DRAFT EIA REPORT: REHABILITATION OF THE OLD TUG JETTY SHEET PILE WALL AT THE PORT OF PORT ELIZABETH

PROJECT NAME:

THE PROPOSED REHABILITATION OF THE OLD TUG JETTY SHEET PILE WALL AT THE PORT OF PORT ELIZABETH, WITHIN NELSON MANDELA BAY METROPOLITAN MUNICIPALITY IN THE EASTERN CAPE PROVINCE

REFERENCE NUMBER: TNPA/2021/12/0012/RFP

DFFE REFERENCE:

REPORT TITLE: ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DATE: 09 JULY 2023

PREPARED BY:

ABANTU ENVIRONMENTAL CONSULTANTS (PTY) LTD

PREPARED FOR:

TRANSNET SOC LTD

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DATE	June 2023	June 2023	June 2023

EXECUTIVE SUMMARY

Transnet is proposing the rehabilitation of the Old Tug Jetty sheet pile wall which is located within the port of Port Elizabeth and within Ward 5 of Nelson Mandela Bay Metropolitan Municipality in the Eastern Cape Province.

The Jetty was constructed in the mid 1970's and comprises of steel interlocking 'U' steel sheet pile sections together with dead man anchors and a concrete capping beam. The extent of the site is 246 m with an advertised berth depth of -4 m CD (Chart Datum). Both structures extend into the seawaters by 6 m each, total extension of 12 m (width) from the existing structures and the site extents are 246 m (length), hence, the development footprint of the port or harbour will be increased or expanded by approximately 2500 square metres in total. The quay wall is currently being used for the berthing of fishing vessels and trawlers. The northern extent of the back of quay area is used for the transshipment of cargo and supplies, while the southern extent is used for boat maintenance.

Motivation

The sheet piles have corroded significantly with large holes visible in the tidal zone. These holes have caused leaching of backfill material resulting in the subsidence of the back of quay area. Transnet National Port Authority (TNPA) has undertaken numerous repair campaigns involving filling holes with soilcrete. However, the continued deterioration of the sheet pile wall has resulted in an unsustainable maintenance regime. This led to the establishment of this project, which is to develop a long-term repair solution to make the quay safe to use and require minimum maintenance.

Alternatives

PRDW were appointed by Transnet to conduct a pre-feasibility (FEL 2) study for the rehabilitation of the Old Tug Jetty sheet pile wall. A set of rehabilitation concepts for the Old Tug Jetty sheet pile wall were developed based on typical marine structure types, construction techniques, functional requirements, and existing site conditions. A prescreening assessment of the concepts was then undertaken using a high level, qualitative, multi-criteria analysis to eliminate options that were not considered viable, or which had fatal flaws. Thereafter, the remaining options were assessed in a multi-criteria analysis to determine the preferred solution. The full set of Old Tug Jetty sheet pile wall rehabilitation options that were considered for the pre-screening assessment are detailed in **Table 8**. All the rehabilitation options presented assume that the existing Old Tug Jetty sheet pile wall will be abandoned and buried, and the back of quay area remediated. Please refer to the full optioneering and multicriteria analysis report which has been attached as Appendix C.

Preferred rehabilitation option (proposed upgrade)

Based on the outcomes of the optioneering and multi-criteria analysis, a counterfort wall and deck on pile hybrid structure was selected as the preferred rehabilitation option for the Old Tug Jetty sheet pile wall. This option comprises of 2 phases. Phase 1 entails the construction of a counterfort wall with a berth depth of -5.2m CD. Phase 2 expansion entails construction of an adjoining deck on pile structure partially supported by the counterfort wall with a design berth depth of -6.5m CD. Both structures extend into the existing seawaters by 6 m each resulting in a total extension of 12 m from the existing structures

EAP DECLARATION OF INDEPENDENCE

I… Dr Patrick Sithole …., on behalf of **Abantu Environmental Consultants,** as the appointed independent environmental practitioner ("EAP") hereby declare that I:

- am the independent EAP in this application and
- the information in this report is true and correct;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- have and will not have any vested interest in the proposed activity proceedings;
- have disclosed, to the applicant and competent authority any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or documents required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and comply with the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information with all the relevant facts, in respect of the application, was distributed or made available to the public, all interested and affected parties; including facilitating for their participation with reasonable opportunity for comments.
- have ensured that all interested and affected parties were considered, recorded and submitted to the competent authority in respect of the application;
- have kept a register of all interested and affected parties that participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of the EIA regulations.

Signature of the Environmental Assessment Practitioner:

Name of company: Abantu Environmental Consultants

Date: June 2023

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ABBREVIATIONS

BA	Basic Assessment
BAR	Basic Assessment Report
CBA	Critical Biodiversity Area
CA	Competent Authority
DFFE	Department of Forestry, Fisheries and the Environment
DWS	Department of Water and Sanitation
DRDLR	Department of Rural Development and Land Reform
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECPHRA	Eastern Cape Provincial Heritage Authority
EIA	Environmental Impact Assessment
EAIR	Environmental Impact Assessment Report
GDP	Gross Domestic Product
I&APs	Interested and Affected Parties
ICMA	Integrated Coastal Management Act
IDP	Integrated Development Plan
NEMA	National Environmental Management Act
NMBMM	Nelson Mandela Bay Metropolitan Municipality
OHSA	Occupational Health and Safety Act
S&EIR	Scoping and Environmental Impact Assessment Report
SAHRA	South African Heritage Resources Authority
SAHRIS	South African Heritage Resources Information System

SDF	Spatial Development Framework

1. INTRODUCTION

1.1 PURPOSE OF THE ENVIRONMENTAL IMPACT REPORT

The National Environment Management Act, 1998 (Act No. 107 of 1998) (the NEMA) introduced the environmental impact management regime, in particular the Environmental Impact Assessment (EIA) process. The EIA process is a tool which requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves the present and future generations. The EIA is South Africa's key regulatory instrument used to mitigate and/or manage the impacts of new developments and activities that are considered to potentially impact on the right to an environment that is not harmful to health and well-being. It is considered as one of the processes that actively promotes or ensures sustainable development. The EIA process is outlined in the Environmental Impact Assessment Regulations and Listing Notices aimed at implementing chapter 5 of the NEMA.

The Regulations provide for listing of activities which may not commence without an environmental authorisation and also identify the process and reports to be submitted to the Competent Authority for decision making purposes. The process provides the proponent with an opportunity to assess the potential environmental impacts of the proposed development as well as provide for identification of mitigation measures to be in place to ensure that environmental impacts are avoided, minimised or mitigated. Key to this process is the public participation element, which is also legislated. It forms the integral part of the EIA process and comments and inputs from the interested and/or affected are taken into consideration by the competent authority when making decisions on applications (DEA, 2018).

The environmental assessment process is used to understand the potential environmental impacts of a development, and to inform environmental decision-making before the development (and more particularly, the listed activities that require environmental authorisation under NEMA) is authorised. The information recorded during the EIA process provides the basis for a decision to grant (with or without conditions) or refuse authorization in respect of a given application, and with regard to the authorisation of an application, informs the selection of the most appropriate alternative (DEA, 2019).

In terms of the NEMA EIA Regulations, 2014 as amended, the purpose of the EIA Report is as follows:

(1) The environmental impact assessment process must be undertaken in line with the approved plan of study for environmental impact assessment.

(2) The environmental impacts, mitigation and closure outcomes as well as the residual risks of the proposed activity must be set out in the environmental impact assessment report.

1.2 OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

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—

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

(ii) degree to which these impacts—

(aa) can be reversed;

(bb) may cause irreplaceable loss of resources, and

(cc) can be avoided, managed or mitigated;

(e) 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;

(f) 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;

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

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

1.3 EIA STUDY APPROACH

The EIA process is a planning and decision-making tool that identifies the potential negative and positive impacts of a proposed development. It also recommends ways to enhance the positive impacts and to minimize the negative ones. The environmental studies that have been undertaken, address the impacts associated with the proposed development, and provide an assessment in terms of the biophysical, social, cultural-historic and economic environments. This will assist both the competent authority and Transnet Port of Port Elizabeth in making decisions regarding implementation of the proposed project. The environmental assessment has been undertaken in compliance with the NEMA, specifically EIA Regulations 2014 (as amended). Cognisance will also be taken of related guideline documents and other relevant legislation.

As outlined in the EIA Regulations, the activity process consists of the following steps:

1. Screening,
2. Scoping,
3. Impact Assessment and Evaluation,
4. Public Engagement,
5. Review, and
6. Appeals

1.4 STRUCTURE OF THE EIA REPORT

The EIA Report includes information as required per Appendix 3 of the 2014 NEMA EIA Regulations as amended. The structure of the EIA Report is presented in **Table 1**.

Table 1. EIA Report structure

APPENDIX 3	CONTENT AS REQUIRED BY NEMA	SECTION/CHAPTER
(1)	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—	Section 2
(a)	details of— (iii) the EAP who prepared the report; and (iv) the expertise of the EAP, including a curriculum vitae;	
(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;	Section 3
(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;	Section 4
(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;	Section 4 and 5

APPENDIX 3	CONTENT AS REQUIRED BY NEMA	SECTION/CHAPTER
(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;	Section 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;	Section 6
(g)	a motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;	Section 7
(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:	Section 8
	(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;	Section 9
	(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;	Section 9.5
	(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 10
	(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;	Section 11.1

APPENDIX 3	CONTENT AS REQUIRED BY NEMA	SECTION/CHAPTER
	(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;	Section 11.1
	(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;	Section 11.3
	(viii) the possible mitigation measures that could be applied and level of residual risk;	Section 11.5
	(ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such; and	Section 11.7
	(x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report;	Section 11.7
(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—	Section 11
	(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	Section 11
	(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;	Section 11.4
(j)	an assessment of each identified potentially significant impact and risk, including—	Section 11

APPENDIX 3	CONTENT AS REQUIRED BY NEMA	SECTION/CHAPTER
	(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;	
(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;	Section 12
(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 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;	Section 13
(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;	Section 13.1

APPENDIX 3	CONTENT AS REQUIRED BY NEMA	SECTION/CHAPTER
(n)	the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Section 14.2
(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;	Section 0
(p)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 15
(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;	Section 16
(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;	N/A
(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 responses by the EAP to comments or inputs made by interested or affected parties;	Section 17
(t)	where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	N/A

APPENDIX 3	CONTENT AS REQUIRED BY NEMA	SECTION/CHAPTER
(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;	N/A
(v)	any specific information that may be required by the competent authority; and	N/A
(w)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A
(2)	Where a government notice gazette by the Minister provides for any protocol or minimum information requirement to be applied to an environmental impact assessment report the requirements as indicated in such notice will apply.	N/A

1.5 DETAILS OF APPLICANT

Details of the applicant, Transnet SOC LTD, are presented in **Table 2** below.

Table 2. Applicant details

Applicant	Transnet SOC Ltd
Contact Person on behalf of Transnet	Nosicelo Biyana
Physical Address	Transnet National Ports Authority 2nd Floor, Admin Building (eMendi) N2 Neptune Road, off Klub Road Port of Nqqura Port Elizabeth
Telephone	+27 67 367 0110
Email Address	nosicelo.biyana@transnet.net

2. DETAILS OF THE EAP

In terms of Regulation 13 of the EIA Regulations (GN R. 982) as amended, an independent EAP, must be appointed by the applicant to manage the application. Abantu Environmental Consultants (AEC) has been appointed by the Applicant as the EAP to assist with compiling the necessary reports and undertaking the public consultation processes, in support of the proposed Old Tug Jetty sheet pile wall rehabilitation project. AEC is compliant with the definition of an EAP as defined in Regulations 1 and 13 of the EIA Regulations, as well as Section 1 of the NEMA. This includes, the requirement that the EAP is:

- Objective and independent;
- Has expertise in conducting EIA's;
- Comply with the NEMA, the environmental regulations and all other applicable legislation;
- Considers all relevant factors relating to the application; and
- Provides full disclosure to the applicant and the relevant environmental authority.

The Curriculum Vitae (indicating the experience with environmental impact assessment and relevant application processes) of the consultants that are involved in the EIA process and the compilation of this Scoping Report is presented in Appendix A.

2.1 EAP CONTACT DETAILS

As per the requirements of the NEMA Regulations, the details and expertise levels of the EAP who prepared the report are provided in **Table 3** below.

Table 3. Environmental Consultant details

Contact Details	
Consultant	Abantu Environmental Consultants (Pty) Ltd
EAP	Dr Patrick Sithole
Cell	078 207 8278
Postal Address	33 Prince Alfred North End Gqeberha 6001
Fax	086 685 9536
Email	Email: info@abantuenvironmental.co.za PE-EIA@abantuenvironmental.co.za
Website	Website: www.abantuenvironmental.co.za

2.2 EXPERTISE OF THE EAP

Dr Patrick Sithole is a registered natural scientific professional (SACNASP – Environmental and Chemical scientist), a registered Environmental Assessment Practitioner (EAPASA), social and sustainability expert with 23 years of experience. Patrick Sithole specializes in Strategic Environmental, Waste Planning, Social and Sustainable Development projects, Climate Change and Health, Environmental Management issues and Construction Supervision of all infrastructural projects. Dr Sithole is also involved in vegetation clearance and pest control projects along infrastructural projects e.g. roads, railway lines, power lines, golf courses and buildings like complexes, houses, malls, etc.

His key experience includes the following areas;

- Environmental (Natural Resource) Management
- Waste Planning
- Environmental Compliance
- Social Facilitation and Consultation
- Compensation of Land Claims
- Climate Change
- Climate (Change) and Human Health
- Air Quality Management
- Renewable Energy
- Waste Management
- Land Rehabilitation

- Water Quality/Demand Management
- Strategic Environmental Assessment
- Waste Water (sewer) Treatment
- Project Management
- ISO 9001 and ISO14001
- Vegetation Control Bush Clearance (Invasive plants)
- Teaching and mentoring

2.3 Details of Independent Specialists

Details of the project team, including the appointed independent specialists are presented in **Table 4** below.

Table 4. Project team

Name and Surname	Role	Years of Experience	Qualifications	Professional registrations	Project Functions
Project Management					
Mr Sive Mlamla	Project Manager Registered Environmental Assessment Practitioner	8	MSc Geography	Pr.Sci.Nat Reg No. 118495 (SACNASP) Registered Environmental Assessment Practitioner (EAPASA) No. 2022/5204	• Overall project management • Site assessments • Management of specialists • Report writing
Technical staff					
Dr. Patrick Sithole	Registered Environmental Assessment Practitioner and Technical Reviewer	23	PhD Environmental Sciences	Registered Environmental Assessment Practitioner (EAPASA) No. 2016/27 Pr.Sci.Nat Reg No. 400264/07 (SACNASP)	• Environmental Impact Assessment • Site assessments • Public Participation • Technical report writing and reviews and approvals
Mrs Andisiwe Xuma	Senior Environmental Consultant	10	MSc Geography and Environmental Resources	Pr.Sci.Nat Reg No.114735 (SACNASP) Registered EAP (EAPASA No, 2019/856)	• Site assessments, report writing and reviews
Ms Mongikazi Gxilishe	Junior Environmental Consultant	2	BSc Hons Environmental Geography	Cand.Sci.Nat Reg. No. 144438 (SACNASP)	• Site assessments, report writing and mapping
Specialists					
Dr Brent Newman	Marine Water and Sediment Quality Specialist	33	PhD Zoology (Marine)	Pr.Sci.Nat Reg No. 123899 (SACNASP)	• Marine water and sediment quality impact assessment Water sampling and analysis • Dredge permitting application
Ms Aadila Omarjee	Marine Ecological Specialist (Zoology)	14	MSc Marine Biology	Pr.Sci.Nat Reg No. 129167 (SACNASP)	• Marine faunal impact assessment • Site and desktop investigations
Dr Solomon Owolabi	Palaeontological Specialist	21	PhD Geology		• Palaeontological Impact assessment • Site and desktop investigation

Name and Surname	Role	Years of Experienc e	Qualifications	Professional registrations	Project Functions
Dr Anton De Wit	Social Impact Assessment	30	PhD Geography		• SIA

3. PROJECT LOCATION AND LAND OWNERSHIP

3.1 LOCATION OF THE PROJECT

Table 5 below provides a description of the property details and size of the proposed development footprints as well as the nearest towns. The location of the affected property and proximity to the nearest towns is provided in ***Figure 1***.

Table 5. Description of property

Province	Eastern Cape
District	Nelson Mandela Bay Metropolitan Municipality
Local Municipality	Nelson Mandela Bay Metropolitan Municipality
Ward number	Ward 5
Property	Erf Humewood 1051 Portion 0
21-digit Surveyor General Code	C05900140000105100000
Application Area (Ha)	11,7112
Magisterial District	PORT ELIZABETH RD
Distance and direction from nearest towns	The proposed Old Tug Jetty sheet pile wall rehabilitation is located within the Port of Port Elizabeth and within Ward 5 of Nelson Mandela Bay Metropolitan Municipality. The Erf is located in Humewood, which is 4km away from Gqeberha Central.

3.2 LAND OWNERS OF THE AFFECTED PROPERTIES

The proposed Old Tug Jetty is located on Erf Humewood 1051 which is owned by Transnet SOC Ltd. According to Lexis Windeed, Transnet is the sole owner of this property, and the ownership was registered in May 1993.

