensure that there is sufficient allocation of resources on the project budget so that the scale of EMPr-related activities is consistent with the significance of project impacts;
- Verify environmental performance through information on impacts as they occur;
- Respond to unforeseen events;
- Provide feedback for continual improvement in environmental performance;
- Identify a range of mitigation measures which could reduce and mitigate the potential negative impacts to minimal or insignificant levels;
- Detail specific actions deemed necessary to assist in mitigating the environmental impact of the project;
- Identify measures that could optimize beneficial impacts;
- Create management structures that address the concerns and complaints of I&APs with regards to the project;
- Establish a method of monitoring and auditing environmental management practices during all phases of the activity;
- Ensure that safety recommendations are complied with; and
- Specify time periods within which the measures contemplated in the final environmental management programme must be implemented, where appropriate.

1.2. STRUCTURE AND FUNCTION OF THE EMPr

An EMPr is focused on sound environmental management practices, which will be undertaken to minimise adverse impacts on the environment through the lifetime of a development. In addition, an EMPr identifies measures that should be in place, or will be actioned, to manage any incidents and emergencies that could occur during the operation of the project.

As such, the EMPr provides specifications that must be adhered to in order to minimise adverse environmental impacts associated with the construction and operation of the St Francis Bay Coastal Protection Scheme Project. The contents of the EMPr, as it is defined in the 2014 Environmental Impact Assessment (EIA) Regulations (as amended) published as Government Notice (GN) No R. 326 of 7 April 2017 in terms of Chapter 5 of the National Environmental Management Act (NEMA) (Act No. 107 of 1998, as amended), are consistent with the requirements as set out in Appendix 4 of the Amended EIA Regulations tabulated below.

Table 1.1: Requirements of an EMPr as per Appendix 4 of the NEMA EIA Regulations.

REQUIREMENTS OF AN ENVIRONMENTAL MANAGEMENT PROGRAMME IN TERMS OF APPENDIX 4 OF GNR 982 OF 2014, AS AMENDED IN GNR 326 OF 2017		SECTION OF REPORT
1	An EMPr must comply with section 24N of the Act and include- a. Details of: • the EAP who prepared the EMPr; and	Chapter 2
	• the expertise of that EAP to prepare an EMPr, including a curriculum vitae.	Annexure 3
	b. a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Chapter 4
	c. a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	Annexure 4
	d. a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including-	Chapter 6
	• Planning and design	
	• Pre-construction activities	
	• Construction activities	
	• rehabilitation of the environment after construction and where applicable post closure; and	
	• where relevant, operational activities;	
	f. description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraphs (d) will be achieved, and must, where applicable, include actions to -	Chapter 6
	• avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;	
	• comply with any prescribed environmental management standards or practices;	
	• comply with any applicable provisions of the Act regarding closure, where applicable; and	
	• comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	
	g. the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Chapter 7
	h. the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	
	i. an indication of the persons who will be responsible for the implementation of the impact management actions;	
	j. the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Chapter 7 and 8
	k. the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	

REQUIREMENTS OF AN ENVIRONMENTAL MANAGEMENT PROGRAMME IN TERMS OF APPENDIX 4 OF GNR 982 OF 2014, AS AMENDED IN GNR 326 OF 2017	SECTION OF REPORT
l. a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	
m. an environmental awareness plan describing the manner in which- • the applicant intends to inform his or her employees of any environmental risk which may result from their work; and • risks must be dealt with in order to avoid pollution or the degradation of the environment.	Chapter 9
n. any specific information that may be required by the competent authority. "The adverse impacts of possible acceleration of erosion, particularly regarding the northern banks of the Kromme River mouth and the northern beaches has not been satisfactorily addressed – the impact assessment, Section 7, Table 7.2 only briefly addresses this by indicating that the banks must remain intact. The method of doing so as well as mitigation measures and ongoing monitoring must be specifically addressed. The few bulleted points contained in the EMPr also do not give sufficient information besides monitoring being enacted."	Chapter 6, Chapter 9

1.3. LEGAL REQUIREMENTS

Construction must be according to the best industry practices, as identified in the project documents. This EMPr, which forms an integral part of the contract documents, informs the Contractor and/or Applicant of their duties in the fulfilment of the project objectives, with particular reference to the prevention and mitigation of environmental impacts caused by the construction and operational activities associated with the St Francis Bay Coastal Protection Scheme. The Contractor and/or Applicant should note that obligations imposed by the approved EMPr are legally binding in terms of environmental statutory legislation and in terms of the additional conditions to the general conditions of contract which pertain to this project. In the event that any rights and obligations contained in this document contradict those specified in the standard or project specifications, then the EMPr must prevail.

The Contractor must identify and comply with all South African national and provincial environmental legislation, including associated regulations and all local by-laws relevant to the project. Key legislation currently applicable to the construction and operational phases of the project must be complied with. The list of applicable legislation provided below is intended to serve as a guideline only and is not exhaustive: -

Table 1.2: Applicable Legislation and environmental policies.

TITLE OF LEGISLATION, POLICY OR GUIDELINE:	ADMINISTERING AUTHORITY:	DATE:
The Constitution of South Africa (Act No. 108 of 1996)	Department of Justice	1996
Local Government Municipal Systems (Act 32 of 2000)	Kouga Local Municipality	2000
National Environmental Management Act (NEMA) (Act No. 7 of 1998)	Department of Environment, Forestry and Fisheries (DEFF) and/or the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT)	1998 and 2014 amendments
Environmental Impact Assessment (EIA) Regulations, 2014 (as amended in April 2017)	DEFF and/or DEDEAT	2014 and 2017 amendments

The National Environment Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004)	DEFF and/or DEDEAT	2004
Conservation of Agricultural Resources Act (43 of 1983) & Subdivision of Agricultural Land Act (No. 70 of 1970)	Department of Agriculture, Forestry and Fisheries (DAFF)	1983 and 1970
National Environmental Management: Waste Act (Act No. 59 of 2008)	DEFF and/or DEDEAT	2008
National Water Act (NWA) (Act No. 36 of 1998)	Department of Water and Sanitation (DWS)	1998
National Environmental Management: Integrated Coastal Management (ICM) Act (Act No. 24 of 2008)	Department of Environmental Affairs (DEA): Oceans and Coasts	2008
National Environmental Management: Air Quality Act (Act No. 39 of 2004, as amended)	DEFF and/or DEDEAT	2004
National Heritage Resources Act (Act No. 25 of 1999)	Eastern Cape Provincial Heritage Resources Authority (ECPHRA)	1999
Occupational Health and Safety Act (Act No. 85 of 1993)	Department of Labour (DoL)	1993
Hazardous Substances Act (HS, Act No. 15 of 1973)	Department of Health (DoH)	1973
National Road Traffic Act (Act No. 93 of 1996)	Department of Transport	1996
Eastern Cape Vision 2030 Provincial Development Plan (ECDP, 2014)	DEDEAT	2014
Provincial Nature and Environmental Conservation Ordinance (No. 19 of 1974)	DAFF	1974
National Development Plan 2030 (2013).	National Government	2013
The Sarah Baartman District Municipality Integrated Development Plan (IDP) 2018/19	Sarah Baartman District Municipality	2018
Kouga Local Municipality Draft Integrated Development Plan 2017-2022	Kouga Local Municipality	2017
Kouga Municipality Spatial Development Framework (2015)	Kouga Local Municipality	2015
The South African Vegetation Map	South African National Biodiversity Institute (SANBI)	2018
The Subtropical Thicket Ecosystem Programme (STEP)	SANBI	2004
The Eastern Cape Biodiversity Conservation Plan (ECBCP)	SANBI	2007
The National Freshwater Ecosystem Priority Areas (NFEPA) project	SANBI and DWS	2011/2014

1.4. ENVIRONMENTAL AUTHORISATION

In accordance with the requirements of the National Environmental Management Act (NEMA, Act No. 107 of 1998) and relevant EIA regulations (2014 and subsequent 2017 amendments), the proposed St Francis Bay Coastal Protection Scheme was subjected to a Full Scoping and EIA Process.

In terms of the EIA process, all reports generated from the environmental studies form part of a series of documents for the project. The Environmental Impact Report (EIR) identified potentially significant environmental impacts and was the main report in the series. Additional Specialist Assessments serve to supplement the assessment contained in the EIR.

This EMPr interprets the findings of the EIR and prescribes project-specific specifications to be achieved. The EMPr is a progressive working document which will be updated based on the relevant conditions stipulated in the Environmental Authorisation (EA). The EMPr will then be submitted to DEDEAT (along with the final approved technical/design layouts) for approval prior to the commencement of construction.

2. DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

EAP:	Mr Gregory Shaw
Company:	Coastal & Environmental Services (CES)
Physical Address:	67 African Street, Grahamstown, 6140
Telephone:	+27 (46) 622 2364
Website:	www.cesnet.co.za
Email:	g.shaw@cesnent.co.za

Consultant Name	E-mail	Position	Role on Project
Dr AM (Ted) Avis	t.avis@cesnet.co.za	Managing Director	Report Review
Mr Gregory Shaw	g.shaw@cesnent.co.za	Principal Environmental Consultant	Report Production
Ms Nicole Wienand	n.wienand@cesnet.co.za	Environmental Consultant	Report Production

Company Overview

CES is a South African based company, with its head office in Grahamstown, and offices in Cape Town, Port Elizabeth, East London and Johannesburg, South Africa, as well as a wholly owned subsidiary in Maputo, Mozambique (CES is registered as an Environmental Practitioner with the Mozambican authorities). Coastal and Environmental Services (Pty) Ltd was established in 1990, to service a then fledgling market in the field of Environmental Management and Impact Assessment. The Company has grown apace with the increased market demand for environmental and social advisory services, in South Africa and numerous other African countries. Our principal area of expertise is in assessing the impacts of project on the natural, social and economic environments through, among other instruments, the environmental impact assessment process, and in so doing contribute towards sustainable development. Our staff is currently comprised of a number of professional and support staff. All professional staff members are well qualified, and as many as 90% have advanced postgraduate qualifications, including PhD, MSc and MA degrees in the biological, social and environmental sciences. In addition, CES has well-developed working relationships with a number of other individual specialist and specialist consulting companies who provide us with expertise in various disciplines. We have a demonstrated ability to manage EIAs for large and complex projects. This experience was initially gained during the undertaking of integrated environmental management studies, as well as the management of large and complex environmental and social impact assessments. CES has managed numerous large EIAs from prefeasibility through to operation for international clients in six southern African countries. These have been rigorously reviewed by parties such as the World Bank, MIGA, European Investment Bank, IFC, German Investment Bank (KFW), African Development Bank, BHP Billiton international peer review team and the Dutch Development Bank (FMO).

Mr Gregory Shaw (*Role: Project Manager*)
Gregory is a Principal Environmental Consultant and Business Development Manager. Greg has 12 years' experience in conducting environmental consultancy services in the energy, transport, maritime and agricultural sectors on behalf of South African and oversees government departments and agencies, local government authorities, private developers, international funding organisations, and non-government organisations. He has a strong track record of projects completed within budget, on time and in accordance with national and/or international environmental legislation and guidelines. Greg's skills include ESIA, environmental survey development, management, execution and monitoring, report writing, project management and strategic planning.

Ms Nicole Wienand (*Role: Report Production*)

Ms Nicole Wienand is an Environmental Consultant based in the Port Elizabeth branch. Nicole obtained her BSc Honours in Botany (Environmental Management) from Nelson Mandela University (NMU) in December 2018. She also holds a BSc Degree in Environmental Management (Cum Laude) with majors in Botany and Geology from NMU. Nicole's honours project focused on the composition of subtidal marine benthic communities on warm temperate reefs off the coast of Port Elizabeth, while her undergraduate project focused on the investigation of dune movement in Sardinia Bay. Nicole's key interests include Marine and Terrestrial Ecology, GIS Mapping, the general EIA process, Public Participation Process (PPP) and Ecological Impact Assessments.

Dr Ted Avis (*Role: Report Review*)

Ted Avis is a leading expert in the field of Environmental Impact Assessments, having project-managed numerous large-scale ESIAs to international standards (e.g. International Finance Corporation). Ted was principle consultant to Corridor Sands Limitada for the development of all environment aspects for the US$1billion Corridor Sands Project. He has managed ESIA studies and related environmental assessments of similar scope in Kenya, Madagascar, Egypt, Malawi, Zambia and South Africa. Ted has worked across Africa, and also has experience in large scale Strategic Environmental Assessments in southern Africa, and has been engaged by the International Finance Corporation (IFC) on a number of projects. Ted was instrumental in establishing the Environmental Science Department at Rhodes University whilst a Senior lecturer in Botany, based on his experience running honours modules in EIA practice and environmental. He is an Honorary Visiting Fellow in the Department of Environmental Sciences at Rhodes. He was one of the first certified Environmental Assessment Practitioner in South Africa, gaining certification in April 2004. He has delivered papers and published in the field of EIA, Strategic Environmental Assessment and Integrated Coastal Zone Management and has been a principal of CES since its inception in 1990, and Managing Director since 1998. Ted holds a PhD in Botany, and was awarded a bronze medal by the South African Association of Botanists for the best PhD adjudicated in that year, entitled "Coastal Dune Ecology and Management in the Eastern Cape". Ted is a Certified Environmental Assessment Practitioner (since 2002) and a professional member of the South African Council for Natural Scientific Professionals (since 1993).

3. DEFINITIONS

For the purposes of this EMPr, the following definitions and abbreviations shall apply:

Alien Vegetation: Alien vegetation is defined as undesirable plant growth which shall include, but not be limited to all declared category 1 and 2 listed invader species as set out in the Conservation of Agricultural Resources Act (CARA) regulations. Other vegetation deemed to be alien shall be those plant species that show the potential to occupy in number, any area within the defined construction area and which are declared to be undesirable. This includes plant species identified as Alien and invasive species in the National environmental Management Biodiversity Act of 2004, Alien and Invasive Species Regulations, 2014.

Contaminated water: Means water contaminated by the contractor's activities such as with hazardous substances, hydrocarbons, paints, solvents and runoff from plant, workshop or personnel wash areas but excludes water containing cement/ concrete or silt.

Construction Camp: Construction camp (site camps) refers to all storage and stockpile sites, site offices, container sites, workshops and testing facilities and other areas required undertaking construction activities.

Environment: Environment means the surroundings within which humans exist and that could be made up of:

I. The land, water and atmosphere of the earth;
II. Micro-organisms, plant and animal life;

- Any part or combination of (i) and (ii) and the interrelationships among and between them; and
- The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental Aspect: An environmental aspect is any component of a contractor’s construction activity that is likely to interact with the environment and pose a potential risk thereto.

Environmental Authorisation (EA): A written statement from the relevant environmental authority, with or without conditions, that records its approval of a planned undertaking to construct the proposed infrastructure and the mitigating measures required to prevent or reduce the effects of environmental impacts during the project’s lifespan.

Environmental Control Officer (ECO): A suitably qualified and experienced person or entity appointed for the construction works, to perform the obligations specified in the EA.

Environmental Site Officer (ESO): An ESO is the site-based designated person responsible for implementing the environmental provisions of the construction contract and is appointed by the service provider that carries-out construction activities.

Environmental Impact: An impact or environmental impact is the change to the environment, whether desirable or undesirable, that will result from the effect of a construction activity. An impact may be the direct or indirect consequence of a construction activity.

Environmental Impact Assessment: The process of examining the environmental effects of a development. The assessment requires detailed/specialist studies of significant issues that have been identified during the scoping phase.

Environmental Management Programme (EMPr): An environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented; and that the positive benefits of the projects are enhanced.

Environmental Management System (EMS): A system enables companies, organizations and operations to systematically manage, prevent and reduce their environmental impacts (or footprint) and associated costs. In terms of ISO 14001 an EMS is defined as, "*that part of the overall management system includes organizational structure, planning activities, responsibilities, procedures, processes and resources for developing, implementing, reviewing and maintaining the environmental policy.*"

Environmental Policy: A statement by the organisation of its intentions and principles in relation to its overall environmental performance which provides a framework for action and for the setting of its environmental objectives and targets.

External Auditor: A suitably qualified and experienced independent environmental auditor.

His: Means his or her, as applicable.

Interested and Affected Party (I&AP): Refers to an I&AP party contemplated in section 24(4)(d) of the National Environmental Management Act - NEMA (1998, Act No. 107) and which, in terms of that section, includes –

a) Any person, groups of persons, organisation interested in or affected by an activity, and;
b) Any organ of state that may have jurisdiction over any aspect of the activity.

Method Statement: Is a written submission by the construction contractor to the ECO in response to the EMPr specifications, or to any request by the ECO, setting out the methods the contractor proposes using to carry out an activity. The Method Statement shall be in such detail that the ECO is able to assess whether the contractor's proposal is in accordance with the EMPr specifications.

Mitigate: The implementation of practical measures to reduce the adverse impacts, or to enhance beneficial impacts of a particular action.

No-Go Area: Areas where construction activities are prohibited.

Pollution: According to the NEMA (Act No. 107 of 1998), pollution can be defined as, "*Any change in the environment caused by (i) substances; (ii) radioactive or other waves; or (iii) noise, odours, dust or heat emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future*".

Potentially hazardous substance: Is a substance that can have a deleterious effect on the environment. Hazardous chemical substances are defined in the Regulations for Hazardous Chemical Substances published in terms of the Occupational Health and Safety Act.

Reasonable: Means, unless the context indicates otherwise, reasonable in the opinion of the ECO, after he has consulted with relevant parties.

Rehabilitation: To re-establish or restore to a healthy, sustainable capacity or state.

Silt laden water: Means water containing sand and silt arising from the contractor's activities and/or as a result of natural run-off.

Site: The area in which construction is taking place.

Solid waste: Means all solid waste, including construction debris, chemical waste, excess cement/concrete, wrapping materials, timber, tins, cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Species of Conservation Concern (SCC): Species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild, Regionally Extinct, Near Threatened, Critically Rare, Rare and Declining.

Threatened species: Threatened species are defined as: a) species listed in the endangered or vulnerable categories in the revised South African Red Data Books or listed in the globally threatened category; b) species of special conservation concern (i.e. taxa described since the relevant South African Red Data Books, or whose conservation status has been highlighted subsequent to 1984); c) species which are included in other international lists; or d) species included in Appendix 1 or 2 of the Convention of International Trade in Endangered Species (CITES).

Topsoil: The top 100 mm of soil and may include top material e.g. vegetation and leaf litter.

4. PROPOSED ACTIVITY

4.1 PROJECT OVERVIEW

The St Francis Property Owners Non-Profit Company (SFPO NPC), on behalf of the Kouga Local Municipality (Kouga LM), has proposed the implementation of a coastal protection scheme for St Francis Bay beach, located within the Eastern Cape Province. The proposed project area is situated approximately 100 km west of Port Elizabeth, within the Kouga LM, seated within the Sarah Baartman District Municipality (SBDM) (Figure 4.1).

Figure 4.1: Location of the proposed project.

The coastal protection scheme will include the sourcing of sand material from the Kromme River (and any other viable sources), nourishment of St Francis Bay beach and the development of coastal structures to retard the erosion of the beach. CES has been appointed by the SFPO NPC to apply for an Environmental Authorisation (EA) by means of conducting a Scoping and EIA process.

4.2 PROJECT LOCATION

The proposed project will take place over coastal public property and within the confines of the Kromme River estuary. As a result, there are a limited number of defined farm, erf or property portions assigned to this project (Table 4.1). The proposed beach nourishment will take place over land defined by the Chief Surveyor-General as “Parks.” The areas where sand will potentially be sourced for the beach nourishment are likely to be located within or adjacent to the Kromme River estuary and the land fall under “Humansdorp Administrative Area 5.”

Table 4.1: Properties Associated with the Proposed Project (as defined by the Chief Surveyor-General).

Description of affected farm portion			
Property Name and Number	21-digit SG Code	Ward	Municipality/ Province
A portion of Humansdorp Administrative Region 5	C034	12	Kouga Local Municipality
Parks 720 1076655	C03400140000072000000	12	Kouga Local Municipality
Parks 1343 1073783	C03400140000134300000	12	Kouga Local Municipality
Parks 623 1073698	C03400140000062300000	12	Kouga Local Municipality
Parks 2257 1073784	C03400140000225700000	12	Kouga Local Municipality
Parks 185 1073697	C03400140000018500000	12	Kouga Local Municipality
Parks 53 1077075	C03400140000005300000	12	Kouga Local Municipality
Parks 184 1073696	C03400140000018400000	12	Kouga Local Municipality
Parks 625 1076606	C03400140000062500000	12	Kouga Local Municipality

4.3 PROJECT DESCRIPTION AND SCOPE

As a result of significant erosion events occurring over the past few decades the St Francis Bay beach has lost a considerable amount of sand material, and the existing dune area across the frontage. This has resulted in existing infrastructure becoming more vulnerable to loss and damage, should more significant erosion events take place.

The erosion has led to a reduction in the width of the beach. The width of beach is not only important from a recreational and tourism amenity point of view but offers significant coast protection by reducing the wave energy. A reduction in wave energy reduces the ability for sediment to be moved and therefore reduces the severity of erosion. The effects of the erosion of the beach (in both width and depth of sediment) has been realised across the full frontage, stretching from the car park at the end of Nevil Rd in the south to the Kromme Estuary mouth in the north.

Approximately 700 m of the frontage, referred to as “the spit” is particularly vulnerable. The erosion has been significant and dramatic such that over the 42-year period between 1975 and 2017, the high water mark has retreated by 75 metres. As a result, the beach has effectively been lost, and erosion of the vegetated sand spit is occurring. In 2020 the spit breached 4 times during particularly high tides and storm swell. This caused damage to infrastructure it continues to pose a risk for as long as the spit remains “unprotected”.

Consequently, various interventions including a beach nourishment scheme, revetment construction and the construction of groynes is required to arrest the rapid erosion of the beach, and ultimately restore it to its pre-erosion status, or at least to a condition that affords protection from storm attack, sea level rise and erosion events associated with these natural perturbations.