3.3 21 DIGIT SURVEYOR GENERAL CODES

The 21 Digit Surveyor General code of the affected property is detailed below:

C	0	5	9	0	0	1	4	0	0	0	0	1	0	5	1	0	0	0	0	0
1	**2**			**3**				**4**								**5**				

4. PROJECT OVERVIEW

4.1 PROJECT BACKGROUND

The Port of Port Elizabeth is located at the southern end of Algoa Bay, which is one of the many half-heart Bays along the south coast at Latitude 33° 57' 58” S and Longitude 25° 37’ 60” E (**Figure *1***). The Port of Port Elizabeth is an established port in the central region, comprising of a container terminal, the tanker berth, multi-purpose terminal and the manganese terminal. The port also supports fishing related activities for birthing, ship repair as well as leisure vessels.

The port is protected by the 1.1 km South Breakwater and the Charl Malan Quay and the entrance channel is 14.10 m with the width of 3210 metres wide. The port essentially comprises three basins, namely the northern, southern and turning basins, and an entrance channel. The northern and southern basins are separated by the Citrus Terminal, the eastern most point of which is taken as defining the northern basin from the turning basin, while an imaginary line extending between the Citrus Terminal and the Tanker Berth is taken as defining the southern basin from the turning basin.

The port handles over 11 million tonnes of cargo per year (approximately 950 commercial cargo vessel calls), with the 30-year forecast predicting volumes to increase to over 18 million tonnes per year. The import and export activities, demand for the ship repair facility as well as repair and maintenance activities are exacting a heavy toll on the port infrastructure. As a result, the Port experience various infrastructural challenges which include among others damage on sea walls, underpinning, and sand accumulation on the western end of the breakwater and fence area bordering the Port. Additionally, the harsh marine environment has a negative corrosive and chemical reactive effect upon various structures, infrastructure and facilities within the Port. Regular maintenance activities are therefore required to counter the afore-mentioned effects. Most equipment pivotal to sustain port business and services is old and require replacement (Transnet, 2017).

The Jetty was constructed in the mid 1970’s and comprises of steel interlocking ‘U’ steel sheet pile sections together with dead man anchors and a concrete capping beam. The extent of the site is 246 m with an advertised berth depth of -4 m CD (Chart Datum). Both structures extend into the seawaters by 6 m each, total extension of 12 m (width) from the existing structures and the site extents are 246 m (length), hence, the development footprint of the port or harbour will be increased or expanded by approximately 2500 square metres in total. The quay wall is currently being used for the berthing of fishing vessels and trawlers. The northern extent of the back of quay area is used for the transshipment of cargo and supplies, while the southern extent is used for boat maintenance.

Several listed activities are triggered by the proposed development and as such Environmental Authorisation is required prior to commencement of the activities detailed in Section 5 of this report. Abantu Environmental Consultants (AEC) has been appointed as the independent environmental assessment practitioners to facilitate the EIA process and obtain the relevant authorisations. The Environmental Authorisation application is subject to a Full Scoping and Environmental Impact Assessment (EIA)

Process and will be adjudicated by the identified competent authority, Department of Forestry, Fisheries and the Environment (DFFE).

This draft EIA Report is prepared in accordance with the requirements of Appendix 3 of the Environmental Impact Assessment Regulations, 2014, as part of the National Environmental Management Act (NEMA-Act 107 of 1998).

Figure 1: Locality map of the proposed Transnet Port Upgrade

4.2 PROJECT DESCRIPTION

Transnet is proposing the rehabilitation of the Old Tug Jetty Sheet Pile Wall which is located within the Port of Port Elizabeth and within Ward 5 of Nelson Mandela Bay Metropolitan Municipality in the Eastern Cape Province. The property that will be affected by the proposed activity is Erf Humewood 1051

The Jetty was constructed in the mid 1970's and comprises of steel interlocking 'U' steel sheet pile sections together with dead man anchors and a concrete capping beam. The extent of the site is 246 m with an advertised berth depth of -4 m CD (Chart Datum). As indicated in Figure 2 both new structures extend into the seawaters by 6 m each, total extension of 12 m (width) from the existing structures and the site extents are 246 m (length). Hence, the development footprint of the port or harbour will be increased or expanded by approximately 2500 square metres in total. The quay wall is currently being used for the berthing of fishing vessels and trawlers. The northern extent of the back of quay area is used for the transshipment of cargo and supplies, while the southern extent is used for boat maintenance.

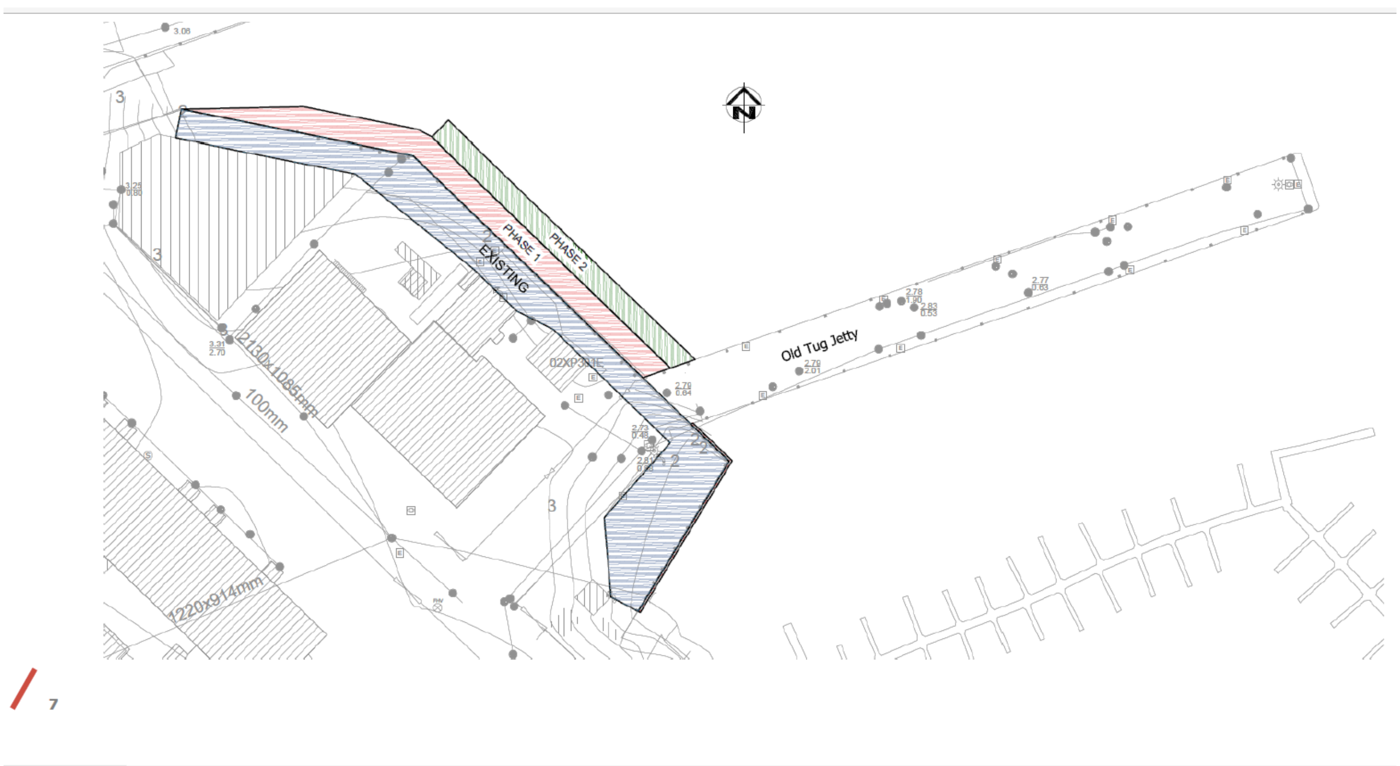


Figure 2: Overall layout of the project (Source: Transnet)

4.2.1 Motivation

As illustrated in ***Figure 3***, the sheet piles have corroded significantly with large holes visible in the tidal zone. These holes have caused leaching of backfill material resulting in the subsidence of the back of quay area. Transnet National Port Authority (TNPA) has undertaken numerous repair campaigns involving filling holes with soilcrete. However, the continued deterioration of the sheet pile wall has resulted in an unsustainable maintenance regime. This led to the establishment of this project, which is to develop a long-term repair solution to make the quay safe to use and require minimum maintenance

From the available information, it was concluded that:

- The current deterioration of the sheet pile wall is ongoing and will get progressively worse;
- Given the advanced state of deterioration the ability of the structure to fulfil its functional requirement is uncertain;
- The progressive weakening of the steel sheet piles because of corrosion could result in a sudden failure if the holes in the piles grow unchecked;
- Doing nothing would eventually result in the abandoning or condemning of the quay due to safety concerns;
- The option of cladding the existing wall to rehabilitate it is fatally flawed since steel deterioration will continue resulting in uncertainty regarding the remaining service life; therefore
- Replacement is the only practical solution that would provide certainty with regards to the future life span of the facility.

4.2.2 **Alternatives**

PRDW were appointed by Transnet to conduct a pre-feasibility (FEL 2) study for the rehabilitation of the Old Tug Jetty sheet pile wall. A set of rehabilitation concepts for the Old Tug Jetty sheet pile wall were developed based on typical marine structure types, construction techniques, functional requirements, and existing site conditions. A prescreening assessment of the concepts was then undertaken using a high level, qualitative, multi-criteria analysis to eliminate options that were not considered viable, or which had fatal flaws. Thereafter, the remaining options were assessed in a multi-criteria analysis to determine the preferred solution. The full set of Old Tug Jetty sheet pile wall rehabilitation options that were considered for the pre-screening assessment are detailed in **Table 8**. All the rehabilitation options presented assume that the existing Old Tug Jetty sheet pile wall will be abandoned and buried and the back of quay area remediated. This means that the counterfort units will be placed proud of the existing sheet pile wall. There will be infilling of rock material between the old sheet pile wall and the new counterfort units with the construction of a new elevated cope, totally encasing the existing sheet pile wall, hence the term “buried and abandoned” (**Figure *5***). Although the old sheet pile wall will remain, it will no longer be in use and will be encased by the new structure, covered by the counterfort wall and will not be visible due to backfilling and concrete capping. Please refer to the full optioneering and multicriteria analysis report which has been attached as Appendix C.

Figure 3: Close-up image indicating the extent of the sheet pile corrosion

4.2.3 Preferred rehabilitation option (proposed upgrade)

Based on the outcomes of the optioneering and multi-criteria analysis, a counterfort wall and deck on pile hybrid structure was selected as the preferred rehabilitation option for the Old Tug Jetty sheet pile wall. This option comprises of 2 phases as illustrated in ***Figure 4***. Phase 1 entails the construction of a counterfort wall with a berth depth of – 5.2m CD. Phase 2 expansion entails construction of an adjoining deck on pile structure partially supported by the counterfort wall with a design berth depth of -6.5m CD. Both structures extend into the existing seawaters by 6 m each resulting in a total extension of 12 m from the existing structures.

Figure 4: Phase construction of preferred solution

The phase 1 counterfort wall is 259.3 m long with a maximum cope line offset of 6 m from the existing, tapering as it approaches the boat ramps at each end. The cope level is at +4 m CD with the berth depth varying from -5.2 m CD along the northwestern face sloping up and tying into the extents of the boat ramps.

The existing sheet pile wall will be abandoned and buried, and the back of quay area will be remediated. This means that the counterfort units will be placed proud of the existing sheet pile wall. There will be infilling of rock material between the old sheet pile wall and the new counterfort units with the construction of a new elevated cope, totally encasing the existing sheet pile wall, hence the term "buried and abandoned". Although the old sheet pile wall will remain, it will no longer be in use and will be encased by the new structure, covered by the counterfort wall and will not be visible due to backfilling and concrete capping. The construction process consists of dredging marine sediment and the excavation of a thin layer of existing rock fill in front of the sheet pile wall. The risk of excavating in front of the existing sheet pile wall would need to be assessed as part of the project detailed design phase. Thereafter, a filter fabric will be laid on top of the rock fill and along the vertical extents of the sheet pile wall. A stone bed is then placed on top of the filter fabric to create a level bed for the precast counterfort units. The counterfort wall is then seated on the stone bed and scour rock placed on top of its toe. Thereafter, the wall will be backfilled with quarry run and the concrete and civil work completed. Finally, the quay furniture will be installed. **Figure *5*** illustrates the typical cross section of the counterfort wall.

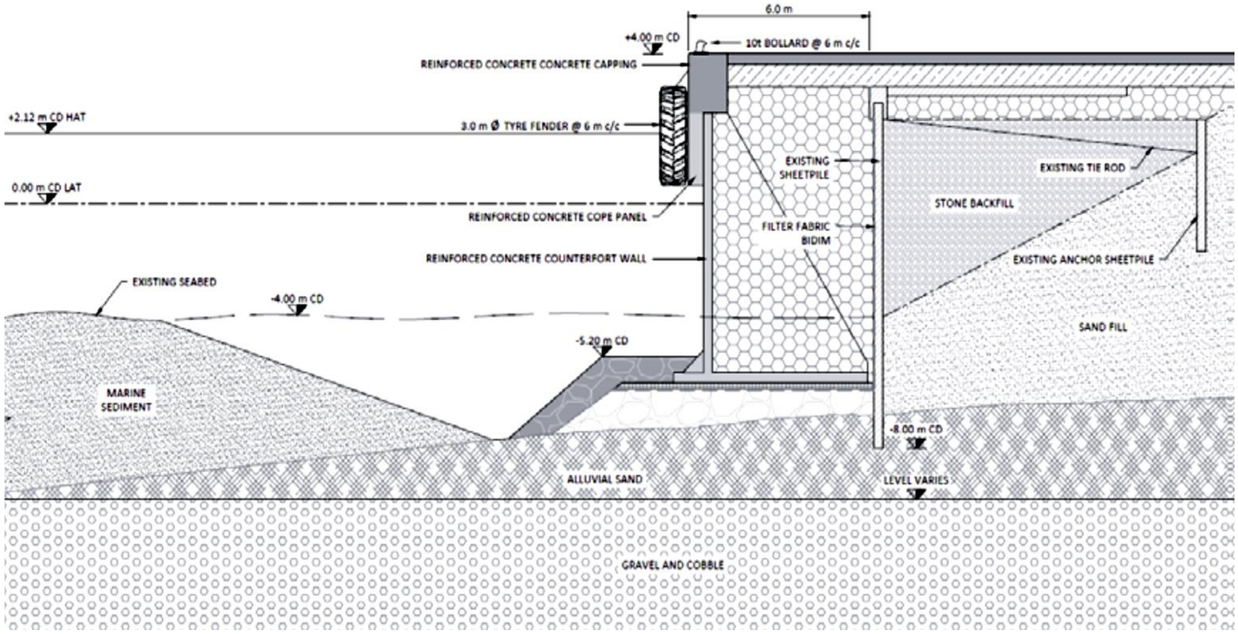


Figure 5: Phase 1 typical section

The structure will be upgraded during the implementation of phase 2. Briefly, Phase 2 of the project entails the construction of a deck on pile structure in front of the counterfort wall. The deck on pile jetty is 87.3 m long with further cope line offset of 5.8 m. The cope level is at +4 m CD with a berth depth of -6.5 m CD. The deck on pile length is limited to the extents illustrated in ***Figure 4*** because it is not possible to achieve the -6.5 m CD berth depth along the approaches to the slipways as the seabed needs to rise to suit the boat ramp geometry.

The construction process would commence with the dredging of marine sediment. The existing quay furniture on the counterfort wall affected by the deck on pile structure will be removed. Thereafter, steel tubular pile casings would be driven at the toe of the existing rock fill, excavated out to toe level and then the reinforced concrete pile cast inside. Precast pile caps would then be seated on top of the pile. Abutments will be constructed into the counterfort units which will house the precast beams and provide lateral support to the deck on pile structure. After placing precast beams, cope panels and planks the elements are stitched together with in-situ reinforced concrete. Finally, the quay furniture would be installed. **Figure *6*** illustrates the typical cross section of the counterfort wall and deck on pile structure.