Sand Sourcing (supported by the Sand Sourcing Specialist Study)

In order for beach nourishment to be implemented, sand must first be obtained from a suitable source area. The identification of a suitable source area was based largely on finding an area where sand will consist of similar grain size to that which is required on the beach as well as being feasible to extract and place along the beach. Three potential source areas were initially identified and all were located within the Kromme River estuarine functional zone. However, as the investigations into possible sources progressed and considering feedback through the public engagement, more discreet areas were identified and classified as priority and secondary areas.

The comparisons showed that overall the particle sizes of the sediment in the estuary are slightly finer than along the beach. There are many samples (mainly in the 2018 data collection) that have median particle sizes less than 0.3 mm, of which there are none in the set of beach samples. However, there is significant overlap of the particle size envelopes from the estuary and beach, particularly between the data collected in 2019. The 2019 estuary samples have median particle sizes (0.31 mm to 0.35 mm) that are compatible with the median particle sizes of the beach (0.3 mm to 0.38 mm). Also, the compatibility at the finer and coarser ends of the envelopes is good.

Given the similarity of the particle size envelopes from the intertidal areas on the south side of the Kromme Estuary and the beach of St Francis Bay, it is concluded that the source (intertidal estuary) and receiver (beach) sites are compatible with respect to particle size distribution. The similarity of particle size distributions between the upper, middle and lower intertidal parts of the estuary indicates that, based on particle size alone, there is no preferred location for extraction of sediment. Also, it is likely that sediments in the subtidal channel, which were not sampled, would be coarser than the adjacent intertidal areas (due to higher current velocities), and so also compatible with the beach.

The proposed coastal protection scheme does not intend to remove all of the features (sand banks) of the estuary, but to rather harvest as much sand material as possible while being cognizant of the ecological and social importance of those features (Figure 4.2). The total sand that can be extracted, based on depths of 1 m in priority areas and 2m in secondary areas, equates to 1 074 000 m^3 (Table 4.2). According to the engineers appointed for the development of the proposed coastal protection scheme, the required volume of sand for capital nourishment is approximately 854 000 m^3. Additional sand may be required to account for losses during the nourishment process (e.g. dredging and pumping losses).

Table 4.2 Potential sand available from each source area (assuming 1m deep excavations from the channel and 2m deep excavations from the intertidal areas). See Figure 4.2 for locations.

Priority / Secondary Area	Label	Area (m^2)	Depth (m)	Volume (m^3)
Priority Area	P1	167 000	1	167 000
Secondary Area	S1	108 000	2	216 000
			Subtotal	***383 000***
Priority Area	P2	296 000	1	296 000
Secondary Area	S2	19 000	2	38 000
	S3	20 000	2	40 000
			Subtotal	***374 000***
Priority Area	P3	57 000	1	57 000
	P4	42 000	1	42 000
Secondary Area	S4	35 000	2	70 000
	S5	74 000	2	148 000
			Subtotal	***317 000***
			Priority Areas	562 000
			Secondary Areas	512 000
			GRAND TOTAL	1 074 000

Advisian advised that the current loss of sand material from the beach is 50 000 m^3 to 100 000 m^3 per annum, but that the loss after full implementation of the preferred solution can be expected to be in the order of 25 000 m^3 to 50 000 m^3 per annum. The analysis of the data collected for the preliminary design suggests that much of the material being transported by longshore drift (South to North) finds its way into the estuary under natural conditions. Given that the design will be such to facilitate the current longshore sediment transport, it is anticipated that the majority of the 25 000 m^3 to 50 000 m^3 "lost" from the nourishment will be deposited into the estuary providing suitable material for the maintenance requirements. The volume of sand required for maintenance will differ as the project progresses through the various phases, but will be limited to a maximum of approximately 25 000 m^3 to 50 000 m^3 per annum (Table 4.4).

Beach Nourishment

The option to artificially nourish the beach with sand from suitable borrow sources has been identified as the least environmentally intrusive method to protect the St Francis Bay coastline from further erosion. The aim of the beach nourishment will be to establish a minimum horizontal dry beach width of 40 m measured from the back of the beach. This additional sand will provide added protection from erosion as waves will dissipate their energy over this re-established sand beach before reaching the existing eroding area. Long term maintenance will be required to maintain the required beach level.

Revetment Structures

To prevent further sea breaching through the St Francis Bay beach spit during a strong storm surge event, revetment structures have been implemented by Kouga Municipality along the length of the beach spit as a temporary coastal protection to prevent further erosion of the spit. These temporary revetment needs to be integrated within the long-term coastal protection scheme consisting of stub groynes and beach nourishment. The state of the temporary revetment at the time of implementation needs to be reviewed so its suitability and long-term functionality can be assessed as the revetment would form an integral part of the long-term coastal protection infrastructure and would be the last defence against wave action, should the proposed re-nourished beach not be sufficient.

Stub Groynes

In order to retain the sand in the nearshore and beach area following the implementation of beach nourishment, and to promote increased sedimentation in the future, six (6) stub groynes will be constructed along the length of the beach. These stub groynes will extend from the back end of the beach and reach a length of between 170m and 200m offshore (Figure 4.3). The stub groynes will be angled perpendicular to the shoreline (except groyne 5 which is oblique), and will be shorter than full length groynes which are generally used for erosion prevention. The shorter (stub) groynes will allow a certain percentage of sediment (expected to be approximately 50% of the long shore drift) to pass between each groyne. This is to facilitate sand movement through the longshore drift process since it is not the intention of the project to trap all sediment moving along the coastline. Maintaining this sand movement along the coast is also anticipated to mitigate for the potential of accelerated erosion “downstream” of the groynes, particularly of the northern most groyne. In addition to the natural movement of sediment, nourishment of the shoreline in the lee of the northern most groyne will be included as part of the project. The volume of sediment will be monitored and re-nourishment will be carried out and form part of the annual maintenance regime.

A maximum of approximately 44 300 m^3 of rock material will be required for the proposed stub groynes. The rock material used for the groynes will be sourced from a licenced local quarry, the details of which will be subject to availability and grading of rock material, and will become known during the implementation stage of each phase of the project.

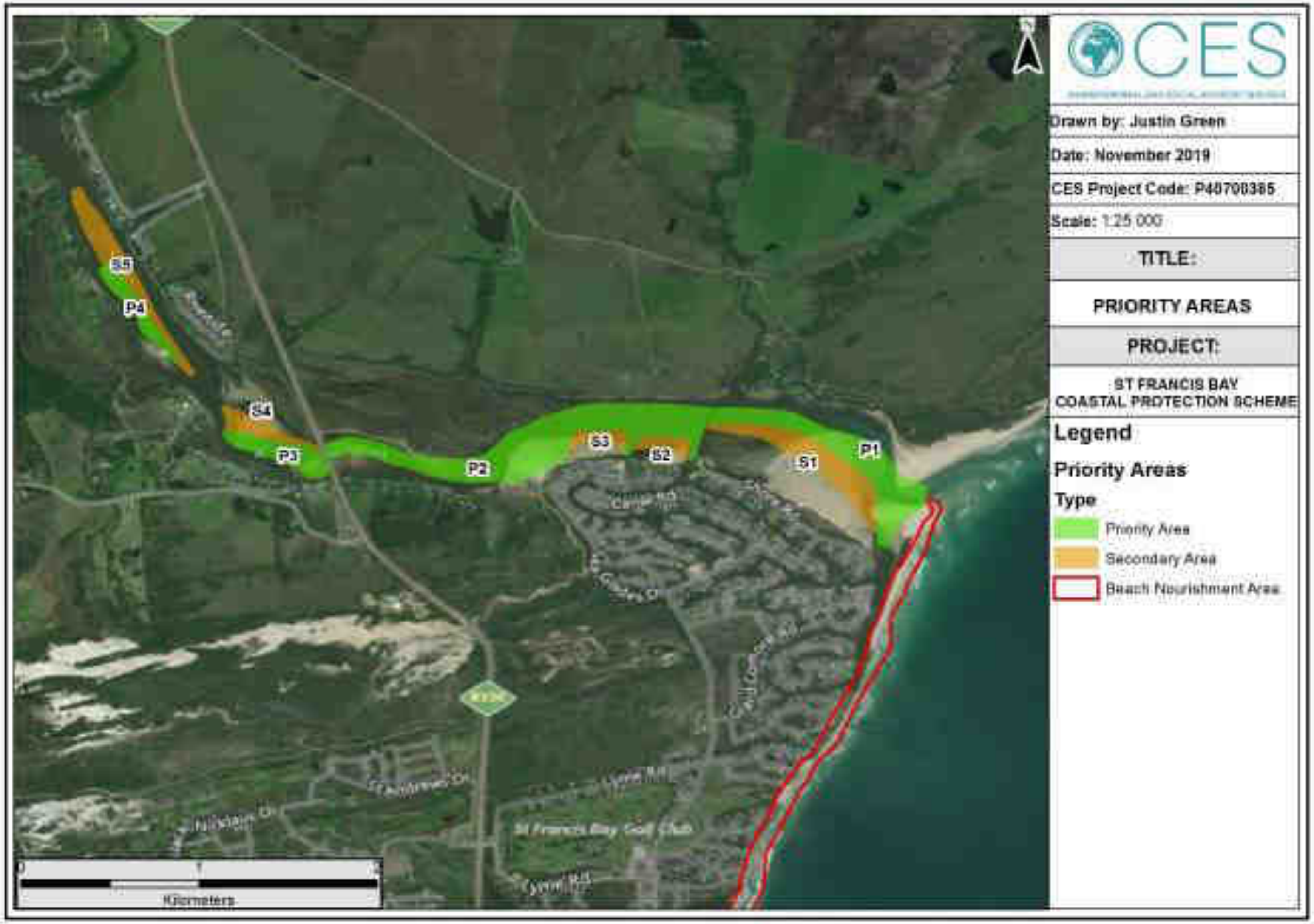

Figure 4.2: Potential areas to be used to source sand material.

A phased implementation of the abovementioned coastal beach protection infrastructure is likely to be required due to financial constraints. Should funding for the full scheme be available at the time of construction then the full scheme will be developed. However, the design of the scheme is such that each phase can be regarded as a standalone project, allowing for funding for additional phases to be sourced prior to their construction.

The advantage associated with a phased approach is that the performance of the first groyne(s) can be assessed, and any desired adjustments can be made to groynes constructed in the subsequent phases. The phased implementation is based on five (5) areas along St Francis Bay beach (Figure 4.3). Area 1 will consist of a 650 m length of beach which will undergo beach nourishment as well as the construction of two (2) 200 m long groyne, one at each end. The long shore drift is northwards, and it is therefore sensible to construct the northernmost groynes first to intercept the transported sand (Figure 4.3). Area 2 will consist of 470 m of beach with one (1) groyne at 170 m and Area 3 a 340 m length of beach with two (2) groynes of 170 m in length. Areas 4 and 5 are flanked by groynes constructed during previous phases and are 280 m and 390 m long respectively. This phased approach will ensure that construction of infrastructure in any phase will only commence when sufficient funding for that particular phase has been secured, thus negating the risk of partially constructed infrastructure.

In order to widen the beach by 40 m with the use of beach nourishment only, a total of between 850 000 to 1,2 million m^3 of sand material would be required (depending on the losses and the state of the beaches at the time of nourishment). Table 4.3 presents the volume of material required for each stage.

Table 4.3 Total initial nourishment requirements of each phase of the coastal protection scheme.

Nourishment Phase	Estimated Initial Sand Volume Required (m^3)
Phase 1	259 000 - 361 000
Phase 2	166 000 -247 000
Phase 3	167 000 - 205 000
Phase 4	78 000 - 134 000
Phase 5	182 000 - 235 000

The operational phase material is considered a top up of the construction material and dependent on the erosion of material from the beach. The volume of sand required for maintenance will differ as the project progresses through the various phases, but will be limited to a maximum of approximately 25 000 m^3 to 50 000 m^3 per annum (Table 4.4). This material is anticipated to be available from the Kromme Estuary.

Table 4.4: Anticipated annual maintenance requirements at the completion of each phase of the coastal protection scheme.

Nourishment Phase	Cumulative maintenance requirement	
	From	To
Annual Maintenance at Completion of Phase 1	8 000	16 000
Annual Maintenance at Completion of Phase 2	13 250	26 550
Annual Maintenance at Completion of Phase 3	17 550	35 200
Annual Maintenance at Completion of Phase 4	20 350	40 850
Annual Maintenance at Completion of Phase 5	24 950	50 050

As detailed below, similar equipment and construction methodologies are anticipated for both construction and operational phases with the scale of the activity being reduced during the "operational" phase.

Construction methodology

In this section potential methodologies are described for the construction of the groynes, beach nourishment and revetment construction. Specific construction methods employed will be finalised through the procurement of a contractor for each phase of the project. The potential methodologies described below include sourcing of material, transporting, stockpiling and the incorporation thereof into the Works.

Similarly, potential methodologies to be employed during maintenance of the infrastructure is described.

Construction stage

The following activities are envisaged during the construction stage.

Groyne construction

Rock for the construction of groynes will be obtained from nearby commercial quarries. The rock will be transported by truck via the R330 provincial road to St Francis Bay and then along the internal road network through St Francis Bay to a potential stockpile area or to access points onto the beach at George Road Parking Area and/or a temporary access point at Aldabara Road Parking Area. The rock will be further transported along the beach to the groyne positions where it will be placed by way of back-tipping and placing the material by excavators, where needed.

This activity will most probably be affected by tides and is expected to be limited to approximately 6 to 8 hours per day. The rate of construction is expected to be in the order of 240 m^3/day. Depending on the size of the trucks approximately 30 - 40 truckloads per day will be required and depending on the haul distance it is envisaged that approximately 10 trucks will be used. The expected duration of this part of the work is:

- For Phase 1: 3 Months
- For Phase 2: 2 Months
- For Phase 3: 3 Months
- For Phase 5: 2 Months
- Should the complete solution be implemented without phasing (highly unlikely): 8 Months

Beach nourishment

Sand will be sourced from the Kromme River Estuary by way of dredging. To ensure that dredging of the estuary is undertaken in a manner which does not significantly alter the current orientation of the existing main estuarine channel, the dredging will have to be undertaken from the existing channel outwards.

A dredger or dredgers with a combined capability to deliver between 250 - 300 m^3 sand per hour will be required. There are various types of dredger available (i.e. cutter suction, jet suction, bucket) that would be suitable for this type of work. The depth of the water will limit the size of the vessels since the vessels will require a shallow draft. While a suitable dredger will be decided upon by a contractor it is likely the dimensions of the dredger will be in the region of 21 m long, 4.8m wide and 1.4 m of hull. It may or may not be self-propelled and likely to have spud legs to secure it.

It is expected that in-line booster pumps will be employed when sand is transported over long distances. The discharge pipes are expected to range between 250 mm to 350 mm in diameter. Depending on the nature of the pumps it is likely that the pumps would occur at intervals of 1 000 m. The sand will be dredged through pipelines along the channel attached to buoys or in places it may be placed on sandbanks.

The noise level associated with the dredging and nourishment activity is expected to be approx. 80 dB at source. Depending on the size of the booster pumps, noise levels are expected to be 92 dB at source, reducing down to 60 dB at 500 m (ICF Jones and Stokes, 2008). To provide context normal conversation is about 60 dB, a lawn mower is about 90 dB, and a loud concert is about 120 dB.

Dredged sand may be spread along the beach using equipment such as a dozer.

Assuming that dredging for the construction phase will take place 8 hours per day, 5 days per week, the expected duration of this part of the work is:

- For Phase 1: 8 Months
- For Phase 2: 5 Months
- For Phase 3: 4 Months
- For Phase 4: 3 Months
- For Phase 5: 5 Months
- Should the complete solution be implemented without phasing (highly unlikely): 16 Months.

It may be that it becomes feasible to transport sand by truck from the upper reaches of the source area identified in the Sand Sourcing Specialist Study. In such a case it is envisaged that the sand will be dredged to a suitable point, where it will be loaded by a loader or TLB onto trucks. The trucks will then transport the sand along the internal road network of St Francis Bay onto the beach. This option is not really envisaged, and if it is employed, it is expected to be relatively limited.

It is envisaged that limited clearing of vegetation, as well as separation of vegetation and debris from the sand will be required at the mouth of the Sand River, and that this vegetation and debris will have to be spoiled at an approved spoil site. Such clearance will be done using mechanical equipment such as excavators or TLB's, and the material will have to be loaded onto trucks and transported off-site. It is foreseen that this will be a limited operation.

Revetment construction:

This activity will pertain to the revetment for the spit area. This revetment may be a rock revetment, a geotextile sand container revetment or a composite revetment (rock / geotextile sand container revetment).

Rock for the construction of a rock revetment will be obtained from nearby commercial quarries. The rock will be transported by truck via the R330 provincial road to St Francis Bay and then along the internal road network through St Francis Bay to a potential stockpile area or to an access point onto the beach at George Road Parking Area or via a temporary access point at Aldabara Road Parking Area. The rocks will be further transported along the beach to the position where it will be placed against the spit sand dune.

The activity may be affected by tides and is expected to be limited to approximately 6 to 8 hours per day. The rate of construction is expected to be in the order of 65 m^3/day. Depending on the size of the trucks approximately 11 truckloads per day will be required and it is envisaged that approximately 3 trucks will be used. The expected duration of this part of the work is 3 months.

Sand for a geotextile sand container revetment will be taken from the beach or be dredged from the canal system, and this activity can take place 8 hours per day. A fairly small dredger can be employed to fill the geotextile containers should sand from the canals be used.

Storage of plant and equipment:

A suitable open area on disturbed land, available at the time of construction of any phase, should be identified prior to tender stage for the Contractor's camp. This area must be sufficient and suitable to house overnight the contractor's plant, such as trucks, loaders, TLB's and the like.

If the dozer used to spread the sand on the beach is stored on the beach overnight, then such storage area must be safely barricaded or fenced to ensure safety of the public.

Stockpiling of material:

It may be that it would be necessary to stockpile rock, should the quarry supplying the rock blast a specific rock size required for the project and removal thereof be required because of limited storage at the quarry. In such a case a suitable open area on disturbed land, available at the time of construction of any phase, should be identified prior to tender stage for such temporary stockpiling of rock. The area should be fenced off and access controlled to ensure public safety.

Maintenance:

Annual maintenance of the infrastructure will be required. This will mainly entail sand nourishment necessary to ensure that the beach width and level remain stable. It will be a dredging operation, using sand obtained from the Kromme Estuary and the canal system. It will not be a continuous operation, but will be performed from time to time, influenced by the requirement for sand on the beach. The point of sand sourcing will change, depending on where dredging is required to ensure navigability of the estuary and canal system. It may be necessary to use mechanical equipment from time to time to spread the placed sand along the beach.

Ad hoc maintenance of the groynes and revetment may also be required over the design life of the infrastructure, but this is not expected to happen at regular intervals.

Assuming that dredging for the operational phase will take place 8 hours per day, 5 days per week, the expected duration of this part of the work is:

- At completion of Phase 1: Between 2 and 4 weeks
- At completion of Phase 2: Between 3 and 5 weeks
- At completion of Phase 3: Between 4 and 7 weeks
- At completion of Phase 4: Between 4 and 8 weeks
- At completion of Phase 5: Between 5 and 10 weeks

Dredging for maintenance purposes will take place from areas in the river and canals where build-up of sand has taken place, and dredging in any particular area in the river and canals will probably be limited to a period of less than two weeks.

Figure 4.3: Proposed layout for the stub groynes

5. LAYOUT OF THE EMPR

In order to ensure a holistic approach to the management of environmental impacts, during the planning and design, construction and operational phases of the proposed St Francis Bay Costal Protection Scheme, this EMPr sets out the methods by which proper environmental controls are to be implemented by the Contractor and all other parties involved. The St Francis Bay Coastal Protection Scheme will not be decommissioned in the foreseeable future, and thus the decommissioning phase for this development is not discussed further. Each remaining phase of development is discussed in more detail below and has specific issues unique to that phase.

5.1 DESIGN PHASE EMPR

The Design Phase EMPr is an integral component of the project life cycle and requires interaction between the design engineers and environmental consultants to ensure that the engineers are aware of the environmental constraints that must be considered and incorporated into the final design of the project. The format of this design EMPr is checklist in nature to ensure that all specifications are included in the design phase. The design EMPr phase requires ongoing and in-depth discussions between the final design team and the Environmental Control Officer (ECO). The engineer will have to cost for, and be available for, ongoing discussions with the environmental officer at all stages of final design. While the majority of the work is undertaken at a desktop level and thus physical impacts are negligible this is an important stage of the project. During this phase the specific methodology for both the construction and operational (maintenance) phases of the project will be consolidated and clarified. This will depend on the funding available which will, in turn, determine the phases of the scheme to be implemented. Linked to the clarification of the construction and maintenance methodology will be the development of specific management and monitoring plans, which will be expected to be produced and reviewed by the competent authority prior to construction commencing.

5.2 CONSTRUCTION PHASE EMPR

The Construction Phase EMPr details the environmental management system/framework within which construction activities will be governed for the Construction Phase. The Construction EMPr consists of various actions, initiatives and systems that the contractor will have to ensure are in place and are undertaken. The Construction EMPr consists of both a management system and environmental specifications which contain detailed specifications that will need to be undertaken or adhered to by the appointed contractor. The Construction EMPr will need to be developed following the Final Design Stages. It is likely that the construction EMPr will be finalised with constructive input from the appointed contractor. Sound environmental management is orientated around a pragmatic, unambiguous but enforceable set of guidelines and specifications, and for this reason it is imperative that the contractor, while being bound by the EMPr, fully understands it and has had input into its final development. For this reason, the final Construction EMPr will need to be signed off after input from the selected contractor prior to the initiation of construction activities.

As mentioned above it is important to consider the timing and phasing of this scheme. It is likely that the scheme will be implemented in phases and therefore, it should be considered that each project phase will have a discreet construction and operation activities. The operation phase of the project phases (i.e. Phase 1 to 5) may overlap with the construction of a subsequent project phase. For example: Phase 1 may be in operation for a number of years before Phase 2 is constructed.

5.3 OPERATIONAL PHASE EMPR

The Operational Phase EMPr provides specific guidance related to operational activities associated with a particular development. Operational EMPr's are sometimes referred to as Environmental Management Systems (EMS). Impacts during the operational phase of a development of this nature will be few in number and low in intensity. By taking pro-active measures during the construction phase, potential environmental impacts emanating during the operational phase will be minimised. Monitoring of certain issues such as the success of vegetation re-establishment and erosion control will be required to continue during operation. As mentioned above it is likely that the monitoring for Phase 1 of the scheme may coincide with subsequent construction phases.

The information gathered as part of the monitoring may be used to inform subsequent Project Phases with the final Operational Phase EMPr developed in conjunction with any other relevant stakeholders prior to the adoption thereof.

6. MITIGATION AND/OR MANAGEMENT MEASURES

6.1 GENERAL CONSTRUCTION PHASE MITIGATION AND MANAGEMENT MEASURES

In addition to the mitigation and management measures which are stipulated in the EIR and included in Section 6.2 of this report, the following general Construction Phase mitigation and management measures apply.

The contractor/s are likely to establish construction camps within a specified and appropriate location within St Francis Bay according to their requirements. However, due to the nature of the work, much of the construction activity will take place in public areas which cannot be secured in a manner similar to that of a construction camp. Therefore, it is important that the contractor establishes suitable and appropriate method statements for managing their activities outside of what could be considered "secure" areas.

Table 6.1: General construction phase mitigation and/or management measures.

GENERAL CONSTRUCTION PHASE		
Activity		Mitigation and/or Management Measures
1	Demarcation	The location, layout and method of establishment of the construction camp, including the following, must be clearly indicated and demarcated prior to the commencement of construction: ➢ All Contractors' offices; ➢ Lay down areas; ➢ Vehicle wash areas (if any); ➢ Workshops and drip trays; ➢ Fuel storage areas (including filling and dispensing from storage tanks); ➢ Planned working areas; ➢ Cement/concrete mixing areas (including the methods employed for the mixing of concrete and particularly the containment of runoff water from such areas and the method of transportation of concrete); and ➢ Other infrastructure required for the running of the project.
		➢ The Contractor must erect and maintain permanent and/or temporary fences in the locations directed by the ECO. Such fences should, if so specified, be erected before undertaking designated activities; and ➢ Should "no-go" areas exist on the site, the Contractor must ensure that, insofar as he/she has the authority, no person, machinery, equipment or materials enter the "no-go" areas at any time.
2	Site Access	Details, including a drawing, showing where and how the access points and routes will be located and managed must be submitted to the ECO and the Applicant. These should be supported by the following management requirements: ➢ On the site and within such distance of the site as may be stated, the Contractor should control the movement of all vehicles, including vehicles of suppliers so that they remain on designated routes, are distributed so as not to cause an undue concentration of traffic and that all relevant laws are complied with. In addition, such vehicles should be routed and operated in a manner that minimises the disruption to regular users of the routes; ➢ On gravel or earth roads on site and within 500 m of the site, the Contractor's vehicles as well as the suppliers' must not exceed a speed of 45 km/h or as directed by the ECO; and ➢ The Contractor must supply the ECO with a Method Statement detailing the location and management of all access points and roads.
3	Materials Handling, Use & Storage	➢ The Contractor must ensure that any delivery drivers are informed of all procedures and restrictions (including identified "no-go" areas) required to comply with this EMPr; ➢ The Contractor must ensure that these delivery drivers are supervised during offloading, by someone with an adequate understanding of the requirements of the EMPr; ➢ Materials must be appropriately secured to ensure safe passage between destinations. Loads including, but not limited to, sand, stone chip, fine vegetation, refuse, paper and cement, should have appropriate cover to prevent them spilling from the vehicle during transit; ➢ The Contractor will be responsible for any clean up resulting from the failure by his/her employees or suppliers to properly secure transported materials;

		➢ All manufactured and/or imported material should be stored within the Contractor's camp, and, if required by the EMPr, out of the rain; ➢ All laydown areas outside of the construction camp will be subject to the ECO's approval; and ➢ Imported gravel, fill, soil and sand materials should be free of weeds, alien invasive seed matter, plant material, litter and contaminants and must be obtained from sources approved by the ECO.
4	Stockpiling	➢ Any stockpiling of sand, gravel, cut, fill or any other material including spoil must only be in areas that have been approved by the ECO within the defined working area; ➢ The Contractor should ensure that the material does not blow or wash away. If the stockpiled material is in danger of being washed or blown away, the Contractor should cover it with a suitable material, such as hessian or plastic. Stockpiles of topsoil must not be covered with plastic; and ➢ No stockpiling of any material will be allowed within 20 m of any “no-go” areas (if applicable).
5	Solid Waste Management	➢ Onsite burning, burying or dumping of any waste materials, litter or refuse must not occur; ➢ The Contractor should provide vermin and weatherproof bins with lids of sufficient number and capacity to store the solid waste produced on a daily basis. The lids must be kept firmly on the bins at all times; ➢ Bins must not be allowed to become overfull and should be emptied daily; ➢ The waste from bins may be temporarily stored onsite in a central waste area that is weatherproof and scavenger proof, and which the ECO has approved; ➢ Recyclable waste should be disposed of into separate skips/bins and removed offsite for recycling; ➢ All solid waste must be disposed of offsite at an approved registered landfill site. The Contractor must supply the ECO with the appropriate disposal certificates; and ➢ The Contractor must submit a solid waste management plan, as part of the Pollution Control Method Statement, to the ECO.
6	Water Use	➢ All sources of water for construction purposes must be approved by the ECO in writing before any such sources can be used to obtain water; and ➢ All wash water should be recycled for use as wash water again or for dust suppression, where applicable.
7	Hazardous substances	➢ The transportation and handling of hazardous substances must comply with the provisions of the Hazardous Substances Act (Act No.187 of 1993) and associated regulations as well as SABS 0228 and SABS 0229; ➢ The Contractor must also comply with all other applicable regional and local legislation and regulations with regard to the transport, use and disposal of hazardous substances. Hazardous chemical substances (as defined in the Regulations for Hazardous Chemical Substances) used during construction must be stored in secondary containers. The relevant Material Safety Data Sheets (MSDS) must be available onsite; ➢ Procedures detailed in the MSDSs must be followed in the event of an emergency situation; ➢ The Contractor will be responsible for the training and education of all personnel onsite who will be handling hazardous materials about their proper use, handling and disposal; and ➢ If potentially hazardous substances are to be stored or used onsite, the Contractor must submit a Method Statement to the ECO detailing the substances/materials to be used, together with the transport, storage, handling and disposal procedures for the substances.
8	Cement & Mixing of Concrete	➢ The proposed location of cement mixing areas (including the location of cement stores and sand and aggregate stockpiles) must be indicated on the site layout plan and approved by the ECO; ➢ All wastewater generated from the operation and cleaning of concrete mixing equipment and other sources of concrete should be passed through a concrete wastewater settlement system; ➢ The Contractor must ensure that minimal water is used for washing of concrete and cement mixing equipment; ➢ Used cement bags must be disposed of in weatherproof bins onsite to prevent the generation of wind-blown cement dust and the bags from blowing away; ➢ The Contractor must ensure that concrete is mixed on mortar boards, all visible remains of concrete are removed and disposed of as waste and that all surplus aggregate is removed; and ➢ As part of the Pollution Control and Concrete Mixing Method Statement, a plan detailing all actions to be taken to comply with the requirements must be submitted to the ECO.
9	Fuel and Oil	Fuel Storage ➢ All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms/bunds. Washing and cleaning of equipment should also be done in berms or bunds, in order to trap any contaminated material and prevent excessive soil erosion;

		➢ All necessary approvals with respect to fuel storage and dispensing must be obtained from the appropriate authorities. Symbolic safety signs depicting "No Smoking" and "Danger", conforming to the requirement of SABS 1186, must be prominently displayed in and around the fuel storage area. There must be adequate fire-fighting equipment at the fuel storage area; ➢ The Contractor must ensure that all liquid fuels and oils are stored in tanks with lids, which are kept firmly shut and under lock and key at all times. The capacity of the tank should be clearly displayed, and the product contained within the tank clearly identified using the emergency information system detailed in SABS 0232 part 1. Fuel storage tanks capacity must not exceed 9 000 litres and must be kept on site only for as long as fuel is needed for construction activities, on completion of which they must be removed; ➢ Tanks onsite should not be linked or joined via any pipe work, but should remain as separate entities. The tanks must be situated on a smooth impermeable base with a bund. The volume inside the bund should be 110% of the total capacity of the largest storage tank. The base may be constructed of concrete, or of plastic sheeting with impermeable joints with a layer of sand over to prevent perishing. The impermeable lining should extend to the crest of the bund. The floor of the bund should be sloped to enable any spilled fuel and/or fuel-contaminated water to be removed. Appropriate material, approved by the ECO that absorbs / breaks-down or encapsulates minor hydrocarbon spillage and which is effective in water should be installed in the sump; ➢ The tanks and bunded areas should be covered by a roofed structure, taken offsite to a disposal site approved by the ECO, and the material that absorbs / breaks-down or encapsulates minor hydrocarbon spillage should be replenished; ➢ Adequate precautions should be provided to prevent spillage during the filling of any tank and during the dispensing of the contents. The dispensing mechanism for the fuel storage tanks should be stored in a waterproof container when not in use; and ➢ As part of the required site layout for the construction camp, a plan must be submitted to the ECO detailing the design, location and construction of the fuel storage area as well as for the filling and dispensing from storage tanks and for the type of absorbing / breaking-down or encapsulating material to be used. <u>Refuelling</u> ➢ Where reasonably practical, the plant should be refuelled at a designated re-fuelling area/depot or at a workshop as applicable. If this is not reasonably practical, then the surface under the refuelling area must be protected and appropriately bunded against pollution to the reasonable satisfaction of the ECO prior to any refuelling activities; ➢ If fuel is dispensed from 200 litre drums, the proper dispensing equipment must be used, and the drum should not be tipped in order to dispense fuel. The Contractor should ensure that the appropriate fire-fighting equipment is present during refuelling operations; and ➢ The Contractor must ensure that there is always a supply of absorbent material readily available to absorb / breakdown or where possible, be designed to encapsulate minor hydrocarbon spillages. The quantities of such materials should be able to handle a minimum of 200 ℓ of hydrocarbon liquid spill. Prior to any refuelling or maintenance activities, the ECO must approve this material. <u>Used oil and hydrocarbon contaminated materials</u> ➢ Used oil should be stored at a central location onsite prior to removal offsite for disposal at an approved disposal or recycling site; and ➢ Old oil filters and oil, petrol and diesel-soaked material must be treated as hazardous waste. The Contractor should remove all oil, petrol, and diesel-soaked sand immediately and should dispose of it as hazardous waste or treat it onsite with material that breaks-down or encapsulates such spillages as approved by the ECO.
10	Workshop, Equipment Maintenance & Storage	➢ The Contractor should ensure that in his workshop and other plant maintenance facilities, including those areas where, after obtaining the ECO's approval, the Contractor carries out emergency plant maintenance, there is no contamination of the soil or vegetation. The workshop must have a smooth impermeable (concrete or thick plastic covered with sand) floor; ➢ The floor should be bunded and sloped towards an oil trap or sump to contain any spillages. When servicing equipment, drip trays should be used to collect the waste oil and other lubricants. Drip trays should also be provided in construction areas for stationary plant (such as compressors) and for "parked" plant (such as scrapers, loaders, vehicles);

		➢ All vehicles and equipment must be kept in good working order and serviced regularly. Leaking equipment must be repaired immediately or removed from the site; ➢ All vehicle and equipment washing must be undertaken in the workshop or maintenance areas, and these areas must be equipped with a suitable impermeable floor and sump/oil trap. The use of detergents for washing should be restricted to low phosphate and nitrate products and low sudsing-type detergents; and ➢ As part of the site layouts, a plan must be submitted to the ECO detailing the design of the bunding of the workshop and how run-off from the workshop will be managed as well as how drip trays used under plant will be managed.
11	Ablution facilities	➢ Washing, whether of a person or of personal effects, and acts of excretion and urination are strictly prohibited other than at the facilities provided. The Contractor must provide the necessary ablution facilities for all his/her personnel prior to the commencement of work; ➢ Ablution facilities must be supplied by the Contractor for the workers at a ratio of at least 1 toilet per 20 workers in areas approved by the ECO. Toilets should be situated within 200 m of any area where work is taking place in numbers sufficient to meet the ratio depicted above for the workers in the area; ➢ The facilities should be maintained in a hygienic state and serviced regularly. Toilet paper must be provided. Temporary/portable toilets should be secured to the ground to prevent them toppling due to wind or any other cause, to the satisfaction of the ECO; and ➢ Discharge into the environment and burial of waste is strictly prohibited. The Contractor must ensure that no spillage occurs when the toilets are cleaned or emptied and that the contents are removed from the site. Toilets must be emptied before any temporary site closure.
12	Eating Areas	➢ The Contractor should designate eating area(s), subject to the approval of the ECO. No cooking is allowed outside of the Contractor's camp area onsite; ➢ At meal times, all workers must eat in designated eating areas. These areas should have shade for the workers; ➢ Sufficient bins must be present in these areas. All disposable food packaging must be disposed of in the bins after every meal; and ➢ The feeding- or leaving of food for animals is strictly prohibited.
13	Site Structures	➢ All site establishment components (as well as equipment) should be positioned to limit visual intrusion on neighbouring areas and the size of the land area disturbed. The type and colour of roofing and cladding materials of the Contractor's temporary structures should be selected to reduce reflection; and ➢ The Contractor should supply and maintain adequate and suitable sheds for the storage of materials. Sheds for the storage of materials that may deteriorate or corrode if exposed to the weather should be weatherproof, adequately ventilated and provided with raised floors.
14	Lighting	➢ The Contractor should ensure that any lighting installed on the site for his/her activities does not cause a reasonably avoidable disturbance to neighbouring residents or the naturally-occurring fauna.
15	Noise	➢ The Contractor should take precautions to minimise noise generated on site (e.g. install and maintain silencers on machinery); ➢ The Contractor must comply with the Noise Induced Hearing Loss Regulations published under the Occupational Health and Safety Act; ➢ Appropriate directional and intensity settings are to be maintained on all hooters and sirens; ➢ Work should be limited to daylight hours – between 06:00 and 18:00; and ➢ No amplified music must be allowed on site. The Contractor must not use sound amplification equipment on site unless in emergency situations.
16	Dust Control	➢ The Contractor will be responsible for the continued control of dust arising from his/her operations. The Contractor must take all reasonable measures to minimize the generation of dust as a result of construction activities to the satisfaction of the ECO. Appropriate dust suppression measures include spraying or dampening with water, using a commercial dust binder (such as Hydropam or Dustex), rotovating straw bales, planting of open cleared space and the scheduling of dust-generating activities. If the conditions are such that the Contractor cannot satisfactorily dampen the dust, then the ECO may halt operations until such time as the conditions are more suitable for lower dust generating construction activities; ➢ Areas that are to have the topsoil stripped for construction purposes must be limited and only stripped when work is about to take place;

		➢ Other activities and situations that may result in a dust nuisance include site clearance and other earth moving operations, open cleared space, stockpiles of topsoil or sand and activities associated with concrete mixing; and ➢ The appropriate health and safety equipment (e.g. dust masks) should be worn by workers during the phases of dust-producing construction activity.
17	Environmental Awareness Training	➢ Environmental awareness training courses should be run for all personnel onsite (See Annexure 2 for a proposed Basic Environmental Education Course). Two courses should be run, one for the Contractor's and Subcontractor's management and one for all site staff and labourers. Courses should be run in the morning during normal working hours at a suitable venue provided by the Contractor. All attendees should remain for the duration of the course and sign an attendance register on completion, that clearly indicates participant's names, a copy of which must be handed to the ECO; ➢ The size of each session should be limited to a maximum of 30 people. The Contractor should allow for sufficient sessions to train all personnel. Subsequent sessions should be run for any new personnel coming onto site. A Method Statement with respect to the organisation of these courses should be submitted; and ➢ Notwithstanding the specific provisions of this clause it is incumbent upon the Contractor to convey the sentiments of the EMPr to all personnel and Subcontractors involved with the Works.
18	Fire Control	➢ The Contractor must take all the necessary precautions to ensure that fires are not started as a result of site activities; ➢ No open fires must be permitted on the site; ➢ Smoking must not be permitted in areas where there is a fire hazard. Such areas include the workshop and fuel storage areas and any areas where the vegetation or other material is such as to support the rapid spreading of an initial flame; ➢ The Contractor should appoint a Fire Officer who will be responsible for ensuring immediate and appropriate actions in the event of a fire and will ensure that employees are aware of the procedures to be followed. The Contractor must forward the name of the Fire Officer to the ECO for approval within 7 days of being on site; ➢ The Contractor must ensure that there is basic firefighting equipment available onsite at all times. This should include at least rubber beaters when working in urban open spaces and natural areas, and at least one fire extinguisher of the appropriate type when welding or other "hot" activities are undertaken; and ➢ The Contractor will be liable for any expenses incurred by any organisations called to assist with fighting fires that were started as a result of his/her activities or personnel, and for any cost relating to the rehabilitation of burnt areas, or consequential damages.
19	Emergency Procedures	➢ Emergency procedures, including the names and contact details of responsible personnel and emergency services must be made available to all staff and should be clearly displayed at relevant locations at the site. The Contractor should advise the ECO of any emergencies onsite, together with a record of action taken, within 24 hours of the emergency occurring; and ➢ The Contractor must submit a Method Statement covering the procedures for the following emergencies: Fire ➢ The Contractor should advise the relevant authority of a fire as soon as one starts and must not wait until it is out of control; and ➢ The Contractor must ensure that all employees are aware of the procedures to be followed in the event of a fire. Accidental leaks and spillages ➢ The Contractor must ensure that all employees are aware of the procedures to be followed for dealing with spills and leaks, which must include notifying the ECO and the relevant authorities. The Contractor must ensure that all the necessary materials and equipment for dealing with spills and leaks are available onsite at all times. Treatment and remediation of the spill areas must be undertaken to the reasonable satisfaction of the ECO; ➢ In the event of a hydrocarbon spill, the source of the spillage must be isolated, and the spillage contained. The area should be cordoned off and secured. The Contractor should ensure that there is always a supply of absorbent material readily available to absorb / breakdown or where possible, be

		designed to encapsulate minor hydrocarbon spillages. The quantities of such materials should be able to handle a minimum of 200 ℓ of hydrocarbon liquid spill; and ➢ Any spills must be cleared, and the contaminated soil or sludge disposed of in an appropriate manner, approved by the ECO, or at a licensed hazardous waste disposal site; ➢ It is possible that a leak or spillage may occur in an aquatic/marine environment. Contractors need to ensure that appropriate training and materials are available to deal with a spillage in this environment.
20	Protection of Natural features	➢ The Contractor must not deface, paint, damage or mark any natural features (e.g. rock formations or trees) situated in or around the site for survey or other purposes unless agreed upon beforehand with the ECO. Any features affected by the Contractor in contravention of this clause must be restored/rehabilitated to the satisfaction of the ECO; and ➢ The Contractor and onsite staff must not at any stage enter dense, intact vegetation without written approval from the ECO.
21	Protection of Flora & Fauna	➢ A Botanist should identify the need for plant search and rescue (prior to construction) to identify Species of Conservation Concern (SCC) to be relocated (if necessary); ➢ Protected plant species identified as having to be removed should then be removed from the designated construction footprint and relocated to adjacent areas of similar habitat that should not be affected by construction activities. The plants should be used in landscaping once construction is complete (if applicable); ➢ Except to the extent necessary for the carrying out of the works, flora should not be removed, damaged or disturbed; ➢ The removal and stockpiling of topsoil must also be carried out in accordance with this EMPr; ➢ Trapping, poisoning and/or shooting of animals is strictly forbidden; ➢ The use of chemicals of all forms should be carefully controlled and monitored to avoid contamination of surrounding areas; and ➢ Construction phases should allow for education of staff as to the significance of SCC.
22	Protection of Heritage Features	➢ Construction managers and/or foremen must be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites; ➢ If concentrations of palaeontological and/or archaeological heritage material and human remains are uncovered during construction, all work must cease immediately and be reported to the Eastern Cape Provincial Heritage Resources Authority (ECPHRA) and/or the South African Heritage Resources Agency (SAHRA) (021 642 4502) so that systematic and professional investigation/ excavation can be undertaken; and ➢ Any person who causes intentional damage to archaeological or historical sites and/or artefacts could be penalised or legally prosecuted in terms of the National Heritage Resources Act 25 of 1999.
23	Vegetation Clearance	➢ Vegetation clearing and trampling should be avoided in areas demarcated as "no-go" areas (if any); ➢ Temporary infrastructure such as the site camp, lay down areas and storage areas must not be placed in any other area than the area approved by the ECO; ➢ The Contractor must work according to a plan, which demarcates areas to be cleared. The plan should be part of the Project Layout Plan developed in the Site Design Phase; ➢ The minimum amount of vegetation clearance must take place; and ➢ Collection of, or wilful damage to, any habitats outside of the areas demarcated for clearing is not allowed.
24	Topsoil	➢ Topsoil, if present, should only be stripped from the areas as indicated below: o Any area which is to be used for temporary storage of materials; o Areas which could be polluted by any aspect of the construction activity; and o Areas designated for the dumping of soil. ➢ Stripping of topsoil should be undertaken in such a manner as to minimise erosion by wind or runoff; ➢ Outside of the development footprint, topsoil will be stripped to a depth not exceeding 150 mm from the original ground level; ➢ Areas from which the topsoil is to be removed must be cleared of any foreign material which could form part of the topsoil during removal including bricks, rubble, any waste material, litter, excess vegetation and any other material which could reduce the quality of the topsoil; ➢ The Contractor must ensure that subsoil and topsoil are not mixed during stripping, excavation, reinstatement and rehabilitation; ➢ If mixed with clay sub-soil the usefulness of the topsoil for rehabilitation of the site will be lost; ➢ Soils should be exposed for the minimum time possible once cleared;