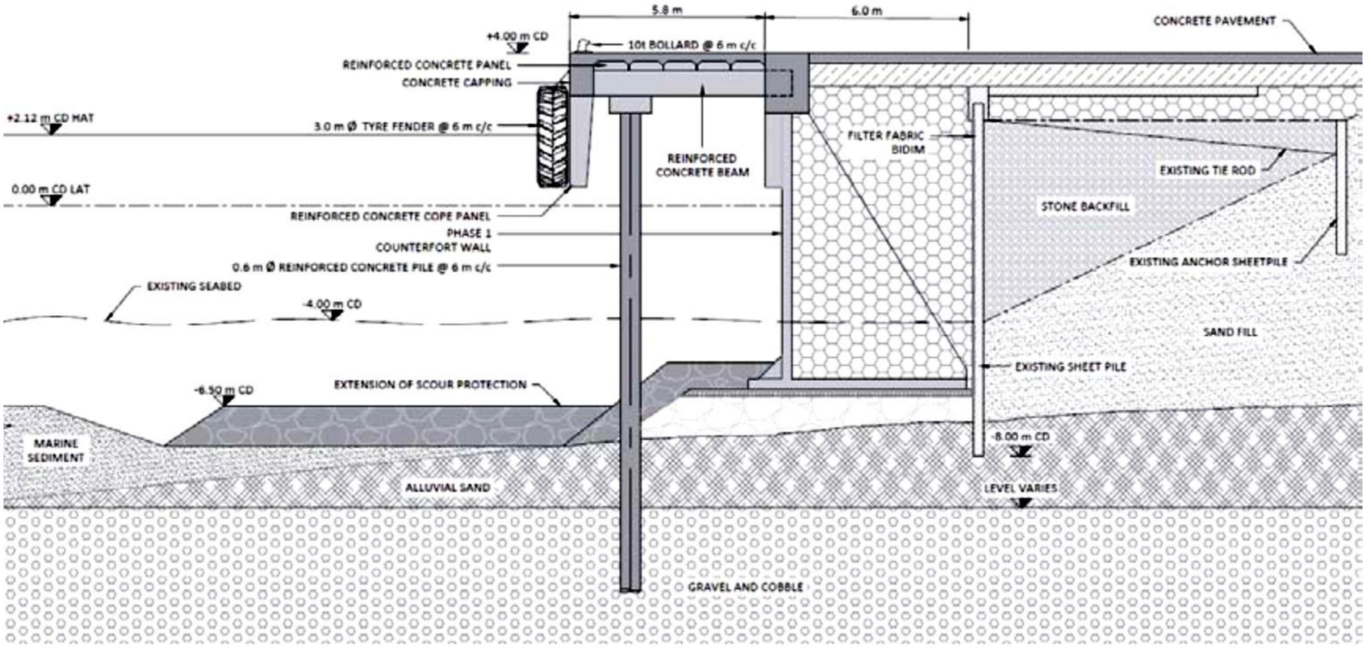


Figure 6: Phase 2 typical section

4.2.4 Project infrastructure and associated activities

Quay furniture that will be installed includes the following:

- Fenders
- Bollards
- Safety ladders
- Life-saving equipment
- Quayside service requirements

The following is a proposed sequence for the construction. Construction will be split into two phases as described below.

Phase 1 – Counterfort wall

- Decommission of Old Tug Jetty sheet pile wall
- Site establishment
- Procurement of materials
- Dredge to appropriate level and remove top layer of rock fill
- Place filter fabric on top of rock fill and along vertical extents of the existing sheet pile wall
- Place stone bed layer
- Cast counterfort units in a casting yard

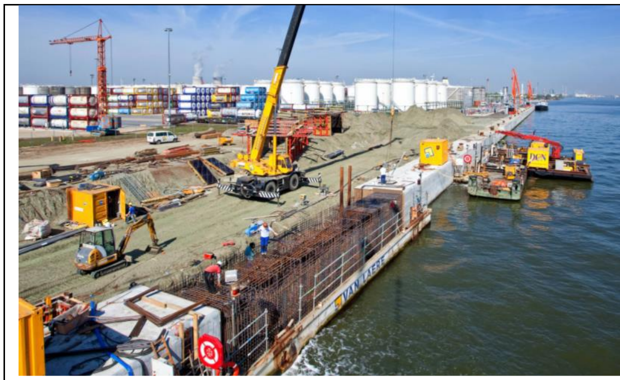
- Remove all the existing quay furniture and demolish existing structures that obstruct the new works
- Place counterfort units
- Install scour rock on top of counterfort toe
- Backfill counterfort with quarry run
- Place filter fabric on top of quarry run backfill
- Undertake pavement layer works
- Install civil services
- Cast concrete capping beam and cope panel
- Install quay furniture
- Paving to final levels and services fit out
- Commissioning

1. Dredge to required level

2. Place counterfort units & block work

3. Place scour rock

4. Backfill & install civil services

 5. Cast capping beam & fender panel	 6. Pave & install quay furniture

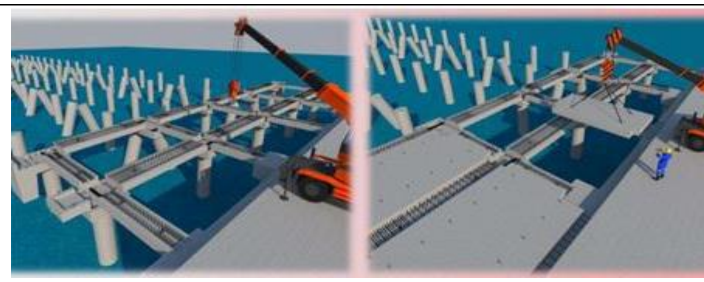
Phase 2 – Deck on pile structure

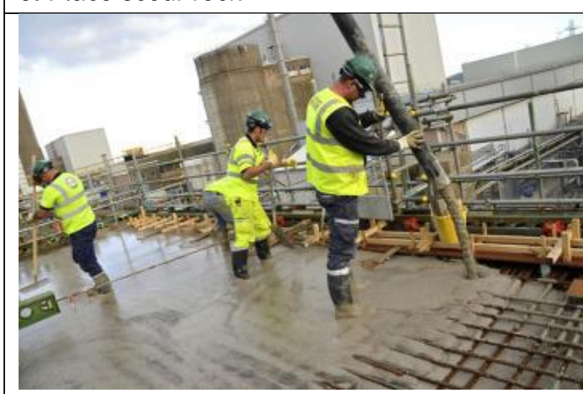
- Partial decommission of Old Tug Jetty counterfort wall
- Site establishment
- Procurement of materials – steel pile casing assumed to be imported
- Dredge to appropriate level
- Remove all the existing quay furniture – store for reuse on the new structure
- Pile installation
- Install guide frame with required temporary support
- Drive tubular pile casing to level
- Excavate out pile using auger, grab and airlift
- Insert reinforcing cage into pile
- Tremie concrete to fill pile
- Install scour protection
- Prepare counterfort capping beam to receive deck on pile primary beam
- Place and grout into position precast pile cap
- Deck installation
- Place precast primary beam seated on counterfort wall and pile cap
- Place precast slab planks between primary beams
- Hang and brace precast cope panel in position using a construction frame
- Pour in-situ concrete to stitch precast elements together and form capping beam and deck slab
- Install quay furniture
- Commissioning

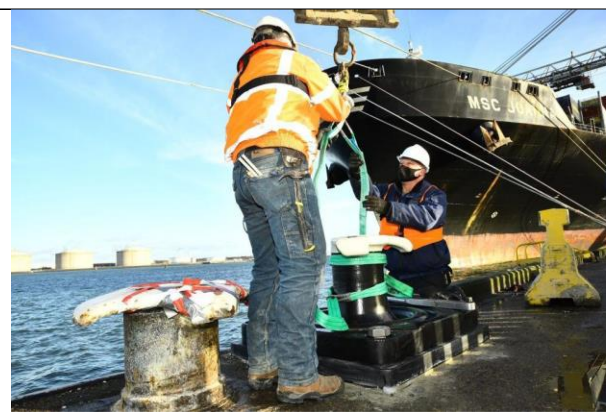
1. Dredge to required level


2. Install piles


3. Place scour rock


4. Place precast elements


5. Install civil services & place stitching concrete


6. Install quay furniture

An illustration of the precast counterfort wall unit is included in **Figure 7** below for reference.

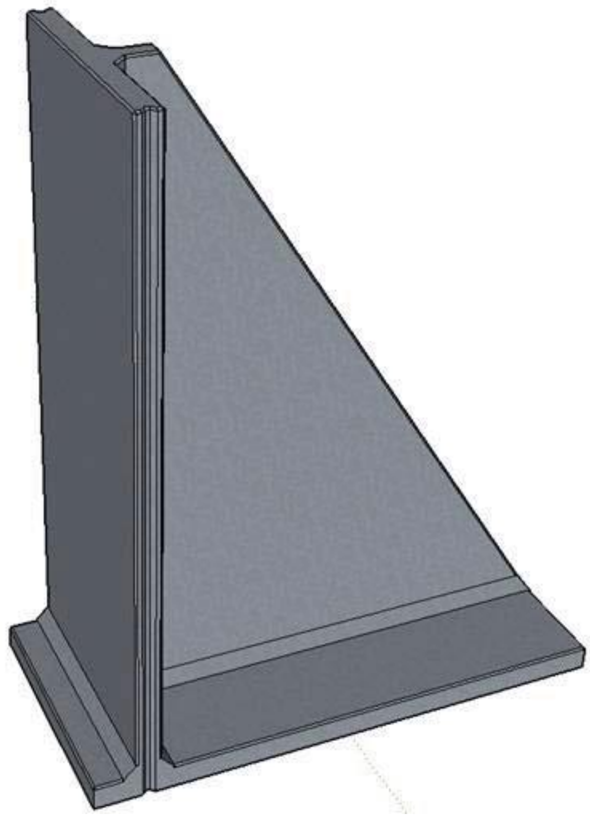


Figure 7: Precast counterfort wall unit

4.2.5 Site access

The project site is located within the Port of Port Elizabeth boundary. Access to the site will need to be through the Baakens River entrance on Lower Valley Road. There is limited backup area and open space for contractor laydown areas and stockyards. However, there is the potential to utilise the open field close to the site.

4.3 PROJECT PHASES

4.3.1 Pre- Construction (Planning) Phase

The planning phase of the project involves undertaking studies and submission of various applications that are required in order for the project to proceed. The proponent also undertakes feasibility studies and detailed designs to allow for seamless execution once all authorizations are obtained. There are minimal environmental impacts anticipated during the pre-construction phase however, this phase is important to ensure that the project complies with the legislative and policy framework. Some economic benefit can be derived from appointment of environmental professionals, engineers and other skilled personnel required during this phase.

4.3.2 Construction Phase

Once the Environmental Authorization and any other required permits are obtained, the construction phase can commence. The Rehabilitation of the Old Tug Jetty Sheet Pile wall is expected to extend over a period of between 12 and 25 months where Phase 1 would take approximately 12-15 months and Phase 2 can be 9-10 months.

The construction phase will involve the transportation of personnel, construction material and equipment to the site, and personnel away from the site. In terms of site establishment, laydown areas will be required at the outset of the construction phase, as well as dedicated access routes from the laydown areas to the working areas.

The laydown area will either be located adjacent to or at the project site. It is expected that the laydown area will be temporary in nature (for the duration of the construction phase) and will include the establishment of the construction site camp (including site offices and other temporary facilities for the appointed Contractors).

All efforts will be made to ensure that all construction work will be undertaken in compliance with local, provincial and national legislation, local and international best practice, as well as the Environmental Management Programme (EMPr), which will be compiled during the EIA Phase and included in the EIA Report. During the construction phase, both skilled and unskilled temporary employment opportunities will be created. It is also anticipated that the normal activities at the Old Tug Jetty may be interrupted during construction especially the vessels and surrounding businesses, however the scheduled will be communicated and all interested and affected parties will be notified of the project as it progresses.

The current occupants of the site have been informed about the development and processes are already underway to move them to the nearby building for the duration of the construction period.

4.3.3 Rehabilitation Phase

The Rehabilitation Phase will involve removal of all temporary structures from the site, disposal of waste and cleanup of all spills and excess materials. All effort will be made to return the site as close to its state prior to construction as possible. No revegetation is envisaged since there is currently no vegetation on the site.

4.3.4 Operation Phase

It is anticipated that once all construction and rehabilitation activities are completed, the Old Tug Jetty will return to its normal and optimal operations which include berthing of fishing vessels and trawlers, transshipment of cargo and supplies and boat maintenance. The new structures will allow these activities to take place in a safe manner. No substantial changes to the use of the area are anticipated following rehabilitation. The only impacts associated with the operational phase of the proposed project that were assessed are thus those associated with an altered geometry of the sheet pile wall on hydrodynamic conditions, ecological and hydrodynamic impacts posed by the deck-on-pile structure, and the permanent loss of open water and sediment habitat.

5. POLICY AND LEGISLATIVE CONTEXT

5.1 APPLICABLE ENVIRONMENTAL LEGISLATION

This section of the report presents an overview of the governing legislation identified which may relate to the proposed project. A summary of the applicable legislation is provided in ***Table 6*** below. The legal compliance obligation for this project stems from the need for an EA to be granted by the competent authority, DFFE, in accordance with the requirements of the NEMA. In addition, there are numerous other pieces of legislation governed by many acts, regulations, standards, guidelines on a national, provincial, and local level, which should be considered in order to assess the potential applicability of these for the proposed project. More detail on the legislative framework is presented below.

Table 6. Applicable key legislation

Legislation and guidelines	**Description**	**Legal requirement for this project**
The Constitution of South Africa, 1996 (Act No.108 of 1996)	The Constitution is the highest and the supreme law in South Africa. The Bill of Rights in chapter 2 section 24 of the Constitution of South Africa Act (Act 108 of 1996) makes provisions for environmental issues and declares that: "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 c) generations, through reasonable legislative and other measures that: i. prevent pollution and ecological degradation; ii. promote conservation; and	The applicant has an obligation to ensure that the project is undertaken in a manner that respects and protects the constitutional rights of all interested and affected parties. The applicant must ensure that the project environment is not harmful and that measures are implemented to prevent pollution so that future generations can enjoy the social and ecological benefits.

Legislation and guidelines	Description	Legal requirement for this project
	iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".	
National Environmental Management Act, 1998 (Act No.107 of 1998) as amended	The National Environmental Management Act, 1998 (Act No.107 of 1998) (NEMA) is a 'principles based Act' and is an overarching statute regulating various aspects of natural resources use, integrated environmental management and pollution control. The Act provides for the right to an environment that is not harmful to the health and wellbeing of the South African people; sustainable development, environmental protection, equitable distribution of natural resources; and the formulation of environmental management frameworks. Its definition of the environment includes the land and water of the earth, microorganisms, plant and animal life or a combination of those things, and the inter relationships among them. The Act aims to provide for cooperative environmental governance by establishing principles for decision making on matters affecting the environment, institutions that will promote co-operative governance, and procedures for coordinating environmental functions exercised by organs of state. Section 24 Provides for the prohibition, restriction and control of activities which are likely to have a detrimental effect on the environment.	The applicant must ensure that construction and operation of activities must be conducted according to the generally accepted principles of sustainable development, integrating social, economic, and environmental factors. An application for Environmental Authorisation has been submitted on behalf of the client in line with the requirements of NEMA since the proposed project will trigger listed activities which require authorization prior to commencement. As part of the EIA process, mitigation measures will be proposed to ensure that the significance of the predicted impacts is reduced thus protecting the environment from degradation.
Environmental Impact Assessment	The Environmental Impact Assessment (EIA) Regulations promulgated under NEMA in 2014 provide a list of activities which are subject to an Environmental Authorisation (EA)	An application for Environmental Authorisation has been submitted on behalf of the client in line with the requirements of NEMA EIA Regulations since the

Legislation and guidelines	Description	Legal requirement for this project
Regulation, 2014 as Amended	process prior to construction or implementation. In accordance with the 2014 EIA Regulations, (as amended) an EIA process is required owing to the applicability of the activities listed in ***Table 7***. According to the NEMA Regulations these activities may not commence without environmental authorization from the competent authority which requires the investigation, assessment and statement of potential impact of activities and must follow the procedure as described in the EIA Regulations.	proposed project will trigger listed activities which require authorization prior to commencement
National Environmental Management Biodiversity Act (Act No. 10 of 2004)	The National Environmental Management: Biodiversity Act (NEM:BA) makes provisions for achieving the objectives of the United Nation's Convention on Biological Diversity, to which South Africa is a signatory. The Bill promotes management, conservation and sustainable use of indigenous biological resources, and provides for: • the management and conservation of biological diversity; • the use of indigenous biological resources in a sustainable manner; and • the fair and equitable sharing of benefits arising from the commercialization through bio-prospecting of traditional uses and knowledge of generic resources. The Bill gives effect to international agreements relating to biodiversity which are binding on the Republic and provides for	The proposed project falls within an area identified as a Critical Biodiversity Area (CBA) according to the Eastern Cape Biodiversity Conservation Plan (ECBCP) as well as the NMBMM Bioregional Plan. The applicant through the EIA process will verify the validity of this categorization in light of the transformed nature of the site and then ensure that areas that remain natural within the CBA are kept as intact as possible. The applicant and its appointed contractor has the responsibility to prevent the establishment of alien vegetation within the site and where it has established, ensure that alien plants are eradicated promptly.