		➢ Topsoil should be temporarily stockpiled, separately from (clay) subsoil and rocky materials; ➢ Topsoil should only be stockpiled in areas designated by the ECO; ➢ Stockpiles will either be vegetated with indigenous grasses or covered by a suitable fabric to prevent erosion and invasion of weeds; and ➢ Stockpiled topsoil must not be compacted.
25	Stormwater Management	➢ Stormwater should be managed using suitable structures such as swales, gabions and rock rip-wrap so that any run-off from the development site is attenuated prior to discharge. Silt and sedimentation should be kept to a minimum, through the use of the above-mentioned structures by also ensuring that all structures don't create any form of erosion; and ➢ Natural run-off must be diverted to stormwater drains where these are available.
26	Erosion & Sedimentation Control	➢ The Contractor must take all reasonable measures to limit erosion and sedimentation due to construction activities and must comply with such detailed measures as may be required by the EMPr; ➢ Revegetate areas that have been disturbed as soon as possible; ➢ Where erosion and/or sedimentation occur, whether on or off the site, despite the Contractor complying with the aforementioned, rectification should be carried out in accordance with details specified by the ECO. Where erosion and/or sedimentation occur due to the fault of the Contractor, rectification must be carried out to the reasonable requirements of the ECO and at the expense of the Contractor; and ➢ Actions must also be taken in the event of heavy rains and potential flooding, whereby diversion barriers must not cause excessive erosion.
27	Aesthetics	➢ The Contractor must take reasonable measures to ensure that construction activities do not have an unreasonable impact on the aesthetics of the area.
28	Community Relations	➢ The Contractor must keep a "Complaints Register" onsite. The Register should contain all contact details of the person who made the complaint, and information regarding the complaint itself as well as the date and time that the complaint was resolved; ➢ The ECO will be responsible for responding to queries and/or complaints and may request assistance from the Contractor's Management Staff; and ➢ Construction materials and other purchases relating to the project should be done, where possible, within the nearby community and at local shops.
29	Temporary Site Closure	If the Site is closed for a period exceeding 5 days, the Contractor's Safety, Health and Environment (SHE) Officer, in consultation with the ECO, should carry out the following checklist procedure and ensure that the following conditions pertain and report on compliance with this clause: <u>Fuels / flammables / hazardous materials stores</u> ➢ Fuel stores are as low in volume as practicable; ➢ The bund is empty and there are no leaks; ➢ The outlet is secure and locked; ➢ Fire extinguishers are serviced and accessible; ➢ The area is secure from accidental damage through vehicle collision and the like; ➢ Emergency and contact numbers are available and displayed; and ➢ There is adequate ventilation in enclosed spaces. <u>Safety</u> ➢ Check that site safety checks have been carried out in accordance with the Occupational Health and Safety Act (No. 85 of 1993) prior to site closure; ➢ An inspection schedule and log for use by security or contracts staff is developed; ➢ All trenches and manholes are secured; ➢ Applicable notice boards are in place and secured; ➢ Emergency and Management contact details are prominently displayed; ➢ Security personnel have been briefed and have the facilities to contact or be contacted by relevant management and emergency personnel; ➢ Night hazards such as reflectors, lighting, traffic signage etc. have been checked; ➢ Fire hazards identified and the local authority notified of any potential threats e.g. large brush stockpiles, fuels etc.; ➢ Pipe stockpiles are wedged / secured; ➢ Scaffolds are secure; and ➢ Structures vulnerable to high winds are secure.

		Erosion ➢ Wind and dust mitigation measures such as straw, brush packs, irrigation etc. are in place; ➢ Excavated and filled slopes and stockpiles are at a stable angle; ➢ Re-vegetated areas have a watering schedule and the supply to such areas is secured; and ➢ There are sufficient detention ponds or channels in place. Water contamination and pollution ➢ Hazardous fuel stores are secure; ➢ Cement and materials stores are secure; ➢ Toilets are empty and secured; ➢ Refuse bins are empty and secured; ➢ Bunding is clean and treated with appropriate material that will absorb / breakdown and where possible be designed to encapsulate minor hydrocarbon spillage; and ➢ Drip trays are empty and secure.

6.2 MITIGATION AND MANAGEMENT MEASURES IDENTIFIED IN THE EIA PHASE

In order to identify the appropriate methods required to manage and mitigate environmental disturbance during the proposed development, the impacts and risks that need to be avoided must first be identified. This has been conducted via an EIA process and the details of the impacts and risks associated with the proposed development are included in the EIR. The aim of the EMPr is to ensure that the impacts which have been identified are properly mitigated to ensure that their significance is reduced (in the case of negative impacts) in order to protect the environment. Table 6.2 below illustrates the significance of the impacts before and after mitigation is taken into account:

Table 6.2: Summary of the significance of the impacts associated with the St Francis Bay Coastal Protection Scheme as well as their residual risk following the implementation of mitigation measures.

CONSTRUCTION PHASE IMPACTS		
Estuarine Physical Characteristics – Change in hydrodynamics	LOW –	LOW –
Estuarine Physical Characteristics – Alteration of water channel due to scour	LOW –	LOW –
Estuarine Physical Characteristics - Erosion of the Kromme riverbanks and beach spit (also applicable for operation phase)	LOW-	LOW-

Surface Water Pollution (machinery)	MODERATE –	LOW –
Estuarine Ecology – Suspended sediment / turbidity (also applicable for maintenance dredging during operation phase)	MODERATE –	LOW --
Estuarine Ecology – Flora (Direct loss of estuarine floral species) (also applicable for maintenance dredging)	MODERATE –	LOW –
Estuarine Ecology – Estuarine Functional Zone (also applicable during operation phase)	MODERATE-	MODERATE-
Estuarine Ecology – Fauna (Direct loss of faunal) (also applicable for maintenance dredging)	MODERATE -	LOW –
Estuarine Ecology – Fauna (Loss of sandbank habitat)	MODERATE-	LOW-
Estuarine Ecology – Fauna (Impacts on bird species)	LOW –	LOW –
Dune Ecology – Loss of dune vegetation (Sand River)	MODERATE-	MODERATE-
Dune Ecology – Impacts on foredunes due to site access	LOW -	LOW-
Dune Ecology – Impacts on nearshore and beach ecology	MODERATE-	MODERATE -
Marine Ecology – Flora (Loss of nearshore reef)	MODERATE-	LOW-
Marine Ecology – Flora (Increased hard substrate/habitat for attachment of benthic species)	MODERATE+	MODERATE+
Marine Ecology – Fauna (Increased hard substrate/habitat for attachment of benthic species)	MODERATE+	MODERATE+
Local Amenity – Estuary (Temporary restricted access in areas)	MODERATE-	LOW-
Local Amenity – Estuary (Decreased area available for bait digging)	MODERATE-	LOW-
Local Amenity – Beach (Restricted access to areas during construction)	MODERATE-	LOW-
Visual Impact – Dredging and construction machinery	MODERATE-	LOW-
Loss of Archaeological Resources	LOW –	LOW +
Loss of Cultural Heritage (built environment)	NO SIGIFICANCE	NO SIGNIFICANCE
Loss of Cultural Landscape	LOW--	LOW-
Loss of graves	MODERATE-	LOW-
Loss of marine archaeological / heritage resources	LOW -	LOW -
Solid Waste Pollution (Relevant to all project aspects) (also relevant to operation phase)	LOW –	LOW –
Dust Pollution (Implementation of coastal protection infrastructure)	LOW –	LOW –
Increased Traffic (Relevant to sand sourcing should the option of truck transportation be implemented) and vehicle movements related to groyne and revetment construction and material transportation	MODERATE –	LOW –
Noise Disturbance (Relevant to all project aspects)	MODERATE –	LOW –
Employment Creation and Economic Benefits (Relevant to all project aspects)	MODERATE +	MODERATE +
OPERATIONAL PHASE IMPACTS		
Estuarine Physical Characteristics (Increased erosion due to boat traffic)	MODERATE-	LOW-
Dune Ecology (Restoration of beach habitat)	MODERATE+	MODERATE+
Marine Hydrodynamics - Impact (erosion) as a result of the infrastructure and dredging	MODERATE-	LOW-
Marine Hydrodynamics - Impact (reduction of sediment supply) to the northern beaches	MODERATE-	LOW-
Local Amenity – Estuary (Increased boat access during all tidal cycles)	MODERATE+	MODERATE+
Local Amenity – Estuary (Potential increased tourism)	MODERATE+	HIGH+
Local Amenity – Beach (Increased recreational use)	VERY HIGH+	VERY HIGH +
Visual Impact – Presence of groynes	MODERATE -	LOW -
Protection of Coastal Public Property (Relevant to all project aspects)	VERY HIGH +	VERY HIGH +
Public Health and Safety	MODERATE-	LOW-
CUMULATIVE IMPACTS		
Erosion of the banks of the estuary through increased boating activity	MODERATE-	LOW-

The following table sets out the potential environmental, social and specialist issues that could occur during the lifespan of the proposed St Francis Bay Coastal Protection Scheme project, as per the Draft EIR for the Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province, (CES, December 2020). The EIR provides mitigation measures and recommendations in an effort to reduce the significance of potential negative impacts and enhance potential benefits for the Construction and Operational Phases of the St Francis Bay Coastal Protection Scheme.

Table 6.3: Summary of the mitigation measures (adverse impact management actions) as outlined in the EIR.

CONSTRUCTION PHASE			
Impact		Description	Mitigation Measures
1	Estuarine Physical Characteristics	Removal of large volumes of sediment from the Kromme Estuary has the potential to change the physical (hydrodynamics) and sedimentary processes within the estuarine system. The dredging of the river will increase the tidal prism, and the area around the river mouth will allow the water to drain out more effectively. The removal of sand from the intertidal areas, together with the subsequent changes to the hydrodynamics of the Kromme Estuary and mouth, could result in the realignment of the main estuarine channel. While the modification of the course of the main channel is not planned, the dredging activity could result in it changing its current orientation or 'straight-lining' its path. Any increase in current velocities, as a result of the change to hydrodynamics, have the ability to transport sediment. With current velocities increasing in the mouth under certain conditions, the integrity of the northern end of the spit could be put at risk through erosion. The project is anticipating nourishing the spit area which is also protected by revetments and future groyne infrastructure. Advisian's (2020) modelling indicates that none of the dredging scenarios they tested led to any substantial changes in current velocities within the estuary under normal and/or flood conditions. This indicates that erosion of the banks of the river, as a result of the dredging, is unlikely.	➢ Maintain the current main sand bank adjacent to Area S1 to act as a sand sink (i.e. a place for sand to accumulate); and ➢ Avoid sensitive areas identified in the EIR.
2	Surface water Pollution (relevant to sand sourcing along the Kromme River)	There will be disturbance of beach sand during the sand sourcing and ongoing operations, and during the construction of the hard infrastructure required for coastal protection. Substances such as oil and diesel may enter the Kromme River and/or the ocean, if spillages are not effectively managed and/or prevented.	➢ Construction vehicles and equipment should be maintained, and daily checks should be done for leaks; ➢ Spill kits and drip trays must be readily available and utilised during refuelling. This includes spill kits and equipment to contain, manage and remediate any spillages in aquatic/marine environments. ➢ Refuelling procedures for aquatic based craft must be included in a method statement, reviewed and approved by the ECO; ➢ No storage of fuel or chemicals close to the shore or estuary must be permitted. The exact distances will need to be determined for each of the Project Phases; ➢ If required, it is recommended that ready mixed cement is used. No cement mixing close to the shore or estuary must be permitted; ➢ Servicing of machinery and vehicles must occur off site unless this is done in a bunded area; and ➢ All stationery plant must be equipped with drip trays.
3	Estuarine Ecology – Flora	The methodology of extracting the sediment may result in the physical loss of estuarine floral species.	➢ Where possible, sediment should be taken from areas where there is low abundance of estuarine vegetation; and ➢ Do not remove or disturb salt marsh habitat.
		The extraction of sediment from the estuary may result in suspended sediment resulting in potential smothering of macrophytes.	➢ Limit extraction of material to areas where sediment particle size is what is required for the beach nourishment. These larger grain

		The estuarine functional zone (EFZ) includes the lateral boundaries of an estuary up to the 5 m contour, with the downstream boundary taken as the estuary mouth and the upstream boundary taken as the limits of tidal variation or salinity penetration, whichever penetrates furthest. Protection/rehabilitation of the estuarine functional zone is considered essential for protection of estuarine biodiversity and associated ecological processes. The proposed project is likely to impact on the estuarine functional zone both directly and indirectly: ➢ The loss of habitat (direct removal of *Zostera capensis*, sandbanks and benthic habitat) ➢ Increases in turbidity (direct impact) which may result in further loss of habitat as a result of smothering (indirect impact). ➢ Altering the nutrient dynamics of the system as a result of releasing trapped nutrient from sediments. Previous authors who have studied water quality in the Kromme have concluded that due to the influence and constant flushing of the system through the tidal cycle, water quality is generally good.	sizes are less likely to become suspended in the water column; ➢ Only the required volume of sediment will be dredged; ➢ Sensitive habitats (*Zostera. sp*) have been identified in the EIR and will be annotated on a map and avoided where possible; ➢ Associated equipment will be placed in areas of low sensitivity only; and ➢ Monitoring of sand bank habitats in close proximity to dredging activities must be implemented during both the construction and operational phases of the project.
4	Estuarine Ecology – Fauna	Direct physical loss would be attributed to the removal of material directly by dredging. Given the type of material required for the project the habitat lost would be that associated with a sandy benthic substrate. Important species in this habitat include sand prawn (*Callianassa kraussi*), pencil bait *Solen capensis* and bloodworm *Arenicola loveni*.	➢ Limit dredging in habitats where high biodiversity / abundance of benthic species exist; and ➢ Do not remove or disturb salt marsh habitat.
		The extraction of sediment may result in suspended sediment either smothering biota or affecting their biology (e.g. filter feeders).	➢ Only the correct size material (course) will be dredged for beach nourishment; ➢ Only the required volume of sediment will be dredged; ➢ Associated equipment will be placed in areas of low sensitivity only; and ➢ Maintaining the sand bank adjacent to Area S1 will ensure that suitable habitat is maintained in a natural state.
		The presence of excavators / dredgers working in the intertidal areas may result in disturbance to wading bird species. While wading species would be temporarily displaced the works would not take place in all intertidal area allowing foraging in other parts of the estuary. Some species may be drawn to the dredger as it would be disturbing the sediment and facilitate foraging.	➢ Avoid working in areas where bird species may nest. Especially during the breeding season; ➢ Restrict activity to discreet sections of the sand banks and channel; and ➢ Encourage owners of dogs to keep their dogs on leashes while on the sandbanks to ensure those water birds using the sandbank are not disturbed unnecessarily.
5	Dune Ecology	Loss of dune vegetation on the vegetated sand banks at the mouth of the Sand River.	➢ It is not possible to mitigate this impact.
		The construction of the groynes, as well as activities associated with beach nourishment will require access over the foredunes in selected areas, and damage to the foredunes and the loss of some vegetation is inevitable. However, the breaching of the sand spit has already resulted in substantial loss of vegetation, which reduces the severity of this impact.	➢ Enforce all provisions contained in the Construction EMPr; ➢ Do not allow any laydown areas within the sensitive foredune area; ➢ Limit access across the foredunes to four access points in total, where each groyne will be located. The access point where the sand spit starts (possibly at the Aldabara Road parking area) will need to serve the first two groynes. The second two will require access from Peter Crescent and at George road; and
		During the construction phase ecological impacts on the beach and nearshore areas are likely to be moderately significant, and will be	

		difficult to mitigate. However, the beach and nearshore ecosystems are resilient to natural perturbations.	the final one at the Ralph Road parking area. These parking areas must also be used as laydown areas; ➢ Limit pedestrian access to these same points; and ➢ Disallow workers from accessing the foredune areas.
6	Marine Ecology – Flora	The placement of sand and / or rock material on or near the nearshore reef structures will result in localised smothering, leading to a loss of individuals and habitat. This is particularly relevant for algal species since they are unable to move from these areas. It should be noted that these reefs would have been covered in sediment in the past.	➢ Design and orientate groyne structures to avoid smothering the nearshore reefs as far as possible. ➢
		The development of groyne structures of rock material may provide additional hard substrate for benthic species	➢ None required.
7	Marine Ecology – Fauna	The placement of sand and / or rock material on or near the nearshore reef structures may result in localised smothering leading to a limited loss of individuals and habitat. However, the development of groyne structures of rock material is anticipated to provide additional hard substrate for benthic species.	➢ None required.
8	Marine Hydrodynamics	Development of the groynes will alter the hydrodynamic regime through the refraction of waves and altering of local currents. This impact is expected to be limited to the area immediately north of the northern-most groyne. The design of the beach nourishment is to nourish this area as part of the maintenance activity. Similarly, the short groyne does not extend sufficiently into the marine environment to have an effect on the northern bank.	➢ Ensure that the adaptive management plan is developed to recognise and mitigate for any accelerated erosion; ➢ Place sand material immediately north of the northern most groyne to act as sacrificial material; and ➢ Maintain nourishment of at least 6,000 m^3/year for each of the embayments south of the spit and 10,000 m^3/year for the remaining embayment at the spit on a regular basis.
		Development of the groynes will restrict the longshore drift that transports sediment to the north. However, even with the restriction at least 50% of the material will pass through the scheme and the beach nourishment and maintenance introduces a new source of sediment which is able to be transported to the north.	
9	Local Amenity – Estuary	The presence of excavators / dredger may result in some areas of the estuary having restricted access for public safety.	➢ Reduce, where possible, the extraction of material during times of peak tourist activity; ➢ Ensure that signage is clear, and areas are made safe during excavation / dredging; and ➢ Ensure that newly excavated / dredged areas are safe for use.
		The removal of sand banks and specifically the fauna within the sandbanks may result in reduced areas available for bait digging – a popular activity in the Kromme Estuary	➢ Reduce dredging activity in popular bait digging areas (i.e. sand bank near the mouth of the estuary) during peak tourist season; ➢ Ensure areas of the sandbanks are available to bait diggers during construction; ➢ Dredging from the channels initially will ensure that sand bank habitat is maintained for a longer period; and ➢ Inform bait diggers of construction schedule to allow digging in areas that are due to be dredged.
10	Local Amenity – beach	The presence of construction vehicles accessing the beach for the construction of the groynes, delivery of material and reworking of the sediment for nourishment may result in restricted access to certain parts of the beach (and carparks).	➢ Reduce, where possible, the placement of material during times of peak tourist activity; ➢ Ensure that signage is clear, and areas are made safe during placement / levelling of the beach; and

			➤ Ensure that newly nourished areas are safe for use.
11	Visual	Visually, the presence of vessels on the estuary are unlikely to be considered to be out of the ordinary. However, should the preferred method be via excavator then this may not fit with the current expectation of “normal” activity on the estuary. The presence of pumps and pipes may also not be considered to be “normal”. However, their visibility is expected to be of low significance and will likely only be visible to those in close proximity to dredging activities.	➤ Only absolutely necessary equipment required for the dredging to be at the work site. All other equipment to be stored in an area less intrusive; and ➤ Pumps and pipe placement should take visual disturbance into account for placement during the works.
		The establishment of revetment structures and the presence of groynes may result in limited views from certain positions along the frontage. The groynes will also be a newly introduced feature and therefore may alter the seascape.	➤ Only absolutely necessary equipment required for the dredging to be at the work site. All other equipment to be stored in an area less intrusive.
12	Loss of Archaeological Resources (relevant to sand sourcing along the Kromme River)	Dredging activities could damage or destroy potentially significant archaeological or cultural heritage sites, should such sites occur within the river. The study did not identify archaeological sites or features in the project area but the project is situated in the larger archaeological coastal sensitivity zone of St Francis where shell middens and other archaeological sites/materials are found. As such, care should be taken not to destroy previously undetected heritage remains.	➤ Should any archaeological or cultural sites or objects be located during the construction of the proposed project, it should immediately be reported to the National Heritage Council and the ECPHRA.); and ➤ All construction site staff should be briefed to immediately report any sites or objects of heritage significance located during the construction phase. In the event of finding what appears to be an archaeological site or a cultural and/or historic site or object, work within that area should be stopped until a qualified archaeologist or historian can examine the item or find.
13	Loss of Cultural Landscape (relevant to the beach nourishment)	The larger area comprises a rich cultural horizon and the natural landscape surrounding the proposed project encompasses vast coastlines and river valleys, typical of the Eastern Cape coast. The cultural landscape holds Herder, Iron Age remains and a Colonial Period frontier which embraces a regional history, represented in a number of significant archaeological sites. However, the proposed project is unlikely to result in a significant impact on the general cultural landscape of this area.	➤ n/a
14	**Loss of Graves / Human Burial sites**	No burial sites were located in the study area. It should be noted that graves and cemeteries often occur within settlements or around homesteads in the rural areas of the Eastern Cape, and they are also randomly scattered around archaeological and historical settlements. The probability of informal human burials encountered during development should thus not be excluded.	➤ If any human bones are found during the course of Construction work then they should be reported to an Archaeologist and work in the immediate vicinity should cease until the appropriate actions have been carried out by the archaeologist; ➤ Where human remains are part of a burial they would need to be exhumed under a permit from SAHRA (for pre-colonial burials as well as burials later than about AD 1500); ➤ Should any unmarked human burials/remains be found during the course of construction, work in the immediate vicinity should cease and the find must immediately be reported to the archaeologist, or the South African Heritage Resources Agency (SAHRA); and ➤ Under no circumstances may burials be disturbed or removed until such time as necessary statutory procedures required for grave relocation have been met.
15	**Loss of Marine Archaeological and/or Cultural**	In terms of Marine and Underwater Cultural Heritage (MUCH), the dredging, beach nourishment and construction of the groynes	➤ A 50 m buffer around the river mouth should be implemented. This buffer includes the beach and coastal dune strips around the river

	Heritage Resources (relevant to dredging, nourishment and groyne infrastructure)	pose a risk to maritime features in the area. The risk of damage or complete removal from the site is possible given the scale and nature of the activities. However, the target areas for dredging occur largely to river-side of the Kromme River estuary and areas within the river system to the west. In addition, the beach infrastructure (i.e. groynes) are expected to be constructed on top of the existing beach sand and level without the need for excavation. The revetment at the spit will be installed on a nourished beach level, which will be approximately 1 m higher than the existing beach level. Therefore, no intersection with submerged items and artefacts are anticipated.	mouth which could potentially hold the washed-up remains of wreckage, artefacts as well as possible survivor camp remnants; ➢ The exclusion of a portion of dredging target area P1 which falls within this proposed buffer zone is recommended. The extent of this proposed exclusion area is approximately 1.1ha; ➢ Bi-weekly monitoring and reporting to SAHRA MUCH Unit by an informed and trained Environmental Control Office (ECO) of the dredging of target areas P1 and S1 and the placing of the northern groyne and revetment; and ➢ A suitably qualified MUCH specialist should be appointed during initial stages of the development in order to provide training to the assigned project ECO.
16	Solid Waste Pollution (relevant to all project aspects)	The construction phase of the activity will produce construction waste in the form of building rubble, excavated soil as well as general waste (e.g. litter from workers on site).	➢ Construction material should be reused or recycled where possible; ➢ Waste that cannot be reused or recycled should be disposed of in the correct manner at the nearest registered waste disposal site; ➢ Any hazardous materials (e.g. paint, fuel, oil) must be disposed of immediately and in the correct manner; ➢ General good house-keeping should be practiced on site; ➢ If rubble is stored onsite it should be stored on designated portions of land. Designated areas for storage of rubble should be set aside at the onset of construction; ➢ Litter must be controlled during construction e.g. adequate bins must be made available on site at all times; and ➢ Construction materials stored as part of the project must be secured (i.e. plastics must be covered to prevent being blown off site). Skips must be regularly emptied and must be covered.
17	Dust Pollution (implementation of coastal protection infrastructure)	The construction of the rock revetments and stub groynes increases the potential for dust within the coastal area. During the construction phase of the activity, materials will be moved to and from the project site and this could result in dust pollution not only from the materials, but also from the construction vehicles which will be operating on site. The effects of dust will be exacerbated during high wind conditions.	➢ Construction activities that result in dust generation should preferably cease during period of high winds; ➢ Exposed surfaces should be wet down where required to avoid dust emissions; and ➢ Vehicles transporting material such as sand should remain at a speed limit of 30km/h and, if required, cover their loads with a tarpaulin to avoid dust emissions.
18	Traffic (relevant to sand sourcing should the option of truck transportation be implemented) and vehicle movements related to groyne and revetment construction and material transportation	During construction, there will be an increase in the number of vehicles using the roads in and around St Francis Bay, including heavy construction vehicles. This may result in damage to the road as well as increased potential for road accidents. The construction vehicles could also impede traffic at certain sections of St Francis Bay if not adequately managed and controlled. As a result of the proposed project, there is likely to be an increase in the use of the roads within the adjacent area (e.g. the R330 and St Francis Bay internal roads).	➢ Appropriate warning signs must be erected, in accordance with the requirements of the District Road Engineer; ➢ Vehicles must be roadworthy and serviced and must abide by the standard traffic laws; ➢ Any abnormal Loads must be approved with the traffic authorities and must comply with any conditions imposed by the authorities; ➢ The contractor must employ flag staff if deemed necessary in order to prevent accidents; ➢ Speed limits on site must not exceed 30km/h and the speed limits along the public roads must be adhered to at all times; and ➢ Manage the travelling times of the delivery trucks so as to allow them to depart and arrive at spaced out time intervals, thus reducing the

			intensity of traffic and avoiding the formation of convoys of heavy vehicles.
19	Noise Disturbance (relevant to all project aspects)	It can be expected that there will be an increase in noise levels during the site preparation and construction phase of the project. The increase in noise will be associated with the operation of construction vehicles, dredging and other equipment and labourers. The noise level associated with the dredging and nourishment activity is expected to be approx. 80 dB at source. Depending on the size of the booster pumps, noise levels are expected to be 92 dB at source, reducing down to 60 dB at 500 m (ICF Jones and Stokes, 2008). To provide context normal conversation is about 60 dB, a lawn mower is about 90 dB, and a loud concert is about 120 dB.	➢ All construction vehicles and equipment to be properly serviced in order to meet the necessary noise level requirements; ➢ Restriction of work to daylight hours where possible; ➢ Restriction of any unnecessary noise e.g. portable radios, vehicle radios, whistles etc.; ➢ Machinery should be fitted with the required mufflers, and notice given to surrounding residents prior to the commencement of construction; and ➢ Adhering to the municipal by-laws relating to noise.
OPERATIONAL PHASE			
20	Estuarine Physical Characteristics	The increase in boat traffic as a result of the ability for the estuary to be used on more states of the tide may result in an increased risk of erosion of the banks of the estuary.	➢ Reduce speed (i.e. no wake zones) of vessels in sensitive areas of the estuary; and ➢ Impose stricter control of boat traffic during peak tourist season.
21	Marine Hydrodynamics	Development of the groynes may alter the hydrodynamic regime through the refraction of waves and altering of local currents, potentially leading to accelerated erosion north of the structures.	➢ Place sand material immediately north of the northern most groyne to act as sacrificial material; and ➢ Ensure that the adaptive management plan is developed to recognise and mitigate for any accelerated erosion.
23	Visual	The establishment of revetment structures and the presence of groynes.	➢ Where possible ensure the design of the groynes does not impede the open seascapes view; and ➢ Where possible ensure the design of the groynes are compatible and blend in.
24	Solid Waste Pollution	During the operational phase, the ongoing maintenance activities may produce solid waste. The incorrect management of this waste will have a negative impact on the environment as it can cause unnecessary pollution and also have a detrimental effect on the aesthetics of the proposed site.	➢ Waste that cannot be reused or recycled should be disposed of in the correct manner at the nearest registered waste disposal site; ➢ Any hazardous materials (e.g. paint, fuel, oil) must be disposed of immediately and in the correct manner; and ➢ General good house-keeping should be practiced during maintenance operations.
26	Public health and safety	Groyne structure will not be designed to be used by the public (i.e. walking, climbing). Groyne structures tend to create rip currents in proximity to the groynes themselves	➢ Ensure that appropriate and visible signage is erected warning the public of the dangers of climbing the structures and the rip currents; and ➢ Local lifeguards must ensure that swimming areas are clearly demarcated.

Table 6.4: Summary of the beneficial impact that requires mitigation to enhance the benefits.

CONSTRUCTION PHASE		
Impact	Description	Mitigation Measures
Employment Creation and Economic Benefits (Beneficial Impact)	The construction phase of the proposed project is expected to create approximately thirty (30) temporary jobs.	➢ As far as possible, local labour should be used during construction; and ➢ Purchase materials locally, where possible, in order to support the local communities.

7. ADMINISTRATION AND REGULATION OF ENVIRONMENTAL OBLIGATIONS

7.1 MANAGEMENT STRUCTURE

In line with this EMPr, the Contractor must prepare a document clearly outlining and demonstrating the environmental responsibilities, accountability and liability of the Contractor's employees. The Contractor must assign responsibilities for the following:

- Reporting structures;
- Actions to be taken to ensure compliance;
- Overall design, development and implementation of the EMPr;
- Documenting the environmental policy and strategy;
- Implementing the EMPr in all stages/phases of the project; and
- All the aspects which require action under the other core elements and sub-elements of the EMPr.

All official communication and reporting lines, including instructions, directives and information, need to be channelled according to the organisation structure.

7.2 ROLES AND RESPONSIBILITIES

7.2.1 THE APPLICANT

The St Francis Property Owners Non-Profit Company (SFPO NPC), on behalf of the Kouga Local Municipality (Kouga LM), is the responsible entity for monitoring the implementation of the EMPr and compliance with the Environmental Authorisation (EA). However, if the SFPO NPC appoints a Contractor to implement the project, then the Contractor is responsible for implementing the proposed mitigation measures documented in this EMPr on behalf of the SFPO NPC. The successful Contractor's responsibilities are outlined in the Sections that follow. The Applicant will also be responsible for stipulating and enforcing fines and penalties to the Contractor for contravention of any non-compliances against the EMPR, EA, and other approved plans.

7.2.2 THE CONTRACTOR

The successful Contractor will:

- Be responsible for the finalisation of the EMPr in terms of methodologies which are required to be implemented to achieve the environmental specifications contained herein and the relevant requirements contained in the EA;
- Be responsible for the overall implementation of the EMPr in accordance with the requirements of the proponent and the EA;
- Ensure that all third parties, who carry out all or part of the Contractor's obligations under the contract, comply with the requirements of this EMPr; and
- Ensure that the appointment(s) of the ESO are subject to the approval of the developer.

7.2.3 THE RESIDENT ENGINEER (RE)

The Resident Engineer (RE) should be appointed by the Applicant and will be required to oversee the construction programme and construction activities performed by the Contractor. The RE is expected to liaise with the Contractor and ECO on environmental matters, as well as any pertinent engineering matters where these may have environmental consequences. The RE will oversee the general compliance of the Contractor with the EMPr and other pertinent site specifications. The RE should also be familiar with the EMPr specifications and further monitor the Contractor's compliance with the environmental specifications on a daily basis, through a Site Diary, and enforce compliance.

7.2.4 THE ENVIRONMENTAL SITE OFFICER (ESO)

The Contractor should appoint a nominated representative of the Contractor as the ESO for the contract. The ESO must be site-based and should be the responsible person for implementing the environmental provisions of the construction contract. The approved ESO must be onsite at all times.

The ESO's duties will include, *inter alia*, the following:

- Ensuring that all the environmental authorisations and permits, required in terms of the applicable legislation, have been obtained prior to construction commencing;
- Reviewing and approving construction Method Statements (MS) with input from the ECO and RE, where necessary, in order to ensure that the environmental specifications contained within the construction contract are adhered to;
- Assisting the Contractor in finding environmentally responsible solutions to problems;
- Keeping accurate and detailed records of all activities on site;
- Keeping a register of complaints onsite and recording community comments and issues, and the actions taken in response to these complaints;
- Ensuring that the required actions are undertaken to mitigate the impacts resulting from noncompliance;
- Reporting all incidences of non-compliance to the ECO and Contractor; and
- The ESO must submit regular written reports to the ECO, not less frequently than once a month, during the construction phase of the St Francis Bay Coastal Protection Scheme.

The ESO must have:

- The ability to manage public communication and complaints;
- The ability to think holistically about the structure, functioning and performance of environmental systems;
- The ESO must be fully conversant with the EIR, EMPr, relevant environmental legislation and any other relevant documents relating to the St Francis Bay Coastal Protection Scheme; and
- The ESO must have received professional training, including training in the skills necessary to be able to amicably and diplomatically deal with the public as outlined in the first bullet point above.

The ECO should be in the position to determine whether or not the ESO has adequately demonstrated his/her capabilities to carry out the tasks at hand and in a professional manner. The ECO will therefore have the authority to instruct the Contractor to replace the ESO if, in the ECO's opinion, the appointed officer is not fulfilling his/her duties in terms of the requirements of the construction contract. Such instruction must be in writing and must clearly set out the reasons why a replacement is required and within what timeframe. The ECO must visit the development site and, in addition to the responsibilities listed in section 7.2.5 below, review the performance of the ESO and submit regular performance reviews to SFPO NPC and the Kouga LM.

7.2.5 *ENVIRONMENTAL CONTROL OFFICER (ECO)*

For the purpose of implementing the conditions contained herein, the Proponent must appoint an ECO for the contract. The ECO will be the responsible person for ensuring that the provisions of the EMPr as well as the EA are complied with during the Construction Phase. The ECO will be responsible for issuing instructions to the Contractor and where environmental considerations call for action to be taken. The ECO must submit regular written reports to the Applicant and the DEDEAT *as required*. The ECO will be responsible for the monitoring, reviewing and verifying of compliance with the EMPr and the conditions of the EA by the Contractor. The ECO's duties in this regard will include, *inter alia*, the following:

- Confirming that all the EAs and permits required in terms of the applicable legislation have been obtained prior to construction commencing;
- Monitoring and verifying that the EMPr, EA and Contract are adhered to at all times and taking action if specifications are not followed;
- Monitoring and verifying that environmental impacts are kept to a minimum;
- Reviewing and approving construction Method Statements with input from the ESO and RE, where necessary, in order to ensure that the environmental specifications contained within this EMPr and the EA are adhered to;
- Inspecting the site and surrounding areas on a regular basis to monitor compliance with the EMPr, EA and Contract;
- Monitoring the undertaking by the Contractor of environmental awareness training for all new personnel onsite;
- Ensuring that activities onsite comply with all relevant environmental legislation;
- Undertaking a continual internal review of the EMPr and submitting any changes to the Applicant and authority for review and approval, as applicable;
- Checking the register of complaints kept onsite and maintained by the ESO and ensuring that the correct actions are/were taken in response to these complaints;
- Checking that the required actions are/were undertaken to mitigate the impacts resulting from noncompliance;
- Reporting all incidences of non-compliance to SFPO NPC and the Kouga LM;
- The ECO must also submit compliance audit reports to DEDEAT, in accordance with the requirements of the EA. Such reports must be reviewed by the SFPO NPC prior to submission;
- Keeping a photographic record of progress onsite from an environmental perspective. This can be conducted in conjunction with the ESO, because the ESO will be the person that will be onsite at all times and can therefore take photographic records weekly. The ECO should ensure that the ESO understands the task at hand;
- Recommending additional environmental protection measures, where necessary; and
- Providing feedback on any environmental issues during the site meetings.

The ECO must have:

- A good working knowledge of all relevant environmental policies, legislation, guidelines and standards;
- The ability to conduct inspections and audits and to produce thorough, readable and informative reports;
- The ability to manage public communication and complaints;
- The ability to think holistically about the structure, functioning and performance of environmental systems; and

- Proven competence in the application of the following integrated environmental management tools:
  - Environmental Impact Assessment;
  - Environmental Management Plans/Programmes;
  - Environmental auditing;
  - Mitigation and optimisation of impacts;
  - Monitoring and evaluation of impacts; and
  - Environmental management systems.

The ECO must be fully conversant with the EIA Process, the St Francis Bay Coastal Protection Scheme EIR, EA (if/when issued), this EMPr and all relevant environmental legislation for the project. The Proponent will have the authority to replace the ECO if, in their opinion, the appointed officer is not fulfilling his/her duties in terms of the requirements of the EMPr or this specification. Such instruction will be in writing and must be clearly set out, with reasons why a replacement is required, and within what timeframe.

7.3 COMPLIANCE MONITORING AND CORRECTIVE ACTION

Non-compliance with the conditions of the EMPr must be viewed as a breach of appointment Contract for which the construction contractors will be held liable. The latter is deemed NOT to have complied with the EMPr if:

- There is evidence of contravention of the EMPr, its environmental specifications or the Method Statements developed by the Contractor within the boundaries of the construction site or areas of Contractor responsibility;
- Construction related activities take place outside the defined boundaries of the site;
- Environmental damage ensues due to negligence;
- The Contractor fails to comply with corrective or other instructions issued by the ECO within a specific time; or
- The Contractor fails to respond adequately to complaints from the public or authorities.

The Applicant and the construction contractors are liable for any construction rehabilitation costs associated with their non-compliance with this EMPr. This rehabilitation will be undertaken to the satisfaction of the ECO. The construction contractors will have the right to appeal any punitive action undertaken by the ECO or the Applicant.

7.4 REPORTING AND REVIEW

The EMPr reporting and documentation requirements must be based on best practice principles, e.g. ISO 14001, which must take the following requirements into account:

- Documents associated with the EMPr must be reviewed regularly and updated by all environmental management parties;
- Audits performed by the ECO, of the environmental performance, of the construction phase of the project will be undertaken on a monthly basis in fulfilment of likely conditions of EA in this regard;
- The findings of external, internal and informal environmental reviews will be recorded and items requiring action will be identified from the recommendations made; and
- The construction contractors will be contractually obliged to fulfil any reasonable recommendations, and implementation of these actions will be assessed in the above audit.

Meetings, where required, should take place onsite. Internal auditing and reporting should be subject to external review by the ECO during the monthly compliance audits.

7.5 MONITORING

Construction activities have the potential to impact on a range of biophysical habitats as well as neighbouring communities. The monitoring programme which requires development by the Applicant, ECO and Contractor should, *inter alia*, allow for analysis of:

1. Air quality (such as dust);
2. Hydrocarbon pollution;
3. Success of local labour employment;
4. Success of local procurement policies;
5. Ambient and workplace noise;
6. Health and safety (including spillages) incidents;
7. Success of traffic management measures;
8. Contamination and soil erosion;
9. Success of avoidance of sensitive habitats (directly) and monitoring changes to habitats as a result of the works (indirect); and
10. Monitoring of habitats to inform the adaptive management plan.

Refer to Chapter 9 for more detail on the monitoring and evaluation aspects.

7.6 EMERGENCY PREPAREDNESS

The Contractor must develop environmental emergency response procedures to ensure that there are appropriate responses to unexpected or accidental actions or incidents that will cause environmental impacts during the construction phase. Such activities include, *inter alia*:

- Accidental discharges to water and land;
- Accidental exposure of employees to hazardous substances;
- Accidental fires;
- Accidental spillage of hazardous substances; and/or
- Specific environmental and ecosystem effects from accidental releases or incidents.

The Contractor and Subcontractors must comply with the emergency preparedness incident reporting requirements that must be developed and be in place prior to the commencement of the construction phase.

7.7 ENVIRONMENTAL INCIDENT MANAGEMENT

The construction contractors must adhere to the hazard and incident reporting protocols to be developed by the Contractor. A report must be completed for all incidents, and appropriate action taken where necessary to minimise any potential impacts. DEDEAT must be informed of any environmental incidents, in accordance with legislative requirements, should this be necessitated by a major environmental incident.

7.8 MANAGEMENT REVIEW

A formal management review should be conducted in which the internal audit reports, written by the ESO and based on frequent inspections and interactions with the ECO and review of the periodic reports, including audit reports by the independent external auditor - will be reviewed. The purpose of the review is to critically examine the effectiveness of the EMPr and its implementation and to decide on potential modifications to the EMPr as and when necessary. The process of management review will be to keep to the principle of continual improvement. Management review should take place when the liaison committee, consisting of representatives from the Contractor, construction Subcontractors (as appropriate), ECO and other Stakeholders or I&APs deem them necessary or on a monthly basis. The purpose of these monthly meetings will be to review the progress of the Contractor in implementing and complying with their obligations in terms of this EMPr for the duration of the project. Where necessary, management review will take place more frequently than the required monthly meetings.

8. REQUIRED DOCUMENTATION AND DOCUMENT CONTROL

8.1 METHOD STATEMENTS

Method Statements must be completed by the Contractor, an individual that is competent with the tasks to be undertaken, for each activity which requires a Method Statement as specified in the EMPr or as requested by the ECO. Each Method Statement must be submitted to the Resident Engineer (RE), ECO and the Applicant for approval. For the purposes of the environmental specification, a Method Statement is defined as: *"A written submission by the Contractor to the ECO setting out the plant, materials, labour and method the Contractor proposes to carry out an activity, in such detail that the ECO is enabled to assess whether the Contractor's proposal is in accordance with the EMPr and/or will produce results in accordance with EMPr."* The Method Statement must include details of the:

- Construction procedures, timings and work areas;
- Public notification of the works;
- Materials and equipment to be used;
- Transportation of the equipment to- and from site;
- How the equipment and/or material will be moved while on site;
- How and where material will be stored;
- The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur, especially to the aquatic and marine environment;
- Timing and location of activities;
- Compliance and non-compliance with the specifications; and
- Any other information deemed necessary by the Engineer.

Method Statements can be for once-off tasks or a series of tasks which are often repeated. The risks are identified during the various work stages when a Method Statement is prepared. Steps taken to reduce the potential risk associated with these stages can then be determined. The sequential steps and actions to be followed by the persons carrying out the works are written down. This sequence of steps should include all environmental and safety aspects relevant to the task being executed. As a minimum, the Contractor should produce the following method statements:

- Site Dust Management;
- Solid Waste Management;
- Hazardous Material Management;
- Hydrocarbon Management;
- Site Clearing and Topsoil Management;
- Erosion and Stormwater Management;
- Fire Management;
- Noise Management;
- Concrete Mixing (if applicable);
- Pollution Control;
- Dredging management;
- Beach nourishment management;
- Groyne construction management;
- Site Access and Traffic Management; and
- Incident and Emergency Response Management.

The Method Statements should be submitted to the RE, ECO and the Applicant not less than twenty (20) days prior to the intended date of commencement of the activity, or as directed by the ECO. The Contractor must not commence an activity until all required Method Statements have been approved by the RE, ECO and the Applicant. The ECO should provide comment on the methodology and procedures proposed by the Contractor, but the ECO will not be responsible for the Contractor's chosen measures of impact mitigation and emergency/disaster management systems. Approval of the Method Statements should not be withheld unreasonably.

All control measures detailed in the Method Statement must be the subject of "tool box" talks prior to the initiation of works. By introducing or reaffirming these measures during the "tool box" talk, everyone involved should have a clear understanding of the work to be carried out, as well as the safe work method sequences and equipment required.

Please refer to Appendix 1 for an example of a Method Statement Layout.

8.2 GOOD HOUSEKEEPING

The Contractor must undertake "good housekeeping" practices during the construction phase. This will help avoid disputes on responsibility and allow for the smooth running of the contract as a whole. Good housekeeping extends beyond the wise practice of construction methods to include the care for and preservation of the environment within which the construction is situated.