Legislation and guidelines	Description	Legal requirement for this project
	co-operative governance in biodiversity management and conservation and provides for a National Biodiversity Institute to assist in achieving the above objectives. The Act gives wide powers to the National Biodiversity Institute to inter alia protect flora and fauna in appropriate enclosures, the collection of information, undertaking and promotion of research on indigenous biodiversity and the sustainable use of indigenous biological resources, the prevention, control or eradication of listed invasive species, biodiversity planning and other functions. This act lists all critically endangered, vulnerable and protected species. The potential occurrence of any such species will be investigated in the BA process.	
National Environmental Management: Integrated Coastal Management Act	The National Environmental Management Integrated Coastal Management Act (No.24 of 2008) [NEM:ICMA] aims to establish a system of integrated coastal and estuarine management and to ensure that development within the coastal zone is socially and economically justifiable and ecologically sustainable. In order to minimise or mitigate negative environmental impacts, the NEM:ICMA refers to the NEMA provisions for the need to obtain environmental authorisations prior to undertaking certain listed activities. Any of the listed activities that are conducted in the coastal zone will require an environmental authorisation in terms of NEMA. In addition to the NEMA requirements and criteria for environmental authorisations, the NEM:ICMA provides for additional criteria that must be considered by the	The proposed project will take place within the coastal zone. Listed activities which include dredging and infilling of material into the sea will be triggered thus the DFFE Oceans and Coasts Department has been identified as competent authority has been identified for handing the Dredging permit application along with Integrated Environmental Authorisations section. The National Environmental Management Act: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) governs the open water disposal of dredged material. The open water disposal of dredged material requires a permit from the Department of Forestry, Fisheries and the Environment. The permitting procedure is in

Legislation and guidelines	Description	Legal requirement for this project
	relevant competent authority when evaluating an application for an activity which will take place in the coastal zone	accordance with the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter of 1972 (the London Convention) and 1996 Protocol thereto, to which South Africa is a signatory. To comply with the Act, Transnet National Ports Authority annually makes an application to the Department to dispose sediment maintenance dredged in the Port of Port Elizabeth at a registered open water disposal site in Algoa Bay (CSIR,2019).
National Water Act, 1998 (Act No.36 of 1998)	In terms of chapter 3 section 12-20, water resources are to be protected, used, developed, conserved, managed and controlled. This Act recognizes that water is a scarce resource; it is a natural resource that belongs to all of South Africa's people. The National Department of Water and Sanitation is responsible for the nation's water resource and also the Minister of Department of Water and Sanitation ensures that the water resource is "protected, used, developed, conserved, managed and controlled" through the implementation of this Act (National Water Act 36 of 1998). This Act makes provisions for the protection of surface water and groundwater resources and their sustainable management for the prevention and remediation of the effects of pollution, and for the control of emergency occurrences. Section 21 of the National Water Act (NWA) lists water uses for which a Water Use License will be required.	The proposed project is located within 100m of a river and within 500m of a wetland. Confirmation has been received from DWS that Section 21 (c) and (i) is not applicable in the proposed project since it will take place within the marine environment.

Legislation and guidelines	Description	Legal requirement for this project
National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004)	The objective of the Act is to protect the environment by providing reasonable measures for the protection and enhancement of air quality and to prevent air pollution. The Act makes provision for measures to control dust and offensive odours. Section 32 of The National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004) deals with dust control measures regarding dust control. The Minister or MEC may prescribe measures for the control of dust in specified places or areas, either in general or by specified machinery or in specified instances, the steps to be taken to prevent nuisance or other measures aimed at controlling dust. The National Dust Control Regulations (2013) provides for the management and monitoring of dust.	The EMPr has been compiled during the EIA phase and includes measures for control of dust during the construction phase. Any exceedances observed in terms of the National Dust Regulations, a dust monitoring programme must be submitted to the competent authority.
National Environmental Management: Protected Areas Act (Act No. 57 Of 2003)	The purpose of the National Environmental Management: Protected Areas Amendment Act (NEMPAA) is to provide for the protection and conservation of ecologically sensitive areas representative of South Africa's biological diversity and its natural landscapes and seascapes. The objectives of NEMPAA are: (a) To provide, within the framework of national legislation, including the National Environmental Management Act, for the declaration and management of protected areas;	The proposed project is located within 5km of a Formal Protected Area. The identified management authorities have been included in this project as interested and affected parties (IAPs).

Legislation and guidelines	Description	Legal requirement for this project
	(b) To provide for co-operative governance in the declaration and management of protected areas; (c) To effect a national system of protected areas in South Africa as part of a strategy to manage and conserve its biodiversity; (d) To provide for a representative network of protected areas on state land, private land and communal land; (e) To promote sustainable utilisation of protected areas for the benefit of people, in a manner that would preserve the ecological character of such areas; (f) To promote participation of local communities in the management of protected areas, where appropriate; and (g) To provide for the continued existence of South African National Parks.	
Occupational Health and Safety Act, 1993 (Act No.85 of 1993)	The Occupational Health and Safety Act make provisions in regulations Section 8 for the general duties of employers to their employees. The act provides for the health and safety of people at work utilising machinery and the protection of others against health and safety risks associated with activities on site/work. General Administrative Regulations (2003) describe the administration of the various OHS Regulations, including the designation of health and safety committees, the reporting and	The applicant must ensure that a safe working environment is provided for its employees during construction and operational phases of the project. This includes obtaining the relevant work permits, providing PPE and ensuring all required facilities are available for a working environment that is conducive. All stalls must have adequate training for their various duties and the applicant must ensure that compliance with the OHSA

Legislation and guidelines	Description	Legal requirement for this project
	recording of incidents and occupational diseases. This Act is applicable to all contractors during the planning, construction and operational phases of the project. To provide for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work.	and Construction Regulations is monitored on a regular basis.
Hazardous Substance Act (No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitizing or inflammable nature of the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products about the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. • Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive, etc., nature or because it generates pressure through decomposition, heat, or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance • Group IV: any electronic product; and • Group V: any radioactive material. The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force. It is necessary to identify and	Relevant permits must be obtained for the storage of hazardous substances if any will be stored on site during construction. The contractor must ensure that hazardous substances are stored in a safe manner and MSDS are retained on file for all hazardous substances on site.

Legislation and guidelines	Description	Legal requirement for this project
	list all the Group I, II, III, and IV hazardous substances that may be on the site and in what operational context they are used, stored, or handled. If applicable, a license is required to be obtained from the	
National Environmental Management: Waste Act, 2008 (Act No.59 of 2008)	During construction waste will be produced, in either liquid, solid and/or hazardous state, and this waste will be required to be adequately and appropriately disposed of. There are several Regulations or Acts that are applicable to the proposed development in terms of waste management. To reform the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures; to provide for the licensing and control of waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith.	No authorization is required in terms of NEMWA, however, the applicant must make sure that waste is managed appropriately on site. This includes separation of waste, routine cleanup of the site and spillages as well as disposal at appropriately licensed waste landfills. Where possible, waste should be recycled to minimizes volumes of waste disposed to landfills

Legislation and guidelines	Description	Legal requirement for this project
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". According to Section 34 of NHRA, No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority. Section 38 Listed Activities: (a) the construction of a road, wall, power line, 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 50 m 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	The site is located within a grade II heritage site. The Heritage Structures are not older than 60 years and therefore no heritage impact assessment will be undertaken. The ECPHRA has been identified as a stakeholder in this project and will be provided an opportunity to comment of the findings of the EIA process.

Legislation and guidelines	Description	Legal requirement for this project
	(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,	
National Ports Act, 2005 (Act 12 of 2005)	The objects of this Act are to- (a) promote the development of an effective and productive South African ports industry that can contribute to the economic growth and development of our country; (b) establish appropriate institutional arrangements to support the governance of ports; (c) promote and improve efficiency and performance in the management and operation of ports; (d) enhance transparency in the management of ports; (e) strengthen the State's capacity to-	By undertaking this project which aims to ensure that the Old Tug Jetty remains operational, the applicant is fulfilling its mandate in terms of the National Ports Act.

Legislation and guidelines	Description	Legal requirement for this project
	(i) separate operations from the landlord function within ports; (ii) encourage employee participation, to motivate management and workers (iii) facilitate the development of technology, information systems and managerial expertise through private sector involvement and participation; and (f) promote the development of an integrated regional production and distribution system in support of government's policies.	
Integrated Environmental Management Information Guidelines Series:	This series of guidelines was published by the Department of Environmental Affairs (DEA) and refers to various environmental aspects. Applicable guidelines in the series for the proposed project include: • Guideline 5: Companion to NEMA EIA Regulations, 2010; • Guideline 7: Public participation; and • Guideline 9: Need and desirability. Additional guidelines published in terms of the NEMA EIA Regulations, 2014 (as amended), in particular: • Guideline 3: General Guide to EIA Regulations, 2006;	These guidelines have been consulted in the compilation of this report as well as the public participation process that will be undertaken.

Legislation and guidelines	Description	Legal requirement for this project
	• Guideline 4: Public Participation in support of the EIA Regulations, 2006; and • Guideline 5: Assessment of alternatives and impacts in support of the EIA Regulations, 2006.	
Municipal Systems Act (Act 32 of 2000)	The Municipal Systems Act provides for the core principles, mechanisms and processes that are necessary to enable municipalities to provide for community participation and for the integration of all activities for the overall social and economic upliftment of communities in harmony with their local natural environment. It also states that a fundamental aspect of the new local government system is the active engagement of communities in the affairs of municipalities of which they are an integral part. The Act requires the implementation and monitoring of Integrated Development Plans, the setting of targets and key performance indicators, including environmental targets, as well as the preparation of by-laws and policies that deal with environmental issues.	The NMBMM has been included as an I&AP for this project and the municipal IDP has been consulted in compilation of this report.
OTHER RELEVANT LEGISLATION	Other legislation that may be relevant to the proposed development 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,	Relevant mitigation measures have been included in Section 11.6 of this report as well as the project EMPr for control of noise during construction, management of alien species, minimizing visual impact as well as use of local labor during the construction phase.

Legislation and guidelines	Description	Legal requirement for this project
	vibration and shock, including prevention, acceptable levels, powers of local authorities related matters; SANS 10103 (Noise Regulations) • 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; • National Web Based Screening Tool • Public Finance Management Act (Act 1 of 1999; PFMA); • Employment Equity Act (Act 55 of 1998; EEA); • Labour Relations Act (Act 66 of 1995; LRA); and • District and Local municipality Integrated Development Plans (IDPs) and • Spatial Development Frameworks (SDFs).	

5.2 LISTED ACTIVITIES TRIGGERED UNDER NEMA

The proposed development triggers listed activities in terms of 2014 EIA Regulations as amended, these are described in ***Table* 7** below.

Table 7: Listed Activities Applied For

Activity No(s):	Provide the relevant Basic Assessment Activity(ies) as set out in Listing Notice 1 of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
GNR 327 Activity 15	The development of structures in the coastal public property where the development footprint is bigger than 50 square metres, excluding— (i) the development of structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (ii) the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (iii) the development of temporary structures within the beach zone where such structures will be removed within 6 weeks of the commencement of development and where coral or indigenous vegetation will not be cleared; or (iv) activities listed in activity 14 in Listing Notice 2 of 2014, in which case that activity applies.	The proposed project involves construction of new structures in the coastal public property that are joined or connected to the existing Old Tug Jetty Sheet Pile Wall. Both structures extend into the seawaters by 6 m each, the total extension of 12 m (width) from the existing structures and the site extents are 246 m (length), hence, the development footprint of the port or harbour will be increased or expanded by approximately 2500 square metres in total.
GNR 327 Activity 17 (i)(iii)(v) (a)(c)(d)(e)	Development— (i)in the sea; (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— (a) fixed or floating jetties and slipways; (b) tidal pools; (c) embankments;	The proposed rehabilitation of the Old Tug Jetty: • Occurs in the sea • Entails construction of a counterfort wall and deck on pile structure in front of the existing structure • The development footprint is more than $50m^2$ The phase 1 counterfort wall is 259.3 m long. The cope level is at +4 m CD with the berth depth

Activity No(s):	Provide the relevant Basic Assessment Activity(ies) as set out in Listing Notice 1 of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
	(d) rock revetments or stabilising structures including stabilising walls; or (e) infrastructure or structures with a development footprint of 50 square metres or more — but excluding— (aa) the development of infrastructure and structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) the development of temporary infrastructure or structures where such structures will be removed within 6 weeks of the commencement of development and where coral or indigenous vegetation will not be cleared; or (dd) where such development occurs within an urban area.	varying from -5.2 m CD along the north western face sloping up and tying into the extents of the boat ramps. Phase 2 expansion entails construction of an adjoining deck on pile structure partially supported by the counterfort wall. The deck on pile jetty is 87.3 m long with further cope line offset of 5.8 m. The cope level is at +4 m CD with a berth depth of -6.5 m CD. Both structures extend into the seawaters by 6 m each, total extension of 12 m from the existing structure. LN1 Activity 17 is included in the listed activities applied for because the proposed rehabilitation will increase the development footprint of the port by extending the structures seawards. Although the development is related to the development of a port, Activity 26 of LN2 applies because the development footprint of the port will be increased. The structure is not temporary and is designed to be robust to achieve a service life of 50 years with minimal maintenance.
GNR 327 Activity 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 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]	The proposed project consists of development and earthworks in the sea. More than 10 cubic metres of material will be removed and deposited during the construction of the proposed structures. Exclusion (a) to (d) does not apply because the development setback is not known, the project is not done for maintenance purposes, LN1 Activity 21 does not apply and the development footprint of the port will be increased. A dredging permit

Activity No(s):	Provide the relevant Basic Assessment Activity(ies) as set out in Listing Notice 1 of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
	(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or (e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.	application will be submitted as part of the EIA process for this project.
GNR 327 Activity 19A (i)(ii)(iii)	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 highwater mark of the sea or an estuary, whichever distance is the greater; or (iii) the sea; but excluding where such infilling, depositing , dredging, excavation, removal or moving— (f)will occur behind a development setback; (g) is for maintenance purposes undertaken in accordance with a maintenance management plan; (h) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (i) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.	The proposed project consists of development and earthworks in the sea. More than 5 cubic metres of material will be removed and deposited during the construction of the proposed structures. The proposed dredging will take place on the seashore, within the littoral active zone of the sea as well as from the sea. A dredging permit application will be submitted as part of the EIA process for this project. Exclusion (f) to (i) does not apply because the development setback is not known, the project is not done for maintenance purposes, LN1 Activity 21 does not apply and the development footprint of the port will be increased. A dredging permit application will be submitted as part of the EIA process for this project.
GNR 327 Activity 31 (i)(ii)(iv)(v) (a)(b)	The decommissioning of existing facilities, structures or infrastructure for—	The proposed project will involve decommissioning of the old sheet pile wall during

Activity No(s):	Provide the relevant Basic Assessment Activity(ies) as set out in Listing Notice 1 of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
	(i) any development and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014; (ii) any expansion and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014; (iv) any phased activity or activities for development and related operation activity or expansion or related operation activities listed in this Notice or Listing Notice 3 of 2014; or (v) any activity regardless the time the activity was commenced with, where such activity: (a) is similarly listed to an activity in (i)[,] or (ii)[, or (iii)] above; and (b) is still in operation or development is still in progress; excluding where— (aa) activity 22 of this notice applies; or (bb) the decommissioning is covered by part 8 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies.	phase 1 and partial decommissioning of the counterfort wall during phase 2. The exclusions (aa) and (bb) do not apply.
GNR 327 Activity 52	The expansion of structures in the coastal public property where the development footprint will be increased by more than 50 square metres, excluding such expansions within existing ports or harbours where there will be no increase in the development footprint of the port or harbour and excluding activities listed in activity 23 in Listing Notice 3 of 2014, in which case that activity applies.	The proposed project entails the expansion of jetty (quay) by a counterfort wall and deck on pile hybrid. The site or application area is in the coastal public property. Both structures extend into the seawaters by 6 m each, the total extension of 12 m (width) from the existing structures and the site extents are 246 m (length), hence, the development footprint of the port or harbour will be increased or expanded by approximately 2500 square metres in total.