8.3 RECORD KEEPING

The ECO must continuously monitor the Contractor's adherence to the approved impact prevention procedures and the ECO must issue the Contractor with a notice of non-compliance whenever transgressions are observed. The ECO should document the nature and magnitude of the non-compliance in a designated register, the actions taken to discontinue the non-compliance, the actions taken to mitigate its effects and the results of the actions. The non-compliance should be documented and reported to the Applicant in the monthly reports. These reports must be made available to the DEDEAT when requested.

8.4 DOCUMENT CONTROL

The Contractor is responsible for establishing a procedure for electronic document control. The document control procedure should comply with the following requirements:

- Documents must be identifiable by organisation, division, function, activity and contact person;
- Every document should identify the personnel and their position(s), who drafted and compiled the document(s), who reviewed and recommended approval, and who finally approved the document for distribution; and
- All documents should be dated, provided with a revision number and reference number, filed systematically, and retained for a five (5) year period.

The Contractor must ensure that documents are periodically reviewed and revised, where necessary, and that current versions are available at all locations where operations, essential to the functioning of the EMPr, are performed. All documents must be made available to the ECO and other independent external auditors.

9. MONITORING AND EVALUATION

The key to a successful EMPr is appropriate monitoring and review to ensure effective functioning of the EMPr and to identify and implement corrective measures in a timely manner. The overall monitoring of the implementation of the EMPr and compliance with the EA is the responsibility of the SFPO NPC. However, if the SFPO NPC appoints a Contractor to implement the project, then it is the responsibility of the Contractor, on behalf of the SFPO NPC, to implement the mitigation measures specified in the in the EMPr. The Contractor must appoint an ESO and the Proponent, an ECO, for the duration of the contract. The ESO must be site based and should be the responsible entity / person for implementing the environmental provisions of the construction contract. The ECO will be responsible for the monitoring, reviewing and verifying of compliance with the EMPr and the conditions of the EA by the Contractor. The monitoring protocol which must be adhered to for the proposed development is included in Table 9.1 below.

9.1 BASELINE DATA COLLECTION

Before construction commences, baseline data of the estuary will need to be collected. The objective of baseline data collection is to provide a statistically robust baseline data set that adequately describes the ambient environment as it stands prior to construction. This data set can be used for comparative purposes during the future phases of the project. The baseline data for estuary must be collected over a period of at least one year (once during the wet season).

<u>The following baseline data must be collected and reviewed by the relevant authority ***prior*** to construction:</u>

- ***Beach profiles:*** the modelling carried out on the beaches to the north of the proposed scheme and within the estuary suggested that no accelerated erosion will occur as a result of the construction of the groynes and the extraction of material from the estuary. However, to ensure this is monitored, baseline data must be collected.
- For the St Francis Bay beach and the beaches to the north, profile locations should be placed at the same locations that have been measured in the past (Advisian, 2020). The beach profiles on the northern beaches must start at the Kromme River mouth and extend northwards, for 250m. The results of the surveys will be compiled into a report which will include comment on the nature of the profiles, their build up/erosion and the likely causes for the observations.
- These measurements should also include the northern bank of the estuary. Estuary bank profiles, should be completed at regular spacing (minimum of 200 m apart) along the length of the estuary adjacent to the priority dredging areas and specifically adjacent to sensitive habitats.
- Both the beach and estuary profile surveys should be carried out once per quarter, for at least one calendar year prior to construction. This will determine the extent of "natural" erosion compared to anthropogenic influence (i.e. peak holiday season).
- The findings will be submitted to DEDEAT upon completion and prior to construction.
- Sediment contaminant testing: while it is anticipated that the sediment suitable for dredging is unlikely to contain harmful contaminants, testing of the sediment is required to establish this. Having collected data prior to construction, sediment testing during the dredging would allow comparison to a pre-dredge condition. It is anticipated that samples be taken from those areas to be dredged. A sample of surface and depth should be taken and analysed for *E. coli* and heavy metals. This is anticipated to be carried out by the dredging contractor periodically throughout the dredging process.

- ***Water quality:*** dredging activities may result in an increase of suspended sediment. In order to monitor the extent of the potential plume initial water quality (physico-chemical) parameters should be tested. Data can be collected from a multi-probe along a number of pre-defined locations within the estuary. The exact location and frequency will be determined following the confirmation of the dredging methodology by the preferred contractor.
- ***Ground truthing:*** Pre-construction distribution and percentage cover data of the salt-marsh and *Zostera* habitats will be collected using an appropriate scientific methodology (e.g. quadrat and fixed-point photography methods, or geo-referenced drone imagery). This should include all habitats deemed to be sensitive, adjacent to the proposed dredging area, with the identification of suitable control sites for both the salt-marsh and *Zostera* habitats. This should be completed and submitted to DEDEAT at least 1 year prior to construction. Following this initial data collection, ongoing monitoring requirements can be determined and implemented.

9.2 CONSTRUCTION AND OPERATIONAL PHASE MONTIORING PARAMETERS

<u>In addition to the monitoring and evaluation programme detailed in Table 9.1 below, the following should be included in the monitoring protocol as a minimum:</u>

- Beach profiles surveys will continue into the construction and operational phases with the frequency determined by the results of the pre-construction survey. A minimum of one year of quarterly beach profiles is recommended following the completion of the construction phase;
- Sediment contaminant testing must be carried out periodically during the construction period to ensure that contaminants are not entering or being released into the water column of the estuary. The frequency will be determined based on the risk identified through the analysis of the pre-construction baseline samples. The testing requirements will be developed in a monitoring plan prepared and presented to DEDEAT prior to construction starting and following confirmation of the dredging methodology;
- Water quality testing during dredging should be carried out regularly. The frequency will be determined by the duration of dredging for each Project Phase. However, it is important that monitoring occurs while the dredging activity is progressing. The monitoring locations will be determined by the location of the dredger and extend at intervals from the dredger (i.e. 50m, 100m, 150m) while dredging activity progresses. It is not necessary for this monitoring to be continuous but needs to provide data to describe the extent of suspended sediment during construction;
- Regular bathymetric surveys of the lower estuary area should be undertaken once dredging commences. It is likely that the contractor would carry out pre- and post-dredging surveys to calculate the volume of material transported. Monitoring of the bathymetry during maintenance dredging is also recommended. This monitoring data will provide valuable information on the sediment distribution, accumulation and transport within this dynamic estuarine system, which can be used to assess the volumes of sediment entering this flood-dominated system and any future modifications to the dredging scheme that need to be implemented. The monitoring surveys could be carried out using a fish finder from a ski boat with reference to a fixed datum. However, it should be provided to a suitably qualified and experienced ecological/environmental expert, in a format that can be easily interpreted, to be able to verify whether the impacts identified in the EIR have occurred. It is recommended that this monitoring takes place at least annually;
- A detailed log of sediment discharge quantities must be maintained by the dredging contractor in order to track the volume of sediment that is removed from the estuary;

- Monitoring the sensitive habitats in close proximity to the dredging activities should be carried out during construction and operation to determine die-back as a result of smothering, dredging and loss of habitat. Should these areas be determined to be reducing, correction measures must be implemented. Corrective measures could include modification to the dredging method and timing of the works and/or alteration of the proposed dredging areas. This should be carried out by a suitably qualified specialist with the emphasis being on the ability to accurately replicate the methodology activity carried out during the construction phase. It is recommended that annual post-construction monitoring be established for those sensitive habitats; and
- An invasive species monitoring, control and eradication plan for land/activities under the control of the Proponent should be developed as part of the Construction EMPr in accordance with CARA.

The outcome of the pre-construction, construction and operation monitoring must be compiled into an annual monitoring report. The report must include sections on the comparison of the construction and operation surveys against the baseline (i.e. pre-construction). In addition, there must be comment on whether the observations are in line with the impacts identified during the EIR. Should the impacts observed through the monitoring differ from that of the EIR and particularly if adverse, additional mitigation measures must be implemented.

The operational phase of the proposed development is predicted to continue for perpetuity. Therefore, it is recommended that adaptive management plans are developed for the estuary and northern beaches and reviewed regularly based on the findings of the monitoring. Adaptive management is a structured approach to decision making and is commonly used in scenarios involving dynamic natural environments. The plans would be compiled to set out the possible management measures required should particular observations be made. For example: if erosion to the banks of the estuary was observed to be accelerating as a result of the dredging then an appropriate management measure may be to move the dredging activity, or replace some of the sediment in the area, or extend the time period between dredging operations. These plans can only be developed following the appointment of a contractor and confirmation of the detailed dredging and nourishment procedures.

It is recommended that an ECO is appointed to conduct monthly monitoring during construction. Construction is considered to be discreet activities associated with the dredging, nourishment and groyne construction for each Project Phase. See Section 4 for detail on the components for each phase.

Subsequent monitoring, as outlined above, must be carried out by a suitably qualified expert. It is important that this expert is appointed and their appointment confirmed with the competent authority.

Table 9.1 below lists the impact management actions (mitigation measures) for the proposed development. Each impact management action must undergo a monitoring method (e.g. visual inspections), at a specific frequency (e.g. daily), by a specific role player (e.g. the ECO), at a particular phase or at particular phases of the development (e.g. construction) and will need to be reported via a specific reporting mechanism (e.g. an ECO audit report). Certain mitigation measures will only be relevant during certain phases of the development, while others will remain applicable in perpetuity. In some cases, the FBDM will be required to appoint an external service provider to oversee the management actions where the FBDM is the responsible entity (e.g. water quality monitoring).

Table 9.1: Monitoring and Evaluation Programme for the proposed St Francis Bay Coastal Protection Scheme.

	Aspect/Impact	Mitigation Measures	Mitigation Target/Objective	KPI	Monitoring Method, Frequency and Responsibility	Reporting Output	Reporting Frequency (D-W-M- Q-A-AR)
Construction Phase							
1	Estuarine Physical Characteristics	➢ Give preference to extraction from primary areas as far as possible.	➢ No damage to infrastructure, estuary banks, sensitive habitats as a result of altered hydrodynamics.	➢ Method Statements relating to Construction Procedures, Timing and location of activities, and relevant specifications, to be compiled by the Contractor and submitted by to the ECO for approval prior to the commencement of construction activity.	➢ Daily visual inspections by the ESO, and monthly inspections by the ECO, to observe and confirm whether any erosion is occurring. ➢ Beach survey data to be included in monthly reporting with comment on whether the data suggests significant erosion. ➢ Should significant erosion be observed and considered to be requiring specialist expertise and input, the ESO and/or ECO will communicate the need for this to the Resident Engineer (RE) for actioning. Any actions will be detailed in the adaptive management plan to be approved by the competent authority prior to construction commencing.	➢ Incident Reporting (including relevant specialist inputs as is necessary) ➢ Monthly ESO reports ➢ Monthly ECO reports ➢ Construction Close-Out Report	➢ Daily (incidents) ➢ Monthly ➢ As Required
2	Surface water Pollution (relevant to sand sourcing along the Kromme River)	➢ Daily checks should be done for leaks/spillages; ➢ Spill kits and drip trays must be readily available; and ➢ It is recommended that ready mixed cement is used. No cement mixing close to the shore or estuary must be permitted.	➢ No hydrocarbon spills or leaks of any nature or volume in/within 100m of the river or beachfront over the construction period. ➢ Spills must be limited to construction camp/workshop areas. ➢ No mixing of concrete outside of the construction camp	➢ Number of spills (type, substance location) within 100m of the river or beachfront during the construction phase. ➢ Presence and number of spill kits observable on site. ➢ Number of personnel trained in the use of spill kits (training attendance registers are required). ➢ Number of reported incidents of concrete mixing outside of the construction camp. ➢ Method statement relating to pollution control to be compiled and submitted by the Contractor to the ECO for approval prior to the commencement of construction activity.	➢ Daily site inspections by the ESO and Contractor personnel of areas that are potentially at risk of spills or leaks. ➢ All spill/leak events to be subject to Incident Reporting and a description of the corrective and close-out actions undertaken by the ESO/ Contractor.	➢ Incident Reporting ➢ Weekly and Monthly ESO reports ➢ Monthly ECO reports ➢ Construction Close-Out Report	➢ Daily (incidents) ➢ Weekly ➢ Monthly
3	Estuarine Ecology – Flora and Flora	➢ Limit dredging in habitats where high biodiversity / abundance of benthic species exist; ➢ Where possible, sediment should be taken from areas where there is low abundance of estuarine vegetation. ➢ Sensitive habitats (including the salt marsh areas) will be identified and avoided where possible; ➢ Avoid working in areas where bird species may nest. Especially during the breeding season; and ➢ Associated equipment will be placed in areas of low sensitivity only;	➢ No infringement on identified sensitive areas by either dredging or other associated construction activities for the duration thereof. This includes construction camps and designated material stockpile areas.	➢ Production of final construction camp and targeted dredging area plans that are overlaid on known areas of sensitivity (Annexure 4) prior to the commencement of construction activity. ➢ Number and physical extent of disturbances to be known and identified sensitive areas during the construction phase.	➢ Daily inspections by the ESO, and monthly inspections by the ECO, to observe and confirm whether disturbances have occurred. ➢ All sensitive area disturbance events to be subject to Incident Reporting and communicated to the relevant authorities if necessary or required.	➢ Incident Reporting ➢ Weekly and Monthly ESO reports ➢ Monthly ECO reports ➢ Construction Close-Out Report	➢ Daily (incidents) ➢ Weekly ➢ Monthly
4	Dune Ecology	➢ Do not allow any laydown areas within the sensitive foredune area; ➢ Limit access across the foredunes to four access points in total, where each groyne will be located. The access point where the sand spit starts (possibly at the Aldabara Road parking area) will need to serve the first two groynes. The second two will require access from Peter Crescent and at George road; and the final one at the Ralph Road parking area. These parking areas must also be used as laydown areas; ➢ Limit pedestrian access to these same points; and ➢ Disallow workers from accessing the foredune areas.	➢ No laydown areas to be established within sensitive foredunes areas. ➢ Restrict access over the foredunes to only four (4) access points. ➢ No access within sensitive foredunes areas, whether by pedestrians, construction staff or plant, to be permitted outside of the four (4) predetermined access routes.	➢ Establishment of laydown areas and access route plans prior to the commencement of construction. ➢ Demarcation of access routes prior to construction to prevent encroachment on sensitive foredune areas. ➢ Physical extent of dune area anticipated to be disturbed to be determined. ➢ Proof of employee, and any third party, attendance of environmental awareness training.	➢ Daily inspections by the ESO, and monthly inspections by the ECO, to observe and confirm whether disturbances to sensitive foredune areas have occurred. ➢ All sensitive area disturbance events to be subject to Incident Reporting and communicated to the relevant authorities if necessary or required.	➢ Incident Reporting ➢ Weekly and Monthly ESO reports ➢ Monthly ECO reports ➢ Construction Close-Out Report	➢ Daily (incidents) ➢ Monthly
5	Marine Ecology – Fauna and Flora	➢ The placement of sand and / or rock material on or near the nearshore reef structures may result in localised smothering, leading to a potential loss of individuals and habitat; and ➢ The development of groyne structures of rock material may provide additional hard substrate for benthic species.	➢ Alter the location of the groynes to avoid known and exposed reef structures.	➢ Limit the footprint of the works to those proposed (i.e. ensure that groynes to not exceed design footprint)	➢ Daily monitoring of construction activities in the marine environment by the ESO and Contractor. ➢ Monthly monitoring by ECO.	➢ Weekly ESO reports ➢ Monthly ECO reports	➢ Daily (incidents) ➢ Monthly ➢ As required
6	Local Amenity – Estuary	➢ Reduce, where possible, the extraction of material during times of peak tourist activity; ➢ Ensure that signage is clear, and areas are made safe during excavation / dredging. ➢ Reduce dredging activity in popular bait digging areas (i.e. sand bank near the mouth of the estuary) during peak tourist season; ➢ Ensure areas of the sandbanks are available to bait diggers during construction;	➢ No dredging during peak tourist season. ➢ Avoidance of popular bait digging areas. ➢ No safety hazards to be created as a consequence of dredging. ➢ Clear signage indicating dredging/construction activities within affected areas. ➢ All bait diggers and regular users of the estuary to be informed and up to date	➢ Physical extent of disturbance and amount of sand required to be determined prior to the construction phase. ➢ Comprehensive monitoring and recording of dredging during construction. ➢ Number of safety incidents or risks reported to the Contractor/ECO. ➢ Number of signs or notice boards erected within the affected areas.	➢ Daily visual inspections by the ESO, and monthly inspections by the ECO, to observe and confirm areas under excavation/dredging. ➢ Monthly monitoring by a Health and Safety Agent. ➢ All health and safety risks or issues to be subject to Incident Reporting and communicated to the relevant authorities if necessary or required.	➢ Incident Reporting ➢ Monthly HSE Reports ➢ Monthly ECO Reports ➢ Construction Close Out Report	➢ Daily (incidents) ➢ Monthly ➢ As required.

Aspect/Impact		Mitigation Measures	Mitigation Target/Objective	KPI	Monitoring Method, Frequency and Responsibility	Reporting Output	Reporting Frequency (D-W-M- Q-A-AR)
		➢ Dredging from the channels initially will ensure that sand bank habitat is maintained for a longer period; and ➢ Inform bait diggers of construction schedule to allow digging in areas that are due to be dredged.	regarding dredging activities, including details on the areas to be dredged.				
7	Local Amenity – beach	➢ Reduce, where possible, the placement material during times of peak tourist activity; ➢ Ensure that signage is clear, and areas are made safe during placement and levelling; and ➢ Ensure that newly nourished areas are safe for use.	➢ No placement of material during peak tourist season. ➢ No safety hazards to be created as a consequence of beach nourishment. ➢ Clear signage indicating nourishment /construction activities within affected areas. ➢ All regular users of the beach and frontage to be informed and up to date regarding dredging and beach nourishment activities, including details on the areas to be worked in/on.	➢ Physical extent of disturbance and amount of sand required to be determined prior to the construction phase. ➢ Comprehensive monitoring and recording of sand placed on the beach during construction. ➢ Number of safety incidents and/or risks reported to the Contractor/ECO. ➢ Number of signs or notice boards erected within the affected areas.	➢ Daily visual inspections by the ESO, and monthly inspections by the ECO, to observe and confirm areas under excavation/dredging. ➢ Monthly monitoring by a Health and Safety Agent. ➢ All health and safety risks or issues to be subject to Incident Reporting and communicated to the relevant authorities if necessary or required.	➢ Incident Reporting ➢ Monthly HSE Reports ➢ Monthly ECO Reports ➢ Construction Close Out Report	➢ Daily (incidents) ➢ Monthly ➢ As required.
8	Loss of Archaeological and/or Cultural Heritage Resources (relevant to sand sourcing along the Kromme River)	➢ Should any archaeological or cultural sites or objects be located during the construction of the proposed project, it should immediately be reported to the National Heritage Council and the ECPHRA.); and ➢ All construction site staff should be briefed to immediately report any sites or objects of heritage significance located during the construction phase. In the event of finding what appears to be an archaeological site or a cultural and/or historic site or object, work within that area should be stopped until a qualified archaeologist or historian can examine the item or find. ➢ A 50 m buffer around the river mouth should be implemented. This buffer includes the beach and coastal dune strips around the river mouth which could potentially hold the washed-up remains of wreckage, artefacts as well as possible survivor camp remnants.	➢ No damage to or loss of archaeological/cultural heritage sites or objects. ➢ All staff educated and informed of potential archaeological or cultural heritage sites or objects.	➢ Proof of employee, and any third party, attendance of environmental awareness training which includes information on possible archaeological/cultural heritage remains within the area. ➢ Number of archaeological/cultural heritage remains (if any) unearth during excavation and/or dredging. ➢ Limited dredging within the buffer zone identified.	➢ Daily visual inspections by the ESO, and monthly inspections by the ECO, to observe and confirm whether any archaeological/cultural heritage remains are present on site. ➢ Any objects or sites of cultural heritage significance to be reported to ECPHRA. ➢ A suitably qualified MUCH specialist should be appointed during initial stages of the development in order to provide training to the assigned project ECO. ➢ Bi-weekly monitoring and reporting to SAHRA MUCH Unit by an informed and trained Environmental Control Officer (ECO) of the dredging of target areas P1 and S1 and the placing of the groyne and revetment.	➢ Any findings reported to ECPHRA, SAHRA MUCH ➢ Bi-weekly and Monthly ECO Reports ➢ Construction Close Out Report	➢ Monthly ➢ As required.
9	Loss of Archaeological and/or Cultural Heritage Resources (relevant to the beach nourishment)	➢ Excavations must be monitored, either by a palaeontologist or by an ECO trained by and in correspondence with a palaeontologist. This should be discussed between the palaeontologist, ECO and site engineer prior to the commencement of work.					
10	Solid Waste Pollution (relevant to all project aspects)	➢ Construction material should be reused or recycled where possible; ➢ Waste that cannot be reused or recycled should be disposed of in the correct manner at the nearest registered waste disposal site; ➢ Any hazardous materials (e.g. paint, fuel, oil) must be disposed of immediately and in the correct manner; ➢ General good house-keeping should be practiced on site; and ➢ If rubble is stored onsite it should be stored on designated portions of land. Designated areas for storage of rubble should be set aside at the onset of construction.	➢ No pollution of the surrounding natural environment. ➢ Correct storage and disposal of solid waste. ➢ No incorrect disposal of hazardous waste. ➢ Correct storage and disposal of hazardous waste on site. ➢ Appoint a hazardous waste disposal company (e.g. Enviro Serve) to removed hazardous waste from site. ➢ Maintain proof of solid and hazardous waste disposal on site, preferably within an environmental site file. ➢ No disposal of recyclable or reusable solid waste. ➢ Designated laydown/stockpile areas within the construction site.	➢ Number of waste disposal bins within the construction site. ➢ Contract of appointment of a solid and hazardous waste removal company. ➢ Number of bins available for recycled material within the construction site. ➢ Contract of appointment of recycling company to collect recyclable and reusable material from site. ➢ Proof of employee, and any third party, attendance of environmental awareness training which must include details pollution and the consequences of incorrect waste disposal. ➢ Penalties or fines for employees who do not adhere to the correct procedure for waste disposal. ➢ Method statement relating to pollution control to be compiled and submitted by the Contractor to the ECO. ➢ Method statement relating to Solid Waste Management and Hazardous Material Management to be compiled and submitted by the Contractor to the ECO.	➢ Daily visual inspections of the site by the ESO, and monthly inspections by the ECO, to observe general housekeeping conditions and litter on site. ➢ Monthly auditing of environmental file and waste disposal slips by the ECO. ➢ Any reports of complaints of litter emanating from construction activities to recorded by the ESO in a complaints register and presented to the ECO during the monthly site audit.	➢ Complaints register ➢ Daily record of waste disposal ➢ Weekly and Monthly ESO reports ➢ Monthly ECO reports ➢ Construction Close-Out Report	➢ Weekly ➢ Monthly ➢ As required.
11	Dust Pollution (implementation of coastal protection infrastructure)	➢ Construction should preferably cease during periods of high winds; ➢ Exposed surfaces should be sprayed down with water where required to avoid dust emissions; and ➢ Vehicles transporting material such as sand should remain at a speed limit of 30km/h and, if required, cover their loads with a tarpaulin to avoid dust emissions.	➢ Prevent dust pollution, as far as practically possible. ➢ Cease construction/dredging/excavation during windy conditions. ➢ Spray down or cover exposed surfaces during windy conditions. ➢ Delivery or transport vehicles not to exceed recommended speed limits.	➢ Number of complaints submitted relevant to dust impacts. ➢ Signage displaying speed restrictions erected on site. ➢ Presence, number and use of tarpaulin(s) available at the site camp and material stockpile areas. ➢ Method statements relating to Site Dust Management compiled and submitted by the Contractor to the ECO.	➢ Daily visual inspections of the site by the ESO, and monthly inspections by the ECO, to observe potential dust pollution. ➢ Any complaints emanating from dust pollution to be recorded by the ESO in a complaints register which must be presented to the ECO during the monthly site audit.	➢ Complaints register ➢ Monthly ECO reports	➢ Daily (incidents) ➢ Monthly ➢ As required.

	Aspect/Impact	Mitigation Measures	Mitigation Target/Objective	KPI	Monitoring Method, Frequency and Responsibility	Reporting Output	Reporting Frequency (D-W-M- Q-A-AR)
			➢ Loads of transport vehicles to be covered during transit.				
12	Traffic (relevant to sand sourcing should the option of truck transportation be implemented) and vehicle movements related to groyne and revetment construction and material transportation	➢ Appropriate warning signs must be erected, in accordance with the requirements of the District Road Engineer; ➢ Vehicles must be roadworthy and serviced and must abide by the standard traffic laws; ➢ Any abnormal Loads must be approved with the traffic authorities and must comply with any conditions imposed by the authorities; ➢ The contractor must employ flag staff if deemed necessary in order to prevent accidents; ➢ Speed limits on site must not exceed 30km/h and the speed limits along the public roads must be adhered to at all times; and ➢ Manage the travelling times of the delivery trucks so as to allow them to depart and arrive at spaced out time intervals, thus reducing the intensity of traffic and avoiding the formation of convoys of heavy vehicles.	➢ Erect appropriate warning signs and speed restrictions on affected roads. ➢ No congestion on public or gravel roads. ➢ No road accidents. ➢ Maintain and service vehicles regularly. ➢ No exceedances of speed limits. ➢ No transport or delivery of unauthorised abnormal loads. ➢ No transport or delivery outside of designated transport times.	➢ Number of complaints relating to traffic congestion. ➢ Number of speeding fines issued to contractor vehicles. ➢ Number of road accidents involving contractor vehicles. ➢ Number of traffic/road safety signs erected around work areas of frequent or regular vehicle movements. ➢ Daily records for vehicle checks and maintenance thereof recorded in a dedicated vehicle maintenance register. ➢ Number of flag staff employed. ➢ Method statements compiled by the Contractor relating to the transportation of the equipment to and from site.	➢ Daily visual inspections of vehicles and recording of vehicle maintenance and servicing in onsite file by ESO/Contractor. ➢ Daily visual inspection of signage by ESO/Contractor. ➢ Constant monitoring of vehicle speeds during transit by ESO/Contractor. ➢ Any complaints emanating from traffic congestion, speeding, etc, to be recorded by the ESO in a complaints register which must be presented to the ECO during the monthly site audit.	➢ Complaints register. ➢ Daily vehicle inspections. ➢ Monthly ECO reports. ➢ Construction Close-Out Report.	➢ Daily ➢ Weekly ➢ Monthly ➢ As required.
13	Noise Disturbance (relevant to all project aspects)	➢ All construction vehicles and equipment to be properly serviced in order to meet the necessary noise level requirements; ➢ Restriction of work to daylight hours where possible; ➢ Restriction of any unnecessary noise e.g. portable radios, vehicle radios, whistles etc.; and ➢ Machinery should be fitted with the required mufflers, and notice given to surrounding residents prior to the commencement of construction.	➢ No unnecessary noise emanating from construction equipment/activities. ➢ Noise levels to be within acceptable standards of SABS 1200A Sub-Clause 4.1 regarding 'built-up' areas. ➢ Appropriate directional and intensity settings applied to all hooters and sirens. ➢ No work after daylight hours. ➢ Implementation of municipal by-laws relating to noise.	➢ Method statements relating Noise Management compiled and submitted by the Contractor to the ECO. ➢ Number of complaints emanating from noise pollution.	➢ Any complaints emanating from noise disturbances to be recorded by the ESO in a complaints register which must be presented to the ECO during the monthly site audit.	➢ Complaints register. ➢ Daily vehicle and noise generating equipment inspections. ➢ Monthly ECO reports.	➢ Daily (incidents) ➢ Weekly ➢ Monthly ➢ As required.
14	Employment Creation and Economic Benefits	➢ As far as possible, local labour should be used during construction; and ➢ Purchase materials locally, where possible, in order to support the local communities.	➢ Creation of employment for local labourers. ➢ No outsourcing of labour. ➢ Secure local suppliers for materials.	➢ Number of individuals employed. ➢ Value of local goods and services spends over the construction period.	➢ Monthly monitoring of these KPI by the ECO.	➢ Monthly ECO reports. ➢ Construction Close-Out Report.	➢ Monthly ➢ As required
				Operational Phase			
15	Estuarine Physical Characteristics	➢ KJRC are custodians mandated to manage vessel activity on the Kromme River. It is important that the committee take responsibility for the management of vessel use on the estuary; and ➢ Reduce speed of vessels in sensitive areas of the estuary.	➢ No infringement on identified sensitive areas (i.e. salt-marsh) as a result of vessel activity. ➢ Signage indicating sensitive areas.	➢ Number of warning and speed signs erected within sensitive areas. ➢ Penalties for those in breach of local river regulations. ➢ No loss/damage to the physical extent of the sensitive areas that is deemed outside of natural variation.	➢ Quarterly monitoring by ECO within the first year of operation.	➢ Quarterly ECO audits ➢ KJRC to report on management activities during their regular meetings and AGM and provide reports to Kouga Municipality as required.	➢ Quarterly; and ➢ As required by KJRC, Kouga Municipality.
16	Dune Ecology	➢ None Required.	➢ Increased width of beach. ➢ Restoration of previously eroded/lost dune habitats.	➢ Physical extent of beach width expansion.	➢ Quarterly monitoring by ECO within the first year of operation.	➢ Quarterly ECO audits	➢ Quarterly ➢ As required
17	Marine Hydrodynamics	➢ Place sand material immediately north of the northern most groyne to act as sacrificial material; ➢ The scheme will not result in significant erosion to the northern bank of the Kromme River mouth and the northern beaches; ➢ The scheme will be designed to maintain the longshore sediment transport; and ➢ Ensure that the adaptive management plan is developed to recognise and mitigate for any accelerated erosion.	➢ No significant downstream erosion of the northern beaches as a consequence of groyne construction. ➢ No significant adverse alternation of marine hydrodynamics and long-shore drift and sediment transport. ➢ Compilation and availability of Adaptive Management Plan.	➢ Physical extent of disturbance or volume of sand lost from northern beaches. ➢ As defined by the Adaptive Management Plan.	➢ Quarterly monitoring by ECO within the first year of operation.	➢ Quarterly ECO audits	➢ Quarterly ➢ As required
18	Local Amenity – Estuary	➢ The extraction of sediment from the navigation channels in the estuary will allow vessels access during all tidal cycles. This will improve safety and increase the recreational use of the estuary ➢ The Kromme Estuary supports many recreational activities. As a result, tourism is viewed as an important income generator in the area.	➢ Increased depth and width of navigation channels in the estuary. ➢ Increased access and recreational use of the Kromme River Estuary. ➢ Increased tourism.	➢ Physical width and depth of the navigation/water channel. ➢ Number of recreational users.	➢ Quarterly monitoring by ECO within the first year of operation.	➢ Quarterly ECO audits	➢ Quarterly ➢ As required
19	Local Amenity – beach	➢ Ensure that, where possible, groynes are maintained as designed.	➢ Increased number of surf breaks. ➢ Increased beach width.	➢ Physical increase in the width of the beach. ➢ Number of additional wave breaks.	➢ Quarterly monitoring by ECO within the first year of operation.	➢ Complaints register ➢ Quarterly ECO audits	➢ Quarterly ➢ As required

	Aspect/Impact	Mitigation Measures	Mitigation Target/Objective	KPI	Monitoring Method, Frequency and Responsibility	Reporting Output	Reporting Frequency (D-W-M- Q-A-AR)
			➢ No further erosion of beaches.	➢ Increased number of tourists. ➢ Feedback from local surfers.	➢ Any complaints relating to changes in wave regime/wave breaks to be reported to the ECO, the SFPO NPCV, and the Kouga LM.		
20	Solid Waste Pollution	➢ Waste that cannot be reused or recycled should be disposed of in the correct manner at the nearest registered waste disposal site; ➢ Any hazardous materials (e.g. paint, fuel, oil) must be disposed of immediately and in the correct manner; and ➢ General good house-keeping should be practiced during maintenance operations.	➢ No pollution of the surrounding environment due to maintenance activities. ➢ Correct disposal of solid waste arising from maintenance activities.	➢ Number of waste bins available during maintenance activities. ➢ Waste disposal slips from a registered landfill. ➢ Number of complaints emanating from pollution due to maintenance activities.	➢ Daily inspections by appointed maintenance Contractor.	➢ Quarterly ECO audits	➢ Quarterly ➢ As required.
21	Public health and safety	➢ Ensure that appropriate and visible signage is erected warning the public of the dangers of climbing the structures and the rip currents; and ➢ Local life guards must ensure that swimming areas are clearly demarcated.	➢ No use/access of groynes by the public. ➢ Adequate safety and warning signage displayed on the beach near groyne structures. ➢ Appointment and presence of local life guards.	➢ Number of safety incidents or risks reported to the ECO/Developer. ➢ Number of safety boards and signs erected on and around the site.	➢ Quarterly monitoring by ECO within the first year of operation.	➢ Quarterly ECO audits	➢ Quarterly ➢ As required

10. ENVIRONMENTAL AWARENESS

10.1 ENVIRONMENTAL AWARENESS TRAINING

The Contractors must ensure that their employees and any third party, who carries out all or part of the Contractors' obligations, is adequately trained with regard to the implementation of the EMPr and the general environmental legal requirements and obligations.

Environment and health awareness training programmes should be targeted at three (3) distinct levels of employment, i.e. the executive, middle management and labour. Environmental awareness training programmes should contain the following information:

- The names, positions and responsibilities of personnel to be trained;
- The framework for appropriate training plans;
- The summarised content of each training course; and
- A schedule for the presentation of the training courses.

The ECO must ensure that records of all training interventions are kept in accordance with the record keeping and documentation control requirements as set out in this EMPr. The training records must verify each of the targeted personnel's training experience.

The Applicant must ensure that adequate environmental training takes place. All employees must be given an induction presentation on environmental awareness and the content of the EMPr. The presentation should be conducted in the language of the employees to ensure it is understood. The environmental training must, as a minimum, include the following:

- The importance of conformance with all environmental policies;
- The environmental impacts, actual or potential, of their work activities;
- The environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirement of the proponent / contractor's environmental management systems, including emergency preparedness and response requirements;
- The potential consequences of departure from specified operating procedures;
- The mitigation measures required to be implemented when carrying out their work activities;
- Environmental legal requirements and obligations;
- Details regarding floral and faunal Species of Conservation Concern and protected species, and the procedures to be followed should these be encountered during the construction;
- The importance of not littering;
- The importance of using supplied ablution facilities;
- The need to use water sparingly;
- Details of and encouragement to minimise the production of waste and re-use, recover and recycle waste where possible; and the
- Details regarding archaeological and/or historical sites which may be unearthed during construction and the procedures to be followed should these be encountered.

Please refer to Appendix 2 for recommended Environmental Education Material.

10.2 MONITORING OF ENVIRONMENTAL TRAINING

The Contractor must monitor the performance of construction workers to ensure that the points relayed during their induction have been properly understood and are being followed. If necessary, the ECO and/or a translator should be called to the site to further explain aspects of environmental or social behaviour that are unclear. Toolbox talks are recommended.

11. CLOSURE PLANNING

The Contractor must clear and clean the site and ensure that all equipment and residual materials, not forming part of the permanent works, are removed from site before issuing the completion certificate or as otherwise agreed.

11.1 POST-CONSTRUCTION AUDIT

A post-construction audit must be carried out and submitted to DEDEAT at the expense of the Applicant. Objectives should be to audit compliances with the key components of the EMPr, to identify main areas requiring attention and recommend priority actions. The Post-Construction Audit (or Close-Out report) should be submitted to DEDEAT within 3 months of completion of the development and/or Project Phase in this case and prior to the operational phase.

Note that this EMPr also recommends the appointment of an ECO / suitably qualified expert to be responsible for the reporting as specified in the Monitoring Plan and Adaptive Management Plan that still require development. This is to ensure that all commitments are met and that suitable monitoring continues during the operational phase.

Results of the audits should inform changes required to the specifications of the EMPr or additional specifications to deal with any environmental issues which arise on site and have not been dealt with in the current document.

11.2 GENERAL REVIEW OF EMPR

The EMPr will be reviewed by the ECO on an on-going basis. Based on observations during site inspections and issues raised at site meetings, the ECO will determine whether any procedures require modification to improve the efficiency and applicability of the EMPr on site.

Any such changes or updates will be registered in the ECO's record, as well as being included as an annexure to this document. Annexures of this nature must be distributed to all relevant parties.

12. CONCLUSIONS

All foreseeable actions and potential mitigations and/or management actions have been (to date) and should be contained in this document. The EMPr should be seen as a day-to-day management document. The EMPr sets out the environmental and social standards, which would be required to minimise the negative impacts and maximise the positive benefits of the St Francis Bay Coastal Protection Scheme. The EMPr could therefore change daily, and, if managed correctly, lead to successful phases of development.

It should be noted that each Project Phase will have a discreet construction and operation phase and that Project Phases may overlap.

The importance of the development of the Construction Phase EMPlan, the Environmental Monitoring Plans and Adaptive Management Plan for the estuary should not be underestimated and needs to form part of the environmental management suite of documents. These need to be prepared and approved by the competent authority prior to construction commencing.

All attempts should be made to have this EMPr available, as part of any tender documentation, so that the Contractors are made aware of the potential cost and timing implications needed to fulfil the implementation of the EMPr, thus adequately costing for these.

ANNEXURE 1: METHOD STATEMENTS

METHOD STATEMENT

CONTRACT:…………………………………………………….. DATE:……………….

PROPOSED ACTIVITY (give title of method statement and reference number from the EMPr):

WHAT WORK IS TO BE UNDERTAKEN (give a brief description of the works):

WHERE ARE THE WORKS TO BE UNDERTAKEN (where possible, provide an annotated plan and a full description of the extent of the works):

Start Date:

End Date:

START AND END DATE OF THE WORKS FOR WHICH THE METHOD STATEMENT IS REQUIRED:

HOW ARE THE WORKS TO BE UNDERTAKEN (provide as much detail as possible, including annotated sketches and plans where possible):

* Note: please attach extra pages if more space is required

DECLARATIONS

1) ENVIRONMENTAL CONTROL OFFICER

The work described in this Method Statement, if carried out according to the methodology described, is satisfactorily mitigated to prevent avoidable environmental harm:

_____________________ _____________________

(Signed) (Print name)

Dated:._____________________

2) PERSON UNDERTAKING THE WORKS

I understand the contents of this Method Statement and the scope of the works required of me. I further understand that this Method Statement may be amended on application to other signatories and that the ECO will audit my compliance with the contents of this Method Statement

_____________________ _____________________

(Signed) (Print name)

Dated: _____________________

ANNEXURE 2: BASIC ENVIRONMENTAL EDUCATION COURSE

http://www.webweaver.nu/clipart/environmental.shtml

Reasons why should we look after the environment

- We have a right to a clean environment
- A clean environment is essential to healthy living
- All our basic needs come from the environment
- A contract has been signed – development vs the environment
- Penalties / fines could be issued

How to look after the environment

- Report issues
- Teamwork
- Follow the set rules and guidelines (EA, EMPr, Method statements etc.)
- Conserve, reuse and recycle

Tips and Guidelines

- Workers and equipment should not be allowed outside demarcated areas
- No swimming or polluting of water bodies allowed
- No damage / disturbance to vegetation or water bodies without consent / permits
- No disturbance allowed in no-go areas
- No hunting of animals
- Report all fires
- No burning or burying of waste
- No smoking near hazardous materials
- Training on fire fighting equipment
- Hazardous materials to be stored in designated and bunded areas
- Spill kits and drip trays a must
- Report all spills
- Control dust and Noise
- Maintain construction vehicles
- Availability and maintenance of sanitation facilities

Tips and Guidelines

- Only eat is designated areas
- Do not litter
- Vehicles to remain on approved tracks and adhere to speed limit
- Ensure emergency phone numbers are available
- Ensure PPE is worn
- Report fires, leaks and injuries
- Ask if unsure

ANNEXURE 3: CURRICULM VITAES

GREGORY SHAW
Curriculum Vitae

CONTACT DETAILS

Name of Company	**CES**
Designation	Grahamstown Branch
Profession	Principal Environmental Consultant
Years with firm	3 Years
E-mail	g.shaw@csenet.co.za
Office number	+27 (0)46 622 2364
Nationality	South African
Professional Body	SACNASP, South African Council for Natural Scientific Profession, Professional (Pending)

Key areas of expertise

- Marine Ecology
- Environmental and Social Impact Assessment (ESIA)
- Environmental Management and Monitoring
- Project Management

PROFILE

Mr Gregory Shaw

Greg is a principal environmental consultant with more than 10 years' experience, who has carried out ESIAs for a variety of infrastructure developments in Africa and Europe. His experience is with development projects where there is creation or modification of infrastructure, via capital works and complex logistics.

He is able to engage with the full portfolio of diverse stakeholder groups and regulators via meetings, written material, face-to-face workshops, presentation events, negotiation and discussion to achieve mutually agreeable mitigation measures and solutions. As part of many of the ESIAs he has been involved in or managed he has been responsible for the development and execution of environmental surveys (and subsequent monitoring programmes), sub-contractor management (including contracting), report writing and project management. In addition, he has been responsible for developing and auditing plans associated with managing large infrastructure projects e.g. Environmental Management Plans (EMP).

Greg forms strong relationships and ensure that the team works together in an integrated way towards the clear common goal, making effective use of time and resources.

EMPLOYMENT EXPERIENCE

November 2016 - Present:
Principal Consultant (EOH Coastal & Environmental Services)
Grahamstown, South Africa

January 2008 – October 2016:
Senior Consultant (Royal HaskoningDHV)
Peterborough, United Kingdom

January 2004 – January 2007:
Part-time consultant (Public Process Consultants)
Port Elizabeth, South Africa

ACADEMIC QUALIFICATIONS

Nelson Mandela Metropolitan University, Port Elizabeth
MSc (Botany)
2005 – 2007

Nelson Mandela Metropolitan University, Port Elizabeth
BSc (Hons) (Environmental Management)
2004

University of Port Elizabeth, Port Elizabeth
BSc (Natural Sciences)
2000 - 2003

COURSES

- 2013 Royal HaskoningDHV Accelerated Development Programme
- 2012 First Aid
- 2012 Handling Conflict
- 2011 Client Relationships
- 2011 Financial Management
- 2010 Report Writing
- 2010 Project Management
- 2010 Effective Communication
- 2010 Knowing Your Business
- 2010 Phase I Ecological Surveying Techniques and Taxonomy
- 2009 CIWEM Structured Training
- 2009 Project Management
- 2008 Sustainable Construction
- 2006 South African Association of Botanists - Annual Seminar
- 2005 Resource Directed Measures
- 2005 Training in Integrated Environmental Management
- 2005 Integrated Water Resource Management Workshop

CONSULTING EXPERIENCE

Environmental consulting experience as project manager or team member is broad and covers a number of key industry sectors (ports, nuclear, renewable energy). The majority of the international ESIAs were conducted in accordance with international standards including the IFC Performance Standards and have been reviewed by international Development Finance Institutions.

South Africa

- Nirove Paint Stripping Facility [Project manager]
- Wison Coal to Urea EIA [Project manager]
- St Francis Bay EIA [Project Manager, Marine specialist]
- EOH Powerstation Feasibility Assessment [Project manager]
- Richard's Bay breakwater refurbishment [Marine specialist]
- KBK Engineers (Sanral) Basic Assessment [Project manager]
- Bayview Wind Energy Facility [Project director]
- Rushmere Noach Attorneys [Project manager and marine specialist]
- TNPA East London Quay 3 Assessment [Environmental specialist]
- TNPA Ballast Water Management Plan [Environmental specialist]
- Fairwood Estate Environmental Authorisation [ESMP author]
- Environmental Scoping Report cc. Erf 2387, Port Elizabeth. Baobab Agencies. [Environmental specialist].
- Proposed Hybrid Residential Development Scoping Report, Port Elizabeth. [Environmental specialist].
- Ingleside Development, Port Elizabeth. [Specialist Review].
- Port of Ngqura Marine Biomonitoring Programme. Coega Development Corporation. [Surveyor / research assistant].
- Construction and Operation of the Deepwater Port of Ngqura EIA. Coega Development Corporation. [Specialist review].