Activity No(s):	Provide the relevant Basic Assessment Activity(ies) as set out in Listing Notice 1 of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
GNR 327 Activity 54 (i)(iii)(v) (a)(b)(c)(d)(e)	The expansion of facilities— (i) in the sea; (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— (a) fixed or floating jetties and slipways; (b) tidal pools; (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, but excluding— (aa) the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; or (bb) where such expansion occurs within an urban area.	Expansion of jetty (quay) by a counterfort wall and deck on pile hybrid will occur in the sea and within the littoral active zone of the sea. The structures will be located within a distance of 100 metres inland of the highwater mark of the sea. The construction of stabilizing walls is applicable as construction process consists of placing the precast counterfort units of embankments, rock fill and stone bed along the vertical extents of the existing sheet pile wall. Both structures extend into the seawaters by 6 m each, total extension of 12 m from the existing structures, hence, the development footprint of the port or harbour will be increased or expanded by 2500 square metres which is more than 50 square metres. The exclusions do not apply to this project.
GNR 327 Activity 55 (i)(iii)(v) (a)(d)(e)(f)	Expansion— (i) in the sea; (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 — (a) facilities associated with the arrival and departure of vessels and the handling of cargo; (d) breakwater structures; (e) coastal marinas;	Expansion of jetty (quay) by a counterfort wall and deck on pile hybrid will occur in the sea and within the littoral active zone of the sea. The structures will be located within a distance of 100 metres inland of the highwater mark. The infrastructure shall serve as breakwater structures to protect against tides, currents, waves, and storm surges. The quay wall is currently being used for the berthing of fishing vessels and trawlers. Both structures extend into the seawaters by 6 m each, total extension of 12 m from the existing structures,

Activity No(s):	Provide the relevant Basic Assessment Activity(ies) as set out in Listing Notice 1 of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
	(f) coastal harbours or ports; but excluding the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.	hence, the development footprint of the port of Port Elizabeth will be increased or expanded.
GNR 327 Activity 65 (i) (ii)	The expansion and related operation of — (i) an anchored platform; or (ii) any other structure; on or along the sea bed, where the expansion will constitute an increased development footprint, excluding expansion of facilities, infrastructure or structures for aquaculture purposes	The proposed expansion of jetty (quay) by construction of a counterfort wall and deck on pile hybrid will occur on or along the sea bed. Both structures extend into the seawaters by 6 m each, total extension of 12 m from the existing structures, hence, the development footprint of the port or harbour will be increased or expanded by more than 50 square metres. The proposed rehabilitation is not for aquaculture purposes
Activity No(s):	Provide the relevant **Basic Assessment Activity(ies)** as set out in **Listing Notice 3** of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
GN.R R324 Activity 14 (ii) (a)(c) a.i.(bb)(ff)(hh)(ii) ii. (cc)	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; excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. a. Eastern Cape i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas;	The rehabilitation of the Old Tug Jetty will take place in the Port of Port Elizabeth, which is in the Eastern Cape. The water surface area of the proposed counterfort wall and deck on pile hybrid exceeds 10m². The physical footprint of the structure is greater than 10 square metres and also located within 5km of the Cape Recife Nature Reserve and the Nelson Mandela University Private Nature Reserve. The project falls within a Critical Biodiversity Area (CBA2) The proposed project will occur within a watercourse, and within 32 metres of a watercourse. Both structures extend into the seawaters by 6 m each, total extension of 12 m from the existing structures, hence, the

Activity No(s):	Provide the relevant Basic Assessment Activity(ies) as set out in Listing Notice 1 of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
	(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve; (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 ii. Inside urban areas: (cc) Areas seawards of the development setback line.	development footprint of the port or harbour will be increased. The project infrastructure is located within 1 kilometre from the high-water mark of the sea.
GNR 324 Activity 23 (ii) (a)(c) a.i.(bb)(ee)(gg)(hh)	The expansion of— (ii) infrastructure or structures where the Physical footprint is expanded by 10 square metres or more; where such expansion occurs—where such expansion 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; excluding the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. a. Eastern Cape i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area	The rehabilitation of the Old Tug Jetty will take place in the Port of Port Elizabeth, which is in the Eastern Cape. The physical footprint of the structure will be expanded by more than 10 square metres and is also located within 5km of the Cape Recife Nature Reserve and the Nelson Mandela University Private Nature Reserve. The project falls within a Critical Biodiversity Area (CBA2) The proposed project will occur within a watercourse and within 32 metres of a watercourse. Both structures extend into the seawaters by 6 m each, total extension of 12 m from the existing structures, hence, the development footprint of the port or harbour will be increased. The project infrastructure is located within 1 kilometre from the high-water mark of the sea. .

Activity No(s):	Provide the relevant Basic Assessment Activity(ies) as set out in Listing Notice 1 of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
	identified in terms of NEMPAA or from the core area of a biosphere reserve; (hh) 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; .	
GNR 324 Activity 26 i	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; —excluding the following activities listed in this Notice— 7; 8; 11; 13; 20; 21; and 24.	The proposed rehabilitation of the Old Tug Jetty: • Inherently occurs in the sea • Entails construction of a stabilising walls on the existing structure • Structures footprint is more than 50m² The Old Tug Jetty sheet pile wall rehabilitation project is divided into two phases. Phase 1 entails the construction of a counterfort wall with a berth depth of -5.2 m CD. Phase 2 will be implemented when there is sufficient demand for a deeper berth.. Phase 2 expansion entails the construction of an adjoining deck on pile structure partially supported by the counterfort wall with a design berth depth of -6.5 m CD. Thus, this activity is triggered because phase 2 will commence after construction of phase 1. Both structures extend into the existing seawaters by 6 m each resulting in a total extension of 12 m from the existing structures, hence the development footprint of the port will increase. The exclusion does not apply because none of the excluded listed activities are applicable to the proposed project.
Activity No(s):	Provide the relevant **Scoping and EIR Activity(ies)** as set out in **Listing Notice 2** of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.

Activity No(s):	Provide the relevant Basic Assessment Activity(ies) as set out in Listing Notice 1 of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
GNR 325 Activity 14(ii) (iii)	The development and related operation of— (ii) an anchored platform; or (iii) any other structure or infrastructure — on, below or along the sea bed; excluding — (a) development of facilities, infrastructure or structures for aquaculture purposes; or (b) the development of temporary structures or infrastructure where such structures will be removed within 6 weeks of the commencement of development and where coral or indigenous vegetation will not be cleared.	The proposed rehabilitation of the Old Tug Jetty: • Inherently occurs in the sea • Entails construction of a stabilising walls on the existing structure • Structures footprint is more than 50m² Phase 1 entails the construction of a counterfort wall with a berth and Phase 2 expansion entails construction of an adjoining deck on pile structure partially supported by the counterfort wall with a design. The proposed project involves construction of a counterfort wall and deck on pile hybrid will occur on or along the seabed. Both structures extend into the seawaters by 6 m each, total extension of 12 m from the existing structures, hence, the development footprint of the port or harbour will be increased or expanded by more than 50 square metres
GN.R 325 Activity 26 (i)(iii)(v) a)(d)(e)(f)	Development— (i) in the sea; (iii)within the littoral active zone; (v)if no development setback exists, within a distance of 100 metres inland of the highwater mark of the sea or an estuary, whichever is the greater; in respect of — (a) facilities associated with the arrival and departure of vessels and the handling of cargo; (d)breakwater structures; (e)coastal marinas; (f) coastal harbours or ports;	The proposed rehabilitation of the Old Tug Jetty: • Inherently occurs in the sea • Entails construction of a stabilising walls on the existing structure Phase 1 entails the construction of a counterfort wall with a berth and Phase 2 expansion entails construction of an adjoining deck on pile structure partially supported by the counterfort wall with a design. Expansion of jetty (quay) by a counterfort wall and deck on pile hybrid will occur in the sea and within the littoral active zone of the sea. The structures

Activity No(s):	Provide the relevant Basic Assessment Activity(ies) as set out in Listing Notice 1 of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
	but excluding the development of structures within existing ports or harbours that will not increase the development footprint of the port or harbour.	will be located within a distance of 100 metres inland of the highwater mark. The infrastructure shall serve as breakwater structures to protect against tides, currents, waves, and storm surges. Both structures extend into the seawaters by 6 m each, total extension of 12 m from the existing structures, hence, the development footprint of the port or harbour will be increased or expanded by more than 50 square metres. The quay wall is currently being used for the berthing of fishing vessels and trawlers. The northern extent of the back of quay area is used for the transhipment of cargo and supplies, while the southern extent is used for boat maintenance.

6. NEED AND DESIRABILITY OF THE PROJECT

One of the objectives of the EIA process is to motivate 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". Consideration should be given to the need and desirability of development in determining whether this is the right time and place for the proposed land use or activity to be established. Hence, it is therefore, equated with rational land use and should be able to answer the question of what the most sustainable use of land is.

QUESTION: NEED (TIMING) OF PROPOSED PROJECT
1. Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved Spatial Development Framework (SDF) agreed to by the relevant environmental authority i.e. is the proposed development in line with the projects and programmes identified as priorities within the Integrated Development Plan (IDP)?
Yes, the proposed rehabilitation of the Old Tug Jetty sheet pile wall is in line with local municipality IDPs and SDF. The quay wall is currently being used for the berthing of fishing vessels and trawlers. The northern extent of the back of quay area is used for the transhipment of cargo and supplies, while the southern extent is used for boat maintenance. Agriculture and processing of agricultural products plays a significant role in the local economy and therefore any project that seeks to strengthen and sustain to ocean economy industries is beneficial. Thus, this project is also in line with the Port Development Framework Plan.
2. Should development, or if applicable, expansion of the town/ area concerned in terms of this land use (associated with the activity being applied for) occur at this point in time?
Yes. This is the right time to implement the rehabilitation as the engineering inspections undertaken to determine the structural stability and safety of the sheet pile wall indicate that it would have to be rehabilitated or else decommissioned.
3. *Does the community/area need the activity and the associated land use concerned (is it a societal priority)? This refers to the strategic as well as local level (e.g. development is a National priority, but within a specific local context it could be inappropriate).*
Yes. The project is relevant and needed in the local context as the fishing and transportation of goods are done by individuals and businesses from the local communities.
QUESTION: NEED (TIMING) OF PROPOSED PROJECT
4. *Are the necessary services with appropriate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?*
No additional capacity from the municipality will be required.
5. *Is this development provided for in the infrastructure planning of the municipality, and if not, what will the implication be on the infrastructure planning of the municipality (priority and placements of services)?*

The proposed rehabilitation of the Old Tug Jetty Sheet pile wall does not specifically have to be provided for in the infrastructure planning of the municipality. The applicant, Transnet is responsible for improving, managing and maintaining the national ports which act as the "economic arteries" of South Africa. Thus, the applicant will be responsible for ensuring all required services for the construction phase,
6. Is this project part of a national Programme to address an issue of national concern or importance?
No. Although the Transnet ports and harbors play a significant role in the general economy of the district.
7. How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?
The proposed project is located in an area that has been transformed through existing developments of the harbour and port. The site is adjacent to a Marine protected area as well as Baakens River mouth. According to the screening Tool Report, the Aquatic and Terrestrial biodiversity of the site is low. Thus, although the project will have some negative ecological impacts, no significant change is anticipated.
*8. **How were the following integrity considerations taken into account?*** *8.1. **Threatened ecosystems*** *8.2. **Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs)*** *8.3. **Environmental Management Framework*** *8.4. **Spatial Development Framework (SDF).***
There are no threatened ecosystems within the project site. **The site is located within 5 km of a Formal Protected Area.** **The project area is located in a CBA 2.** **There is no Environmental Management Framework (EMF).** **The proposed development will not compromise the integrity of the Eastern Cape Biodiversity Conservation Plan (ECBCP) which has been adopted by DEDEAT or the provincial and Local SDF.**
9. How will this development pollute/ degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?
The proposed project may result in some erosion and sedimentation of watercourses due to excavation and backfilling. There is also a possibility of contamination of watercourses due to spillages caused by plant and equipment used during undertaking of works. The mitigation hierarchy has been taken into consideration. Environmental awareness training, daily inspection of plant and equipment for faults as well as storage of plant and equipment at least 30m from a watercourse are some of the measures that will be implemented to avoid contamination and pollution. Where pollution and contamination cannot be avoided, measures such as recycling, waste separation, disposal of waste at licensed facilities will be implemented in order to reduce the impacts. Positive

impacts are enhanced through employment of local labour and ongoing monitoring post construction to evaluate the effectiveness of the measures implemented.
10. Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life).
No, the proposed development does not exacerbate the increased dependency on increased use of resources to maintain economic growth. Sustainable and energy efficient methods will be used during construction, where applicable.
11. Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?
According to STATS SA General Households Survey (2019), 21,6% of households in Nelson Mandela Bay listed grants as their main source of income. The proposed project will create employment opportunities to individuals and businesses in the municipality for a period of approximately 12 months. The quay wall is currently being used for the berthing of fishing vessels and trawlers. The northern extent of the back of quay area is used for the transhipment of cargo and supplies, while the southern extent is used for boat maintenance. Agriculture and processing of agricultural products plays a significant role in the local economy and therefore any project that seeks to strengthen and sustain to ocean economy industries is beneficial.
12. Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?
The Economic Development, Tourism and Agriculture function of Nelson Mandela Bay ensures that Local Economic Development helps communities to realise a lively, resilient and sustainable local economy to improve the quality of life of residents. This will be achieved by growing and diversifying the local economy through the attraction of new investment, skills development and the facilitation of an enabling environment for small business growth and job creation. Improvement of transport infrastructure maintenance and creation of business and job opportunities is one of the ways in which these this project will complement the local socioeconomic initiatives.
13. What measures were taken to ensure the participation of all interested and affected parties (I&APs)?
Please refer to Section Error! Reference source not found. **of this report for more detail on the public participation p rocess throughout this EIA process.**

QUESTION: DESIRABILITY (PLACING) OF PROPOSED PROJECT
1. Is the development the best practicable environmental option (BPEO) for this land/ site?

Yes, the project is a rehabilitation project to reconstruct collapsed or deteriorating infrastructure in the Port to sustain and improve operational efficiency of the Port. The property on which the development is proposed to be situated is currently used for the activity applied for i.e. the existing Old Tug Jetty and similar land-uses. The property and many of the erven immediately adjacent to the Jetty are owned by Transnet.
2. Would the approval of this application compromise the integrity of the existing approved Municipal IDP and SDF as agreed to by the relevant authorities?
No. The approval of the project would not the integrity of the existing approved Municipal IDP and SDF as agreed to by the relevant authorities. The project is also in line with the Port Development Framework Plan.
3. *Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in Environmental Management Framework (EMF)), and if so, can it be justified in terms of sustainability considerations?*
No. This application area does not interfere with strategic development zones or EMFs.
4. Do location factors favour this land use (associated with the activity applied for) at this place?
Yes. The location of the project is based on pre-feasibility studies that were undertaken to determine the stability of the existing sheet pile wall. The sheet piles have corroded significantly with large holes visible in the tidal zone. These holes have caused leaching of backfill material resulting in the subsidence of the back of quay area. Transnet National Port Authority (TNPA) has undertaken numerous costly repair campaigns involving filling holes with soilcrete. However, the continued deterioration of the sheet pile wall has resulted in an unsustainable maintenance regime. As such there are no alternatives sites considered for this project, the location favours the selected land use.
5. How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/ natural environment)?
During the construction phase, the excavation and movement of earth materials may result in erosion and sedimentation of the adjacent watercourse, however, mitigation measures such as silt traps will be installed and rehabilitation will be undertaken when construction is completed. The site area itself is not completely natural and has been transformed to a certain degree. A majority of the works will be undertaken within the Transnet property which is already disturbed.
6. How will the development impact on people's health and wellbeing (e.g. in terms of noise, odours, visual character and sense of place, etc.)?
It is anticipated that the proposed project will have minimal impact as there are no directly adjacent landowners and occupants. However, working hours will be kept between 07:00 and 17:00 and house-keeping will be done on a daily basis to maintain a good visual aesthetic. Equipment and vehicles used in construction will be maintained in good order to minimize noise and unnecessary emissions.
7. *Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?*

No. The proposed rehabilitation works are done to improve stability of the existing Old Tug Jetty. The quay wall is currently being used for the berthing of fishing vessels and trawlers. The northern extent of the back of quay area is used for the transshipment of cargo and supplies, while the southern extent is used for boat maintenance. There may be ceasing of these activities during construction phase, no unacceptable opportunity costs are anticipated as the Jetty would otherwise be permanently decommissioned if this project would not take place,
8. *Will the proposed land use result in unacceptable cumulative impacts?*
No unacceptable cumulative impacts have been identified, this will be confirmed upon completion of the specialist studies. The project will improve operational efficiency of the Port. Please refer to section 6 for more information on the assessed impacts and proposed mitigation measures.
9. ***In terms of location, describe how the placement of the proposed development will:*** 9.1. ***Result in the creation of residential and employment opportunities in close proximity to or integrated with each other.*** 9.2. ***Be in line with the planning for the area*** 9.3. ***Encourage environmentally sustainable land development practices and processes.***
QUESTION: DESIRABILITY (PLACING) OF PROPOSED PROJECT
The proposed project will create employment opportunities to individuals and businesses in the municipality for a period of approximately 12 – 24 months. The location of the project in in line with existing plans as it is located with the current Transnet Ports land and there will be no significant land use changes except for halting of activities during construction. Opportunities for employment will be available for skilled and unskilled labour
10. *What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?*
The applicant is fulfilling its mandate to develop and maintain National Ports across South Africa. A multi-disciplinary team consisting of engineers, contractors and consultants are appointed to manage various risks associated with the proposed development. Due diligence is undertaken to confirm the knowledge and expertise of these parties thus it is anticipated that the level of risk due to limits of current knowledge is very low.
11. *What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?*
Safety and Environmental Awareness training will be provided to all workers on commencement of the construction phase in line with the TNPA's SHE Governance Framework. The applicant and its contractors are responsible to comply with the Occupational Health and Safety Act (OHSA) and all employees will be informed of their labor laws in terms of the labour laws of South Africa. A procedure will be in place to record all complaints and monthly audits will be undertaken.
12. How will this development use and/or impact on non-renewable natural resources?

The proposed development will make use of diesel for construction vehicles, plant and equipment. Electricity will also be required for site offices and cooking facilities within the site camp. The main energy source for these activities is non-renewable natural resources.
13. How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?
The proposed project will result in a structurally stable and safer Old Tug Jetty which is used by the communities in their daily social and economic activities. The social needs of the relevant communities will be addressed through the provision of jobs and income. Moreover, a safe and stable Jetty will sustain the fishing industry and allow continued transportation of products. The quay wall is currently being used for the berthing of fishing vessels and trawlers. The northern extent of the back of quay area is used for the transshipment of cargo and supplies, while the southern extent is used for boat maintenance.
14. What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socioeconomic considerations?
The best practicable environmental option in terms of the socioeconomic context has been selected by ensuring consultation with interested and affected parties throughout the Scoping and EIA process. The municipal plans such as IDP, LED strategy, the Port Development Framework Plan and SDF have been reviewed to ensure that the proposed project is aligned with municipal objectives. Mitigation measures will be included in the EMPr, which includes use of local labour and businesses as well as environmental awareness training of employees.
15. How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage?
It is possible that this project will disturb/enhance *landscapes and/or sites that constitute the nation's cultural heritage, The NWBEST report indicates that there archaeological and heritage sensitivity of the application area is very high as it is located within 2km of a Grade II Heritage site. A heritage specialist has been appointed to assess the significance of this potential impact and provide suitable mitigation measures to avoid or minimize the impact.*
16. Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socio-economic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?
Humans and the environment are interdependent, people need the environment to sustain our livelihoods and wellbeing and the environment requires that anthropogenic activities are managed in a manner that does not lead to depletion of natural resources. Although aspects of the proposed development such removal of material or dredging from the sea may lead to sedimentation and deterioration of water quality, this impact will be limited to the construction period and will be addressed through rehabilitation which will attempt to return the environment to its previous state.
17. Describe how the development will impact on job creation in terms of, amongst other aspects:
Employment opportunities are created from the planning phase, where scientists and engineers are appointed to carefully design and plan the proposed project. Both skilled and unskilled labour will be required during the construction phase of this project.

18. Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?
The EMPr describes all reasonable and feasible mitigation measures and addresses long-term environmental management.
19. Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives / targets / considerations of the area?
Please refer to Chapter 10 of this Report for more information on the significance of all potential impacts that have been identified and assessed for the proposed design of.

7. MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT

No other development footprint alternatives were considered for this project because the location of the rehabilitation works is defined and dictated by the position of the existing sheet pile wall which needs to be constructed in order to improve structural stability.

PRDW were appointed by Transnet to conduct a pre-feasibility (FEL 2) study for the rehabilitation of the Old Tug Jetty sheet pile wall. A set of rehabilitation concepts for the Old Tug Jetty sheet pile wall were developed based on typical marine structure types, construction techniques, functional requirements, and existing site conditions. A prescreening assessment of the concepts was then undertaken using a high level, qualitative, multi-criteria analysis to eliminate options that were not considered viable, or which had fatal flaws. Thereafter, the remaining options were assessed in a multi-criteria analysis to determine the preferred solution. The full set of Old Tug Jetty sheet pile wall rehabilitation options that were considered for the pre-screening assessment are detailed in **Table 8**. All the rehabilitation options presented assume that the existing Old Tug Jetty sheet pile wall will be abandoned and buried, and the back of quay area remediated. This means that the counterfort units will be placed proud of the existing sheet pile wall. There will be infilling of rock material between the old sheet pile wall and the new counterfort units with the construction of a new elevated cope, totally encasing the existing sheet pile wall, hence the term “buried and abandoned” (**Figure *5***). Although the old sheet pile wall will remain, it will no longer be in use and will be encased by the new structure, covered by the counterfort wall and will not be visible due to backfilling and concrete capping. Please refer to the full optioneering and multicriteria analysis report which has been attached as Appendix C.

The preferred development footprint will be kept to what is required for safe and efficient construction and operation of the structures. The mitigation measures proposed in the specialist reports will be implemented in order to avoid or minimize negative social and environmental impacts. Compliance with the Environmental Authorisation, EMPr and any other permits obtained will be monitored by the appointed ECO on a regular basis.

8. PROJECT ALTERNATIVES

The identification of alternatives is a key aspect of the success of the environmental scoping phase. All reasonable and feasible alternatives must be identified and screened to determine the most suitable alternatives to consider and assess in the EIA phase. There are, however, some significant constraints that have to be considered when identifying alternatives for a project with this scope. Such constraints include social, financial and environmental issues, which will be discussed as part of the evaluation of the alternatives for this project.

“Alternatives”, in relation to a proposed activity, is defined as 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.

Essentially there are two types of alternatives:

- incrementally different (modifications) alternatives to the Project; and
- fundamentally (completely) different alternatives to the Project.

Fundamentally different alternatives are usually assessed at a strategic level, and EIA practitioners recognize the limitations of project-specific EIAs to address fundamentally different alternatives.

Fundamental alternatives are developments that are totally 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.

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.

8.1 Full description of the process followed to reach the proposed preferred alternative within the site

The process followed to reach the preferred alternative may be described as follows:

- Developer provides description of project and proposed site area;

- The preliminary sensitivity of the site area is determined using the National Web Based Screening Tool;
- Verification of site sensitivity is done through visual site assessment;
- Options of how the desired project can be implemented with least disturbance of sensitive areas are considered (i.e. alternatives);
- The feasibility of the options/alternatives presented is assessed, only feasible and reasonable alternatives are considered for impact assessment;
- The potential Impacts that may be caused by the feasible alternatives are identified, inputs from specialist reports and I&APs are taken into consideration in this process;
- The technical justification for the alternatives are also considered;
- An assessment of the significance of the impacts is done using the methodology described in Section 11;
- The alternative with the lowest (negative) overall combined impact significance score is selected as the preferred alternative.

8.2 Details of Alternatives Considered

8.2.1 Property or Location Alternatives

The proposed project will take place at the existing Old Tug Jetty which is located at the port of Port Elizabeth. A counterfort wall and deck on pile hybrid structure was selected as the preferred rehabilitation option for the Old Tug Jetty sheet pile wall. Both structures extend into the seawaters by 6 m each, total extension of 12 m (width) from the existing structures and the site extents are 246 m (length), hence, the development footprint of the port or harbour will be increased or expanded by approximately 2500 square metres in total. Although the rehabilitation will increase the development footprint of the port, all the works will occur within ERF Humewood 1051, a property which is owned by Transnet. Thus, no other property or location alternatives are feasible except for the proposed Site Alternative 1.

8.2.2 Activity Alternatives

The activity involves the rehabilitation of the existing sheet pile wall of the Old Tug Jetty. The activity is specific to the location and thus there is no other alternative activity type that can be implemented at this location.

8.2.3 Design or Layout Alternatives

PRDW were appointed by Transnet to conduct a pre-feasibility (FEL 2) study for the rehabilitation of the Old Tug Jetty sheet pile wall. A set of rehabilitation concepts for the Old Tug Jetty sheet pile wall were developed based on typical marine structure types, construction techniques, functional requirements, and existing site conditions. A prescreening assessment of the concepts was then undertaken using a high level, qualitative, multi-criteria analysis to eliminate options that were not considered viable, or which had fatal flaws. Thereafter, the remaining options were assessed in a multi-criteria analysis to determine the preferred solution. The full set of Old Tug Jetty sheet pile wall rehabilitation options that were considered for the pre-screening assessment are detailed in **Table 8** below. All the rehabilitation options presented below assume that the existing Old Tug Jetty sheet pile wall will be abandoned and buried and the back of quay area remediated. Please refer to Appendix C for a detailed assessment of alternatives was undertaken during the feasibility study conducted by PRDW on behalf of Transnet. This has been submitted as details of the all the alternatives considered for this development as required in Appendix 2 (2) (1) (g) (i) (v) (vi) of the NEMA EIA Regulations, 2014, as amended.

Table 8: Sheet pile wall alternatives

No.	Alternative	Description	Reason for eliminiation of alternative
1.	Steel sheet pile wall	Construction of a new steel sheet pile wall in front of the existing steel sheet pile wall. Excavation of existing scour rock would be required before the piles could be driven. Wall would thereafter be backfilled and an in-situ cap and slab cast.	A fatal flaw was identified in terms of the Health and Safety considerations. Low score for maintainability and upgradeability.
2.	Steel tubular combi-wall	Construction of a sheet pile wall using steel tubular piles. Tubular piles would be advanced through the existing scour protection by chiselling/excavating through the tube. The piles would have a minimal offset from the existing wall which would be grouted up.	Poor rating for localization, not suitable for the selected site. Low score for maintainability and upgradeability.
3.	Steel sheet pile Wall (Offset)	The proposed sheet pile would be offset beyond the toe of the existing scour rock layer. This would allow the existing sheet pile to remain unaffected by the proposed construction. Wall would thereafter be backfilled and an in-situ cap and slab cast.	Poor rating for maintainability, low score for localization.
4.	Blockwork gravity wall	The blockwork wall would be located seaward of the existing scour protection in order to avoid destabilizing the existing sheet pile wall. The option would entail the construction of a stone foundation, placing the concrete blocks, backfilling, casting an in-situ cap and slab.	Option is fairly expensive and rated poorly in terms of Environmental considerations.
5.	Caisson gravity wall	The caisson option is very similar to the blockwork structure. The caissons would be constructed in the dry, launched on one of	Option is fairly expensive and rated poorly in terms of

No.	Alternative	Description	Reason for eliminiation of alternative
		the slipways adjacent to the Old Tug Jetty, floated into place and submerged.	Environmental considerations and constructability
6.	Counterfort gravity wall	Construction of the counterfort wall would require dredging and removal of existing rock material in order to place a stone bed foundation. Partial relief of the backfill behind the existing sheet pile wall would probably be required during construction. Thereafter, the wall would be placed, backfilled, scour rock placed and concrete works undertaken.	A fatal flaw was identified in terms of the Health and Safety considerations.
7.	Counterfort gravity wall (Offset)	Similar to option 6, the only difference is that the counterfort wall would be placed seaward of the existing scour protection in order to avoid destabilizing the existing sheet pile wall.	Option is fairly expensive and rated poorly in terms of Environmental considerations
8.	Counterfort and deck on pile hybrid	This option is broken into two phases: Phase 1 – Dredge and excavate to the top of the existing scour rock. Thereafter, construct the counterfort wall similar to option 6. Interim berth depth -5.2m CD. Phase 2 – When there is sufficient demand for a deeper berth, the structure could be expanded by driving piles beyond the existing scour rock and constructing a deck on pile structure with the designed berth depth of -6.5m CD.	Preferred option because it rated good to excellent for most of the criteria except maintainability which is average
9.	Blockwork counterfort hybrid	This option would entail dredging and constructing a stone foundation for a concrete block. This would serve as a step and provides a foundation for the counterfort which would be constructed on top of the block. This option was considered since it would reduce the structure's footprint in comparison to option 7.	Option is expensive and rated poor for health and safety and constructability
10.	Deck on pile wharf	The deck on pile option would entail driving the piles just beyond the toe of the existing	Option rated good for most criteria and average for

No.	Alternative	Description	Reason for eliminiation of alternative
		scour protection. Thereafter, the existing wall would be buttressed by the rock fill, and precast beams and slabs are used to construct the deck.	environment and maintainability. Cost is modest.

The alternatives were assessed qualitatively against the following criteria:

- Health and safety considerations
- Environmental considerations
- Constructability
- Localisation
- Maintainability
- Capital costs
- Upgradeability

Pre-screening options were then assessed holistically in a qualitative manner relative to the other options being considered, according to the scoring guideline outlined in **Table 9**.

Table 9: Pre-screening assessment – scoring guideline (PRDW, 2019)

Rating	
(dark green)	Excellent / Cheapest
(light green)	Good / Modest Cost
(yellow)	Average / Moderate Cost
(orange)	Fair / Fairly Expensive
(red)	Poor / Expensive
(grey)	Fatal Flaw

The rating was scored from poor to excellent or when considering cost, from expensive to cheapest. If an option was deemed as fatally flawed, it was automatically eliminated as it was no longer considered viable.

The summary results of the pre-screening assessment for the rehabilitation of the Old Tug Jetty sheet pile is presented in **Table 10** below. For the detailed assessment comments please refer to Appendix C.

Table 10: Pre-screening assessment summary of results (preferred options numbered in red)(PRDW, 2019)

REHABILITATION OPTIONS		CRITERIA						
No.	Option	Health and safety considerations	Environmental considerations	Constructability	Localisation	Maintainability	Capital cost	Upgradeability
1	Steel sheet pile wall	Fatal flaw	Excellent	Good	Fair	Poor	Cheapest	Poor
2	Steel tubular combi-wall	Good	Excellent	Good	Poor	Fair	Average	Fair
3	Steel sheet pile wall (offset)	Excellent	Good	Average	Fair	Poor	Modest cost	Average
4	Blockwork gravity wall	Fair	Poor	Fair	Excellent	Good	Fairly expensive	Good
5	Caisson gravity wall	Fair	Poor	Poor	Average	Excellent	Expensive	Good
6	Counterfort gravity wall	Fatal flaw	Average	Good	Excellent	Excellent	Average	Average
7	Counterfort gravity wall (offset)	Average	Poor	Fair	Excellent	Good	Fairly expensive	Good
8	Counterfort deck on pile hybrid	Good	Good	Excellent	Good	Average	Good	Excellent
9	Blockwork counterfort hybrid	Poor	Average	Poor	Excellent	Excellent	Fairly expensive	Average
10	Deck on pile wharf	Good	Average	Good	Good	Average	Modest cost	Good

Based on the pre-screening assessment, the following concept options were selected to proceed to the multicriteria assessment to determine the preferred option:

- Steel tubular combi-wall (2)
- Offset sheet pile (3)
- Counterfort deck on pile hybrid (8)
- Deck on pile (10)

These 4 options were selected since they scored the best holistically.

The selected options identified by the pre-screening assessment were assessed using the multi-criteria analysis (MCA). The criteria used is the same as in the pre-screening assessment however, the associated criteria weightings have been used to determine the scoring for the MCA.

Table 11: Multi-criteria assessment – base case weightings (PRDW, 2019)

Criteria	Weighting
Health and safety considerations	15%
Environmental considerations	20%
Constructability	15%
Localisation	5%
Maintainability	15%
Capital cost	20%
Upgradeability	10%
Total	100%

Based on the outcomes of the optioneering and multi-criteria analysis, a counterfort wall and deck on pile hybrid structure was selected as the preferred rehabilitation option for the Old Tug Jetty sheet pile wall. This alternative comprises of 2 phases. Phase 1 entails the construction of a counterfort wall with a berth depth of - 5.2m CD. Phase 2 expansion entails construction of an adjoining deck on pile structure partially supported by the counterfort wall with a design berth depth of -6.5m CD. Both structures extend into the existing seawaters by 6 m each resulting in a total extension of 12 m from the existing structures. This will be assessed Design/Layout Alternative 1 in this EIA.

Incremental Alternatives

The preferred counterfort wall and deck on pile hybrid structure described above was then assessed by specialists as part of the respective studies. A modification to the current design was recommended by the aquatic ecology specialist to include in the engineering design strategies for reducing existing impacts, such as surface runoff storage systems to limit the ingress of contaminants into the waterbody. This proposed modification will thus be assessed as Design/Alternative 2.

8.2.4 Technology Alternatives

No technological alternatives have been considered in this assessment.

8.2.5 Operational alternatives

No operational alternatives have been considered in this assessment.

8.2.6 Option of not implementing- “no-go alternative”

The no-go alternative means doing nothing, which would eventually result in the abandoning or condemning of the quay due to safety concerns. As such, the ‘do nothing’ alternative or keeping the current status quo of a with no activities occurring on-site. Although the no-go alternative would maintain the current environmental status with no negative impacts on aquatic organisms and water quality, the socio-economic impact of abandoning the fishing and transportation activities at the Old Tug Jetty would be detrimental to the local economy. The no-go alternative will be assessed as Alternative 3 in this EIA report.

8.3 SUMMARY OF ALTERNATIVES

Table 12: Assessment of alternatives

Alternative level	Alternatives	Advantages	Disadvantages	Reasonable and feasible	Further assessment	Comment
Property or Location	Site Alternative 1 - There is only one feasible and reasonable site alyernative for this project which applies to all alternatives considered.	Existing Old Tug Jetty sheet pile wall is located on this property. Property is owned by applicant and is already disturbed.	Minimum space for laydown areas during construction	YES	YES	
Type of Activity	Alternative 1- Only activity alternative.	Rehabilitation of the Old Tug Jetty sheet pile wall. The sheet piles have corroded significantly with large holes visible in the tidal zone. These holes have caused leaching of backfill material resulting in the subsidence of the back of quay area. Transnet National Port Authority (TNPA) has undertaken numerous repair campaigns involving filling holes with soilcrete. However, the continued deterioration of the sheet pile wall has resulted in an unsustainable maintenance regime.	Construction phase of the project will lead to temporary disturbance of the current land uses, deterioration of water quality due to sedimentation and negative impact on aquatic animal and plant species.	YES	YES	

Alternative level	Alternatives	Advantages	Disadvantages	Reasonable and feasible	Further assessment	Comment
Design/Layout	Design/Layout Alternative 1	Based on the outcomes of the optioneering and multi-criteria analysis, a counterfort wall and deck on pile hybrid structure was selected as the preferred rehabilitation option for the Old Tug Jetty sheet pile wall. The advantages of this layout are as follows: • The sizing of the counterfort has been dictated by the need to limit water area reclaimed to minimise effects on port operations. • To assist with constructability, counterfort units will be precast off site and placed into position. • There are two large open sites on TNPA property within 150 m from the Old Tug Jetty that could possibly be utilized as a casting yard. • The deck on pile will tie into the existing counterfort structure by constructing an abutment to house the deck on pile precast beams spanning between the counterfort and the piles. The abutments	Dredging and construction within the watercourse will lead to sedimentation and ecological impacts. The contractor will need to be made aware of any loading and other limitations to the backup area behind the sheet pile wall for phase 1 and the back area behind the counterfort wall for phase 2.	YES	YES	

Alternative level	Alternatives	Advantages	Disadvantages	Reasonable and feasible	Further assessment	Comment
		provide lateral support and transfers all lateral loads from the deck on pile to the counterfort structure. • Although the existing wall is deteriorating the opportunity to use it as a construction platform is a significant cost saver. Similarly, the phase 1 counterfort wall can also be utilised as a platform when constructing the deck on pile in phase 2.				
Design/Layout	Design/Layout Alternative 2	Same as above but includes surface runoff storage systems which will limit the ingress of contaminants into the waterbody	Same as above	YES	YES	
Technology	N/A	N/A	N/A	NO	NO	
Operational	N/A	N/A	N/A	NO	NO	
No-Go Alternative Mandatory to consider the option of not implementing the project	No rehabilitation of Old Tug Jetty sheet pile wall.	No disturbance of the environment	-Safety risk to current activities -Loss of income when Quay is decommissioned -No job creation	YES	YES	

8.4 ALTERNATIVES TO BE ASSESSED

The removal of the non-feasible alternatives listed above leaves THREE (3) alternatives applicable to the proposed project:

- Design/Layout Alternative 1;
- Design/Layout Alternative 2;
- No-Go Option Alternative 3 (land and sea to remain unaltered).