Africa

- Kenmare Mangrove Baseline Assessment (Mozambique) [Lead surveyor]
- Sphinx Energy Solar PV Facilities in Guider & Maroua (Cameroon) [Project manager]
- Olam Cocoa Plantation ESIA (Tanzania) [Project manager, ESIA manager]
- MCA-Malawi RAP Audit [Project Manager, Lead Auditor]
- JCM Power ESMS [Project manager]
- JCM Power Solar Power Station ESIA [Project Manager, Report Author]
- Suni Resources Traffic Impact Assessment [Report author]
- NCCL Isanye Dam EPB (Zambia) [Project manager]
- NCCL Ngoli Dam EPB (Zambia) [Project manager]
- NCCL Kasama Dam ESIA (Zambia) [ESIA manager]
- JCM Power Solar PV ESIA (Cameroon) [ESIA manager]
- Tete Iron Ore Project ESIA (Mozambique) [ESMP]
- Triton Ancuabe ESIA (Mozambique) [Specialist coordination, ESMP]
- Badagry Greenfield Port Development ESIA including management plans (Nigeria) [ESIA and marine specialist]
- Saly Coastal Protection Project ESIA (Senegal) [Marine specialist]
- Port Mole Waterfront Development ESIA including management plans (Gabon) [ESIA manager and marine specialist]
- Bulk Handling Facility ESIA including management plans (Conakry Guinea) [ESIA manager and marine specialist]
- Kamsar Container Terminal ESIA including management plans (Conakry Guinea) [ESIA manager and marine specialist]

- Port of Ziguinchor ESIA including management plans (Senegal) [Marine specialist / Reviewer]
- Eko Atlantic Shoreline Protection ESIA including management plans (Nigeria) [Marine specialist]
- Eko Atlantic Topside Infrastructure ESIA (Nigeria) [ESIA manager]
- Construction of a Jetty Facilitating Transfer of Petroleum Products from Ship to Shore (Eritrea) [Environmental Clerk of Works]

United Kingdom

- Thamesport Phase IV Quay Extension EIA [Reviewer]
- East Lane, Bawdsey Coast Defence Works [Environmental Clerk of Works]
- Kilkeel Offshore Wind Farm Feasibility and Scoping Report [Project manager]
- Wells Channel Deepening and Jetty Construction EIA [EIA and marine specialist]
- Wells Channel Deepening and Jetty Construction Environmental Monitoring Programme (2010-2016) [Project manager and marine specialist]
- Trinity III Enhancement Monitoring Programme (2008 – 2011) ([Marine specialist]
- Trimley Ecological Monitoring Programme (2008 – 2011) [Marine specialist]
- SEAs for the Eastern England Shoreline, required for Shoreline Management Plans [Marine specialist]
- River Habitat Survey, Tributary of Car Dyke [Field work and report writing]
- Hinkley Point C Environmental Impact Assessment [EIA coordinator and marine specialist]
- Harwich Haven Annual Environmental Reporting (2009 – 2011) [Project manager and marine specialist]
- Environmental Monitoring and Mitigation Plan / Habitat Regulations Assessment East Lane [Project manager and marine specialist]
- Thanet Offshore Wind Farm [Environment Manager]
- The Wash Tide Gauge [Consent advisor and marine specialist]
- Dogger Bank Creyke Beck A&B, Teesside A&B EIA [Marine specialist]
- Kentish Flats Offshore Wind Farm Extension [Consent advisor / environment manager]
- Royal National Lifeboat Institute (RNLI) Feasibility [Project manager and marine specialist]
- Bacton Gas Terminal Coast Protection Works and Offshore Borrow Area EIA [Consent and marine specialist]
- Newhaven East Quay and Port Expansion Area EIA [Marine specialist]
- Sizewell C New Nuclear Build Habitats Regulations Assessment [Project manager]
- DNV Subsea Cable Installation Guidelines [Marine and Consenting expert]

CERTIFICATION

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes me, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

GREGORY SHAW Date: January 2020

Nicole Wienand
Curriculum Vitae

CONTACT DETAILS

Name of Company	**Coastal and Environmental Services (Pty) Ltd trading as CES**
Designation	Port Elizabeth Branch
Profession	Environmental Consultant / Junior Ecological Specialist
Years with firm	One (1) Year
E-mail	n.wienand@cesnet.co.za nicole.wienand@eoh.com
Office number	+27 (0)41 045 0496 +27 (0)41 393 0700
Nationality	South African
Key areas of expertise	➢ Environmental and Ecological Impact Assessments ➢ Botanical Specialist Studies ➢ Environmental Auditing/Compliance Monitoring ➢ GIS Mapping

PROFILE

Ms Nicole Wienand

Ms Nicole Wienand is an Environmental Consultant based in the Port Elizabeth branch. Nicole obtained her BSc Honours in Botany (Environmental Management) from Nelson Mandela University (NMU) in December 2018. She also holds a BSc Degree in Environmental Management (Cum Laude) from NMU. Nicole's honours project focused on the composition of subtidal marine benthic communities on warm temperate reefs off the coast of Port Elizabeth and for her undergraduate project she investigated dune movement in Sardinia Bay. Nicole's key interests include marine ecology, botanical specialist assessments, GIS Mapping, the general EIA process, Public Participation Process (PPP) and Ecological Impact Assessments. Since her appointment with CES in January 2019, Nicole has undertaken a number of Ecological Impact Assessments under the guidance of Dr Greer Hawley and Tarryn Martin.

EMPLOYMENT EXPERIENCE

Environmental Consultant, CES
07 January 2019 – Present

- Basic Assessment Reports
- Ecological Impact Assessments
- Environmental Audit/Compliance Monitoring
- GIS Mapping
- Public Participation

ACADEMIC QUALIFICATIONS

Nelson Mandela University, Port Elizabeth
BSc Honours Botany (Environmental Management)
2018

Nelson Mandela Metropolitan University, Port Elizabeth
BSc Environmental Sciences
2015-2017

CONSULTING EXPERIENCE

Basic Assessments
- Duyker Island Prospecting Right, North West Province – Assisting Report Writing
- ZMY Steel Traders (Pty) Ltd. Steel Recycling Plant, Zone 5 of the Coega SEZ, Eastern Cape Province – Basic Assessment Report;
- Fairview Sand Mine near Port Alfred, Eastern Cape Province – Basic Assessment Report;
- Kareekrans Boerdery Agricultural Development near Kirkwood, Eastern Cape Province – Report Writing; and
- Sitrusrand Dwarsleegte Farm Citrus Development near Kirkwood, Eastern Cape Province – Report Writing.

Ecological Assessments
- ZMY Steel Traders (Pty) Ltd., Steel Recycling Plant, Zone 5 of the Coega SEZ, Eastern Cape Province;
- Kareekrans Boerdery Agricultural Development near Kirkwood Eastern Cape Province, Ecological Impact Assessment and Report Writing;
- Sitrusrand Dwarsleegte Farm Citrus Development near Kirkwood, Eastern Cape Province – Ecological Impact Assessment and Report Writing;
- Uitsig Boerdery Trust Citrus Development near Kirkwood, Eastern Cape Province – Ecological Impact Assessment and Report Writing;
- Mosselbankfontein Coastal Dune and Ecological Impact Assessment near Witsand, Western Cape Province – Ecological Impact Assessment and Report Writing;
- Nomzamo Citrus Farm Development near Kirkwood, Eastern Cape Province – Ecological Impact Assessment and Report Writing; and
- Mangrove Forest Survey for the Kenmare Biodiversity Management Plan, Topuito, Mozambique.

Environmental Auditing
- Khayamnandi Extension on Erven 114, 609, 590 and 24337, Bethelsdorp, within the Nelson Mandela Bay Municipality;

- Aberdeen Bulk Water Supply Phase 2, Dr Beyers Naude Local Municipality, Eastern Cape Province, South Africa;
- The Milkwoods Integrated Residential Development, Remainder Erf 1953, Victoria Drive, Walmer, Nelson Mandela Bay Municipality, Eastern Cape Province;
- Fishwater Flats Wastewater Treatment Works Refurbishment, Nelson Mandela Bay Municipality, Eastern Cape Province;
- The Refurbishment of the Kwanobuhle Wastewater Treatment Plant, Nelson Mandela Bay Municipality, Eastern Cape Province, South Africa; and
- Driftsands Sewer Collector Augmentation (Phase Ii), Within the Nelson Mandela Bay Municipality, Eastern Cape Province.

Geographical Information Systems (GIS)

- ZMY Steel Traders – Basic Assessment Report and Biophysical Mapping;
- Duyker Island – Prospecting Area Mapping & Biophysical Mapping;
- Fairview Sand Mine near Port Alfred, Eastern Cape Province – Biophysical and Layout Mapping;
- St Francis Coastal Protection Scheme – Kromme Estuary Functional Zone Mapping; Biophysical Mapping; and Sand Source Area Mapping;
- Kareekrans Boerdery Agricultural Development – Biophysical and Layout Mapping;
- Nomzamo Citrus Farm Development near Kirkwood, Eastern Cape Province - Biophysical and Layout Mapping;
- Siyahluma Citrus Farm Development near Addo, Eastern Cape Province – Biophysical and Layout Mapping; and
- Sitrusrand Dwarsleegte Farm Citrus Development – Biophysical and Layout Mapping.

Public Participation process

- Duyker Island Prospecting Right, North West Province St Francis Coastal Protection Scheme;
- Fairview Sand Mine near Port Alfred, Eastern Cape Province;
- Kareekrans Boerdery Agricultural Development near Kirkwood Eastern Cape Province;
- Proposed Coastal Protection Scheme, St Francis Bay, Kouga Local Municipality, Eastern Cape Province; and
- Sitrusrand Dwarsleegte Farm Citrus Development near Kirkwood, Eastern Cape Province.

Social Auditing

- Malawi Millennium Development Trust – Resettlement Action Plan Implementation Auditing.

CERTIFICATION

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes me, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Nicole Wienand **Date: January 2020**

ANNEXURE 4: SENSITIVITY MAPS

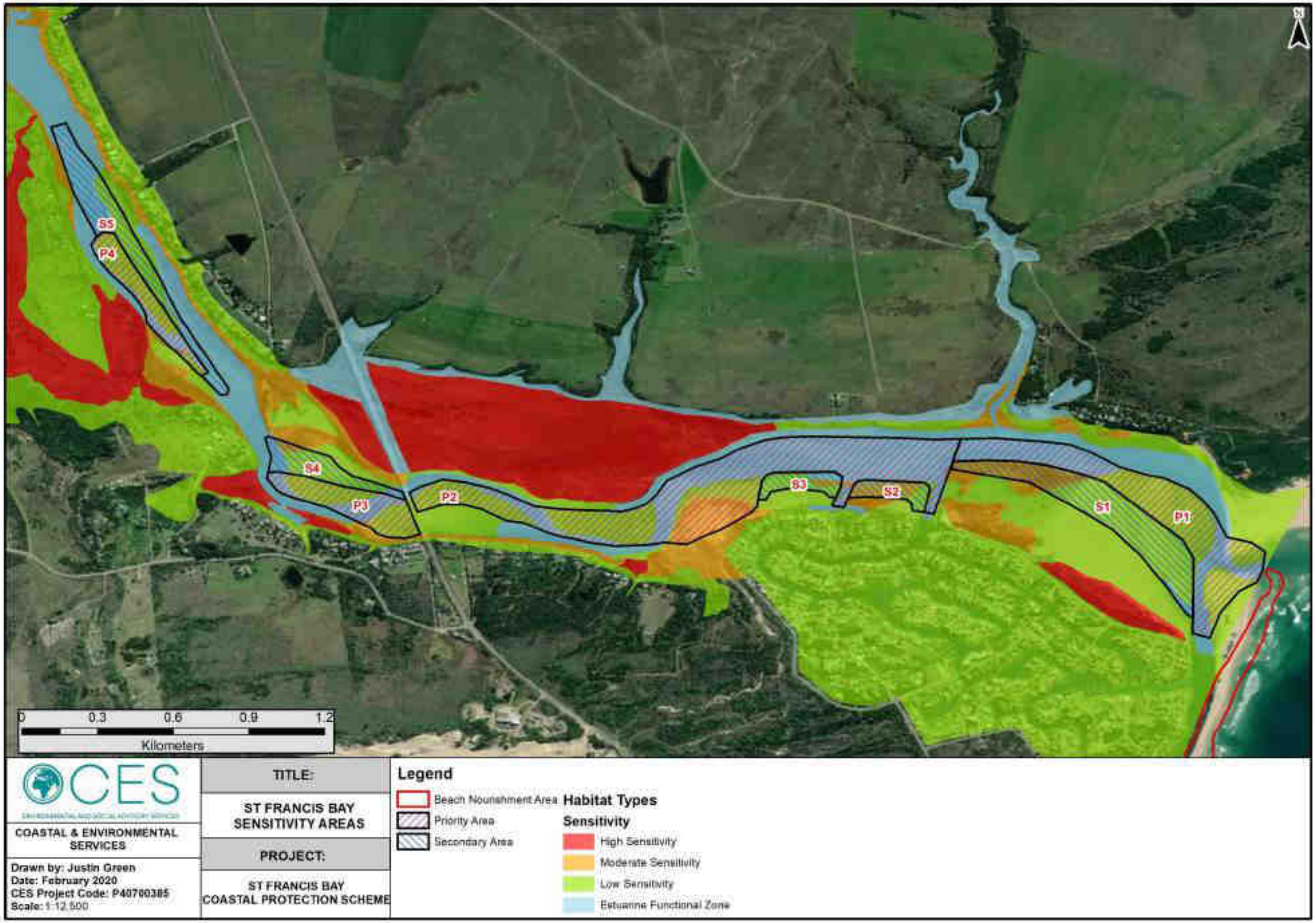

Figure A1: Map of the Habitat Sensitivity for the Kromme River Estuary.

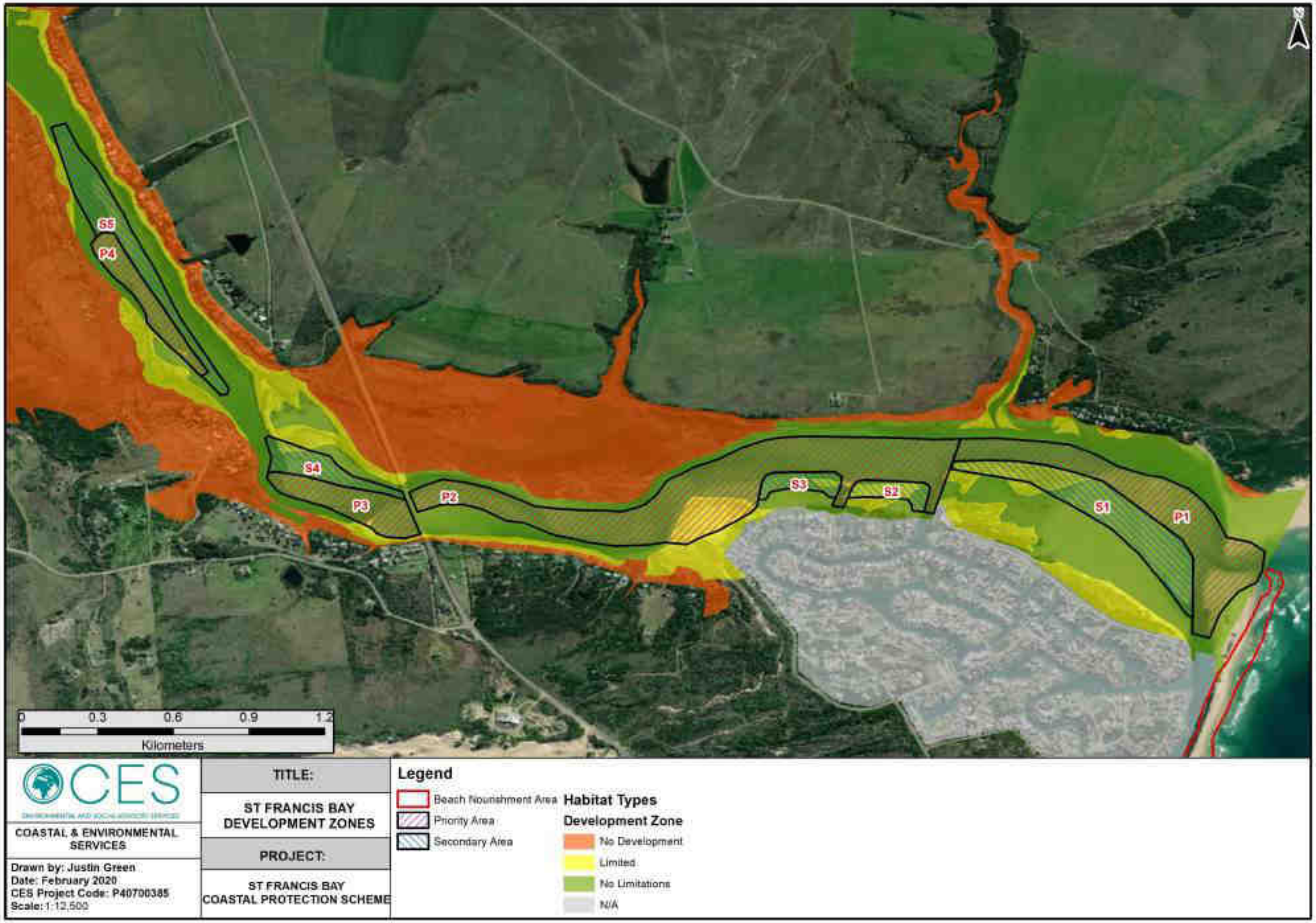

Figure A2: Map of the Development Zoning for the Kromme River Estuary.

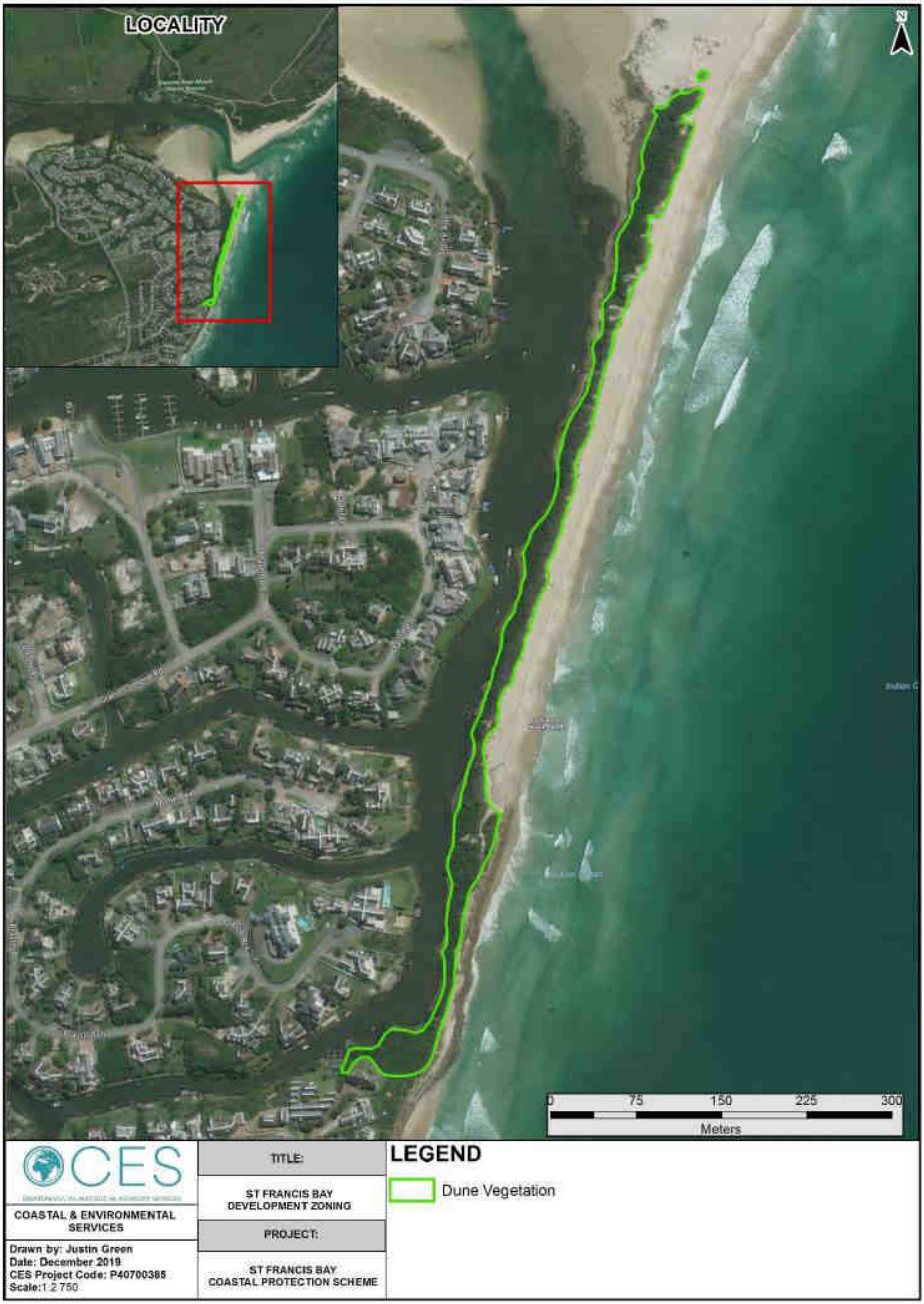

Figure A3: Map of the extent of the dune vegetation – limited development.