The Environmental Impact Assessment will therefore only consider these alternatives.

9. PUBLIC PARTICIPATION

The Public Participation Process (PPP) is a requirement of several pieces of South African Legislation and aims to ensure that all relevant I&AP's are consulted, involved and their opinions are taken into account and a record included in the reports submitted to Authorities. The process ensures that all stakeholders are provided this opportunity as part of a transparent process which allows for a robust and comprehensive environmental study.

The public participation (PP) process has been undertaken in line with the requirements of Regulations 39 to 44 of the EIA Regulations as amended. The primary aim of the public participation process is to ensure that:

- Information that reasonably has or may have the potential to influence any decision regarding an application is made available to potential stakeholders and I&APs;
- Potential or registered interested and affected parties, including the competent authority, may be provided with an opportunity to comment on reports and plans; and
- Comments received from potential stakeholders and I&APs are recorded and incorporated into the FSR to be submitted to the Competent Authority.

The primary objectives of the public participation process are to:

- Inform and notify potentially I&APs of the proposed application (explain steps that were taken to achieve this);
- Initiate or promote meaningful and timeous participation of I&APs by providing proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed, or given;
- Maintain a list of all persons, organization and organs of state that were registered as interested and affected parties in relation to the application;
- Identify issues and concerns of key stakeholders and I&APs with regards to the application for the proposed project;
- Provide a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues; and
- Provide responses to I &AP's queries.

The PPP for this project has been undertaken in accordance with the requirements of the NEMA, as well as the principles of Integrated Environmental Management (IEM). IEM implies an open and transparent participatory process, whereby stakeholders and other I&APs are afforded an opportunity to comment on the project.

9.1 Identification and registration of key departments and other I&APs

An initial I&AP list was compiled using records from previous studies undertaken to determine the contact details of government officials and traditional authorities. Landowners were identified using windeed searches and through consultation with known landowners. The I&AP database was compiled containing the following categories of stakeholders:

- The competent authority
- Directly impacted landowners/occupiers
- Adjacent landowners/occupiers
- Relevant organs of state departments
- Municipalities
- Ward councilors and other key stakeholders.

Registered I&APS have been kept abreast of the application and Scoping process and received notification when there is opportunity to provide comment.

Table 13. Registered I&APs

I&AP Category	Name	Organization	Contact Detail
Competent Authority	Ms. Makhosi Yeni	Department of Forestry, Fisheries and the Environment	MYeni@dffe.gov.za
Competent Authority	Ms. Thandeka Mbambo	Department of Forestry, Fisheries and the Environment	OCEIA@dffe.gov.za
Competent Authority	Mr Seoka Lekota	Department of Forestry, Fisheries and the Environment	'BCAdmin@environment.gov.za'
Competent Authority	Mr Sydney Nkosi	DFFE: Protected Areas Systems Management	shnkosi@environment.gov.za
Directly impacted landowners/occupiers	Ms Pamela Yoyo	Transnet SOC Ltd	pamela.yoyo@transnet.net
Adjacent Landowners	Ms. Renee DeKlerk	Transnet SOC Ltd	Renee.DeKlerk@transnet.net
Relevant organs of state departments	Mr. Andries Struwig	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism	Andries.Struwig@dedea.gov.za

I&AP Category	Name	Organization	Contact Detail
	Mr. Dayalan Govender	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism	dayalan.govender@dedea.gov.za
	Ms Natasha Higgit	SAHRA	nhiggitt@sahra.org.za.
	Mrs. Afika Maxongo	Eastern Cape Provincial Heritage Resources Authority	africam@ecphra.org.za
	Mr. Mark Mandita	Eastern Cape Provincial Heritage Resources Authority	markm@ecphra.org.za
	Ms. Ntombiyamayirha Mpumela	Department of Water and Sanitation	MpumelaN@dws.gov.za
	Mr. Siyabonga Ngcobo	Department of Water and Sanitation	NgcoboS@dws.gov.za
	Ms. Shane Gertze	ECPTA	Shane.Gertze@ecpta.co.za
	Ms. Phumza Mathumba	Department of Agriculture, Rural Development and Land Reform	phumza.mathumba@drdlr.gov.za
	Mr. Zibule Bolana	Department of Agriculture, Rural Development and Land Reform	Zibule.Bolana@dalrrd.gov.za
	Mr Simphiwe Dlamini	South African National Defence Force	'siphiwe.dlamini@dod.mil.za'
Municipality	Ms. Teresa Wiegand	NMBMM	twiegand@mandelametro.gov.za

I&AP Category	Name	Organization	Contact Detail
	Mr. Lonwabo Ngoqo	NMBMM	cm@mandelametro.gov.za
	Mr. John Mervyn Mitchell	NMBMM	stagmitchell@gmail.com
	Mr N Peterson	Sarah Baartman District Municipality	npeterson@sbdm.co.za
Ward councillors	Ms. Terri Stander	NMBMM	ward5@mandelametro.gov.za
	Mr Renaldo Gouws	NMBMM	Ward2@mandelametro.gov.za
Other Stakeholders	Mr. Dale Clayton	Zwartkops Conservancy	dale@zwartkopsconservancy.org
	Dr Tommy Bornman	SEAON	tommy@saeon.ac.za
	Ms. Marjorie Makama	Coega	marjorie.makama@transnet.net
	Mr Simphiwe Silwana	Coega	Simphiwe.Silwana@coega.co.za
	Mr Simlindele Manqina	Coega Development Corporation	simlindele.manqina@coega.co.za
	Ms Kirsten Day	Bird Life	kirsten.day@birdlife.org.za
	Mr. Sibongile Dimbaza	Nelson Mandela Bay Business Chamber	baygrow@nmbbusinesschamber.co.za / info@nmbbusinesschamber.co.za
	Port Elizabeth Office	South African Maritime Safety Authority	pereception@samsa.org.za
	Mr. Mzwandile Mjadu	South African National Parks	Mzwandile.Mjadu@sanparks.org
	Mr. R. Adams	WWF SA	Radams@wwf.org.za

I&AP Category	Name	Organization	Contact Detail
	Mr. Fani	Commercial Marine PE	orders@commercialmarine.co.za
	Mr. Lloyd Mthembo	Black Impala	blackimpala@info.co.za
	Mr. Martel	Nelson Mnadela Bay Yatch Club	info@nmbyc.co.za / martel@nmbyc.co.za

9.2 Notification of IAPS

The principles of NEMA govern many aspects of the Scoping and EIA process, including consultation with Interested and Affected Parties (I&APs). These principles include the provision of sufficient and transparent information flow to I&APs on an ongoing basis, to allow them to comment; and ensuring the participation of historically disadvantaged individuals, including women, the disabled and the youth throughout the process.

The I&AP database will be updated throughout the Scoping and EIA process and new participants register on the project. All I&APs who register will be included within this database and included in project related correspondence going forward.

9.3 Public Announcement of the Project

The following means of public engagement were made:

- Postal notification of identified adjacent property owners
- Electronic notification of stakeholders via email
- Publication of media advertisement
- On-site notices were placed, detailing the proposed development, the Scoping and EIA process, and an invitation to register and comment.
- Notices were placed at strategic places on site and in the vicinity of the site (along the road, at intersections, etc.) as well as at high frequented places within the area; and
- Distribution of letters by email and post to I&APs and telephonic calls.

During the Scoping phase of this project, the key objective of public participation was to provide I&APs with an opportunity to provide comment and input in the planning phase of the project. Issues of concern and suggestions raised by I&APs have been addressed and responded to as required in the Scoping Report, and I&APs were also given the opportunity to comment on the findings of both the Scoping and EIA Reports and findings of the Specialist studies during the specified comment periods. I&APs were provided with a 30-day comment period in which to raise issues and / or concerns in response to the Background Information Document.

A draft Scoping Report (dSR) was compiled and made available for public comment for a period of 30 days, where after the Final Scoping Report (FSR) including Comments and Responses from the public was submitted to the Competent Authority, DFFE during April 2023. On 26 May 2023, the DFFE accepted the FSR and confirmed that the project may proceed to the Impact Assessment Phase.

This Draft Environmental Impact Report (DEIR) will be made available for a 30 day comment period during July 2023. Thereafter the Final Environmental Impact Report (FEIR), together with all comments and responses from the public will be submitted to DFFE for decision. I&APs will be notified in writing of any decisions made by DFFE after submission of the FEIR. Please note that communications regarding the process and the availability of reports will only be sent to registered I&APs.

9.4 Public Meetings

Two public meetings were held during the scoping phase, one face-to-face with some of the key stakeholders as well as a virtual meeting. The meetings were held in line with COVID-19 protocols and safety precautions. To limit exposure to COVID-19, all relevant documentation regarding the proposed application was made available on the public venues with a register for comments and responses, Abantu Environmental Consultants website (www.abantuenvironmental.co.za) as well as electronically on request.

Interested and Affected Parties (I&APs) are invited to register and comment on the Draft Environmental Impact Assessment (EIA) Report that is available for public comment for a period of 30 days from 3 July 2023 to 3 August 2023. Two public meetings will be held where the contents of the Draft EIA Report will be discussed.

- Two virtual meetings via Microsoft Teams will be hosted on Friday 14 July 2023 and Friday 28 July 2023 at 11:00 am. A link will be distributed to all potential and registered I&APs.

9.5 Summary of Comments Received

Please refer to the Comments and Responses Report in Appendix E for a full account of comments and responses as well as copies of all correspondence between the EAP and I&APs. They key issues that were raised during the public review period of the Draft Scoping Report can be summarized as follows:

- Registration of IAPs
- Acknowledgement of receipt of EA application
- Request for Site Inspection
- Support of the proposed project
- Request for clarification regarding project description, application form and listed activities, alternatives and layout maps
- Recommendation to include additional key stakeholders in public participation process
- Content of Specialist Assessment Reports
- Specialist studies required by the Screening Tool
- General
- Request For Extension of Timeframes
- Comments from Oceans & Coasts branch
- Environmental and social impacts
- Comments from Biodiversity Conservation Directorate
- Significance of impacts in sensitive areas after mitigation
- Contact details for distribution of Public Participation Process documents

9.6 Availability of the EIA report

As per the requirements of Regulation 43 of GN R982 of 2014 as amended, the Draft EIA Report will be made available for a 30-day commenting period. Printed copies of this report will be available for viewing at:

- The Ward Committee Chairman's office;
- North End Library 12 Mount Rd, Mt Croix, Gqeberha, 6001; and
- The report can also be accessed as an electronic copy on Abantu Environmental Consultants website (https://abantuenvironmental.co.za/company-projects/) under the Projects Tab.

Comments may be submitted in writing by post, or email to:

Abantu Environmental Consultants

33 Prince Alfred

North End

Gqeberha

6001

Cell: 081 410 2569

Fax: 086 685 9536

E-Mail: PE-EIA@abantuenvironmental.co.za

Attention: Dr Patrick Sithole

The commenting period on the Draft EIA Report will run from 10 July 2023 to 11 August 2023.

10. DESCRIPTION OF AFFECTED ENVIRONMENT

10.1 PHYSICAL ENVIRONMENT

This section of the EIA Report provides a description of the environment that may be affected by the proposed project. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed project have been described. Baseline information sourced from various spatial datasets, the NMBMM Spatial Development Framework (SDF) as well as the screening tool report. Information presented in the description of the receiving environment has also been sourced from specialist studies conducted as well as available conservation tools such as the SANBI LUDS. The receiving area of the proposed project is entirely transformed and developed. The biophysical environment descriptions below include the areas close to the proposed construction area.

10.1.1 Climate

The weather patterns of the Nelson Mandela Bay area change throughout the day as it lies at the confluence of several climatic regimes, the most important of which are temperate and subtropical (Stone 1988). Gqeberha is dominated by topographical or gradient winds for most of the year (Grobler, 2012). The area experiences westerly winds throughout the year, though in summer the percentage of easterly winds reached more than 40% (Schumann et al., 199). Maximum and minimum mean temperatures are experienced in February and July, respectively (McCallum 1981). Exceptionally high temperatures (~30°C) can occur during berg wind conditions that develop frequently in autumn and winter. The mean annual rainfall for the Port Elizabeth area is approximately 600 mm (Stone 1988). The strongest winds occur during October and November, with weakest winds during May and June (Schumann et al. 1991).

The annual rainfall in the area has decreased throughout the recent year (refer to **Figure 8**). The whole Eastern Cape province has been affected by the drought as a result of reduced rainfall. This has led to shortages of water in the Metro that are currently being felt throughout.

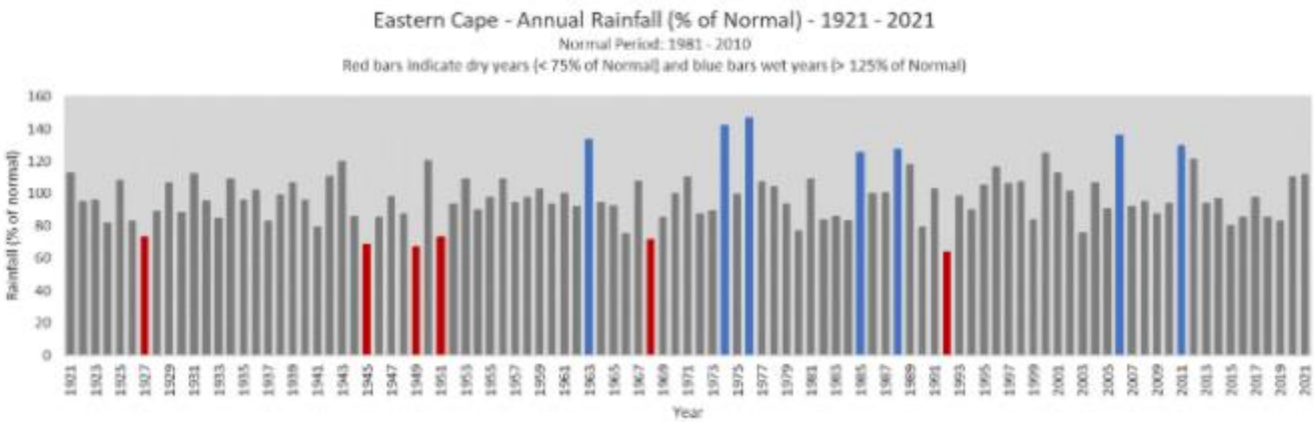


Figure 8. Eastern Cape rainfall statistics between 1921-2021 (SAWS)

10.1.2 Topography

The Nelson Mandela Bay Municipality lies at the southern tip of Africa in the southeastern Cape at the shores of the Indian Ocean. The topography of the NMBM area is the result of soft marine strata filling a broad valley near the end of the east-west striking Cape Fold Belt. A combination of marine and continental erosion has reduced the topography of most of the study area to a flat, seaward sloping coastal plain averaging 75 m above mean sea level, drained by deeply incised rivers. High, rugged mountain terrain protrudes sharply in the northwestern part of the metro. Tall dunes are conspicuous features in the south.

The NMBM coastline extends for some 110 km of the Indian Ocean between the mouths of the Sundays and Van Stadens Rivers in the east and west, respectively. The NMBM straddles the two large, half-heart shaped bays of Algoa and St Francis that are separated by the headland of Cape Recife. Their surf-swept sandy beaches interspersed with rocky outcrops vary widely in physical form owing to the combined effects of coastal orientation relative to prevailing winds, deepwater swell and sheltering by headlands. Two island groups are part of the metro. They are National Parks and have no human settlements.

The Bird Islands, consisting of Bird, Seal, Stag and Black Rocks are located at the eastern end of Algoa Bay 8 km opposite Woody Cape and approximately 55 km east of the Port of Ngqura. The islands of St Croix, Brenton and Jahleel (collectively: the Islands of the Cross) occur a few kilometres offshore between the mouths of the Swartkops and Sundays Rivers, the two large, perennial rivers draining extensive catchment areas that flow into Algoa Bay. In contrast, the mouths of the Maitland and Van Stadens Rivers are seasonally closed and there are no islands in St Francis Bay.

The proposed site is located within the Port of Port Elizabeth, which is situated on the western city boundary, adjacent to the suburb of South End and the Indian Ocean. The site can be accessed via Lower Valley Road, which runs below the M4 highway and curves to the right, where a security plaza must be negotiated. The site is located at the existing jetties, approximately 170m east of the security plaza, adjacent to the slip way. The regional topography slopes towards the east, in the direction of the Port. Locally, the topography is fairly level, as the investigation area has been developed and is used as a cargo port with supporting infrastructure. (Jeffares & Green (Pty) Ltd, 2015)

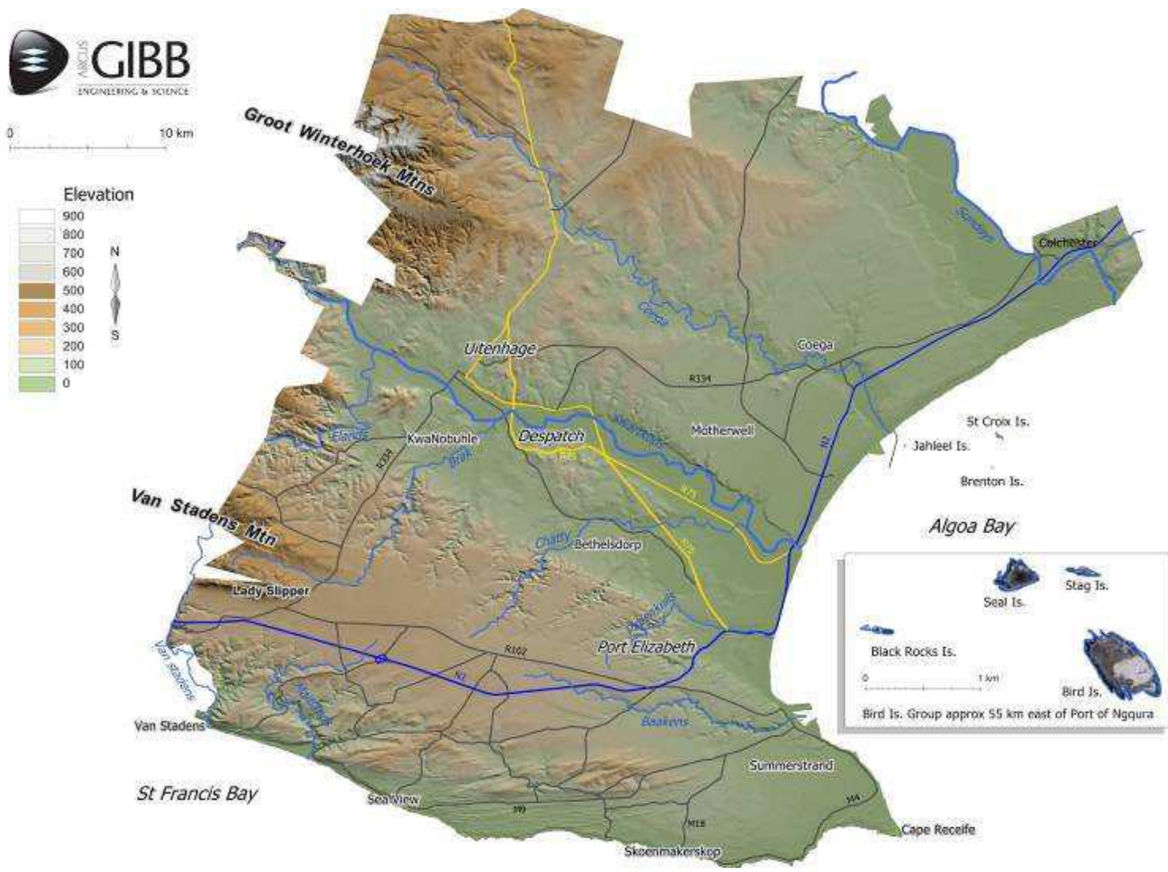


Figure 9: Topography of NMBMM (GIBB, n.d)

10.1.3 Air Quality

According to the South African Air Quality Information System (SAAQIS), the Air quality Index (AQI) of Port Elizabeth has a good (Index 1) for most air quality parameters. IQ Air indicates that the air pollution level (US AQI) is measured at 37 and real-time data from SAAQIS shows the main pollutants $PM_{2.5}$ is measured at a concentration of 8.977 µg/m³ which currently meets the WHO annual air quality guideline value. The air quality monitoring station is located at Coega Special Economic Zone (SEZ) in Nelson Mandela Bay. The satellite air quality monitoring done by IQ Air indicates that 2021 average $PM_{2.5}$ concentration in South Africa was 4.5 times the WHO annual air quality guideline value. There is concern about PM_{10} and $PM_{2.5}$ because of the potential health risks that they pose, given that such fine particles are able to be deposited in, and cause damage to, the lower airways and gas-exchanging portions of the lung. The South African National Ambient Air Quality Standards (NAAQS) for PM_{10} and $PM_{2.5}$ (daily mean) is 75 µg/m³ and 40 µg/m³ respectively. The WHO Air Quality Guideline (AQG) for PM_{10} and $PM_{2.5}$ (daily mean) is 50 µg/m³ and 25 µg/m³ respectively (DFFE, 2009). The current WHO Air Quality Guidelines are much lower than the SA NAAQS limits. However, it must be acknowledged that the WHO AQG levels are not achievable in many areas of the world, including many parts of South Africa. This is partly due to the many strong and varied natural sources of pollution (including dust, biomass burning, biogenic and marine sources) in South Africa. The impact of natural sources on air pollution levels is a key research gap. Long term observations in background sites, as initially envisaged in the Framework for Air Quality Management (RSA, 2012), are important to better understand these sources. Robust modelling experiments to estimate the contribution of natural sources to background levels across South Africa are also an important aspect that must be considered in the review of the NAAQS and setting of standards (Garland et al, 2021). The data in ***Figure 10*** and ***Figure 11*** shows that the $PM_{2.5}$ and PM_{10} levels at the Saltworks monitoring station generally meet the WHO Air Quality Guideline although there are some exceedances recorded during February 2023.

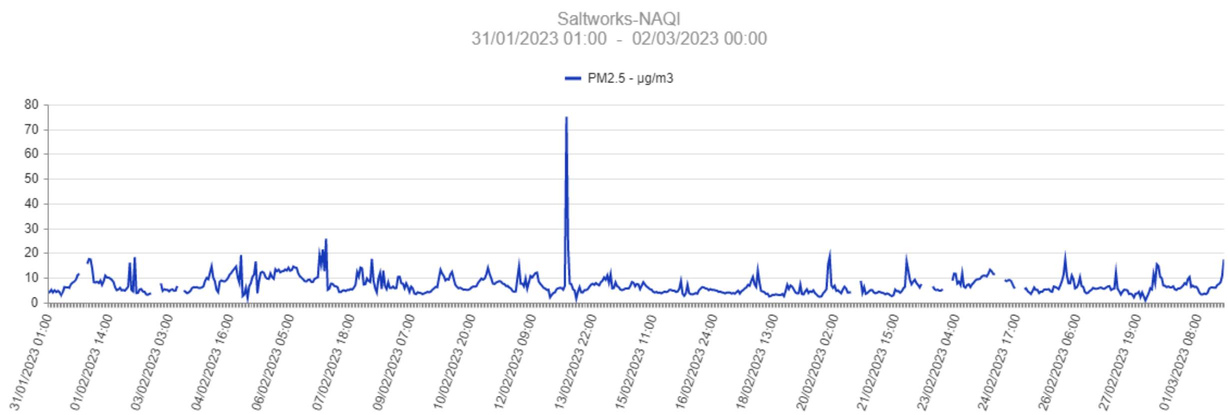


Figure 10: PE $PM_{2.5}$ Data between January and March 2023 (SAAQIS,2023)

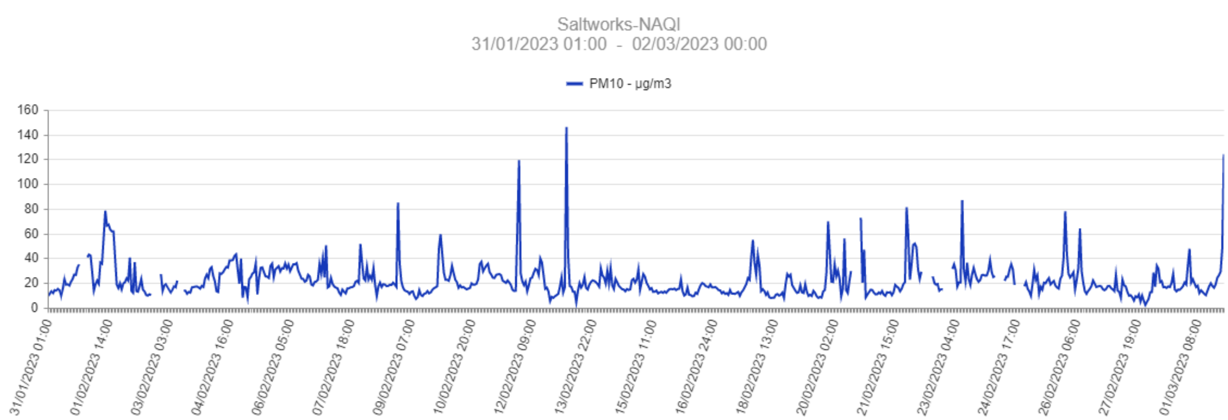


Figure 11: PE PM_{10} Data between January and March 2023 (SAAQIS,2023)

10.1.4 Water quality

Transnet National Ports Authority has commissioned a Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth. The water quality component of the monitoring programme has generated sufficient data to allow a good description of the main physical, chemical, and biological properties of the water column in the port (CSIR, 2016, 2017, 2018, 2019, 2020). The discussion below is based on water quality measurements made for the monitoring programme between 2015-2019 (CSIR, 2016, 2017, 2018, 2019, 2020). Water quality surveys were made in summer and winter each year, at the stations shown in Figure 15. The temperature, salinity, pH, dissolved oxygen concentration, turbidity, and chlorophyll-a concentration was measured in situ using an automated water quality monitoring instrument. Other water quality indicators were measured in surface water samples returned to the laboratory for analysis, including faecal indicator bacteria, salinity, pH, and total suspended solids, nutrient and metal concentrations. The Long-Term Ecological Monitoring Programme has generated a large amount of data, but it is not necessary to discuss in detail the findings for each water quality indicator in this assessment. Rather, the focus below is on the findings for key water quality indicators most relevant to the proposed project.

The influence of the Baakens River inflow on water quality in the port is evident in numerous water quality indicators. Perhaps the clearest and most consistent evidence for this influence is provided by salinity, an example of which is provided in Figures 12 and 13. The salinity depression is usually evident in the uppermost part of the water column. The salinity of bottom water usually approximates that for seawater. The restriction of low salinity water to the upper part of the water column reflects the fact that freshwater is less dense than seawater and thus tends thus to 'float' on seawater as it is gradually diluted, and that the inflow of freshwater via the Baakens River was low relative to the volume of water in the port at the time of the surveys.

Dissolved oxygen is a particularly important indicator of water quality since almost all aquatic organisms rely on a good supply of oxygen for their survival. Figures 14 and 15 provide examples of the dissolved oxygen concentration trend through the water column and across the port. The minimum and maximum dissolved oxygen concentration measured in surface and near-bottom water in the port in surveys between 2015-2019 was 2.71 mg.l-1 and 9.40 mg.l-1 respectively, while the 10th percentile and median concentration were 6.04 mg.l-1 and 7.16 mg.l-1 respectively. The dissolved oxygen concentration in the port was thus usually quite high and was sufficient to sustain healthy populations of most forms of aquatic life (usually regarded as a concentration ≥5 mg.l-1). The lowest dissolved oxygen concentrations were measured in one survey in the summer of 2019. The dissolved oxygen concentration at this time was also low at stations in the marine environment, suggesting that the low concentrations were the consequence of a large-scale oceanographic phenomenon that also affected the port, such as upwelling, rather than a problem that was restricted to the port.

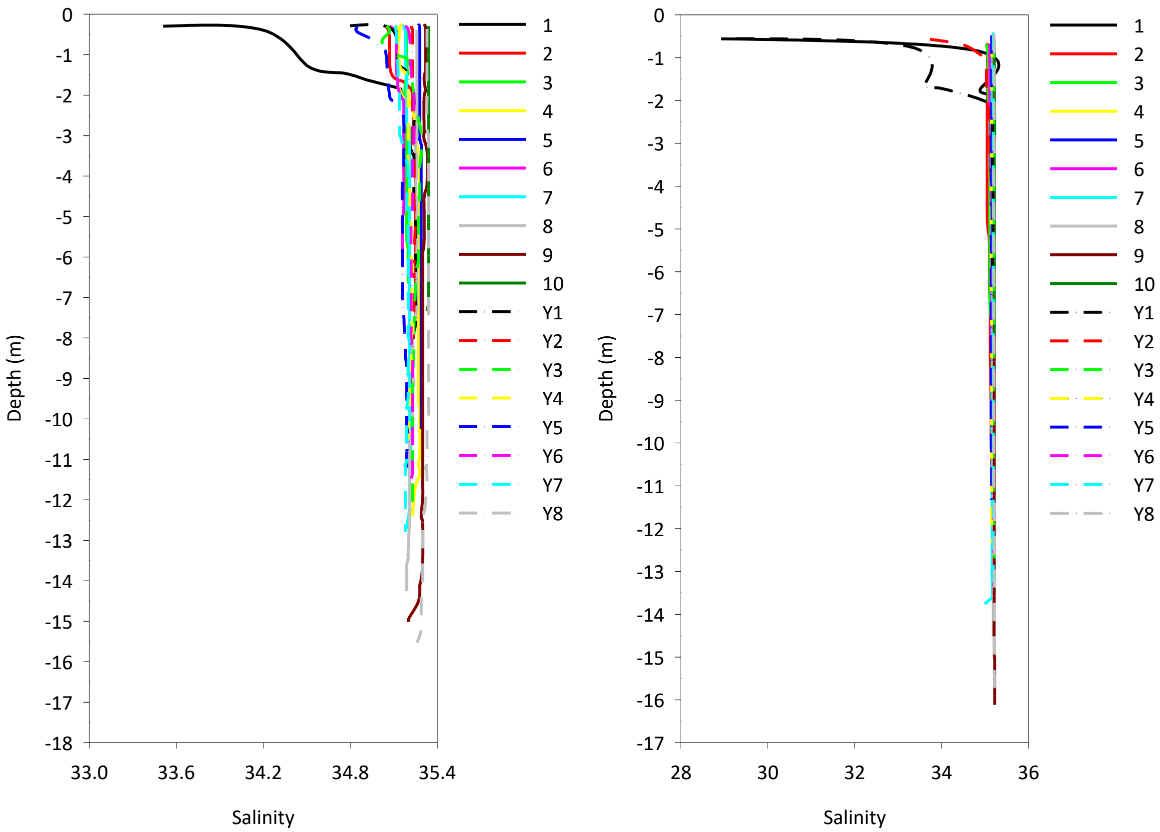


Figure 12: Salinity profiles for the water column in and near the Port of Port Elizabeth for the winter survey on 16 July 2019 (left) and the summer survey on 19 February 2020 (right) for the Long-Term Ecological Monitoring Programme.

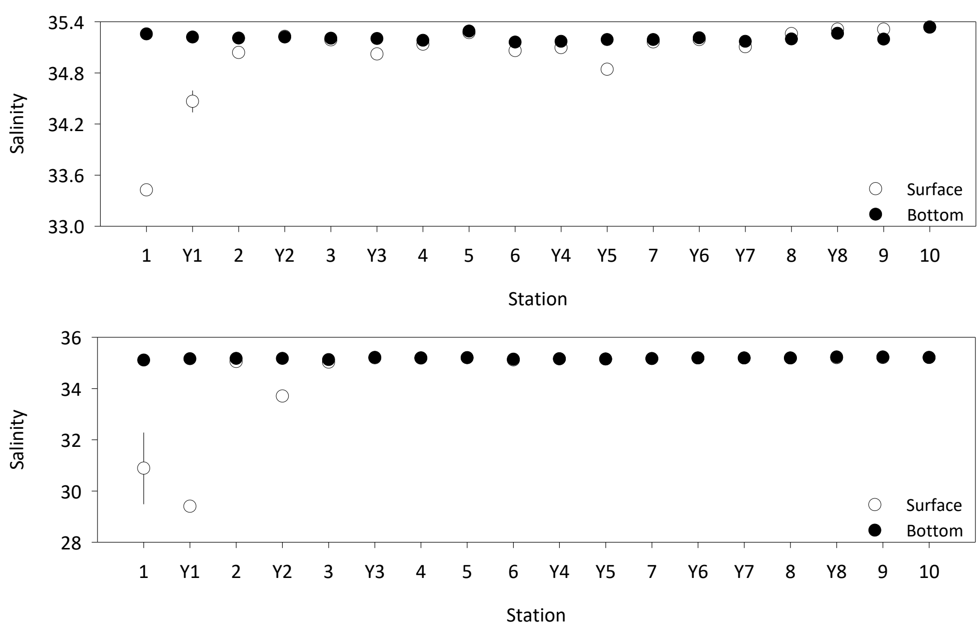


Figure 13: Comparison of the salinity of surface and bottom waters in and near the Port of Port Elizabeth for the winter survey on 16 July 2019 (top) and the summer survey on 19 February 2020 (bottom) for the Long-Term Ecological Monitoring Programme.

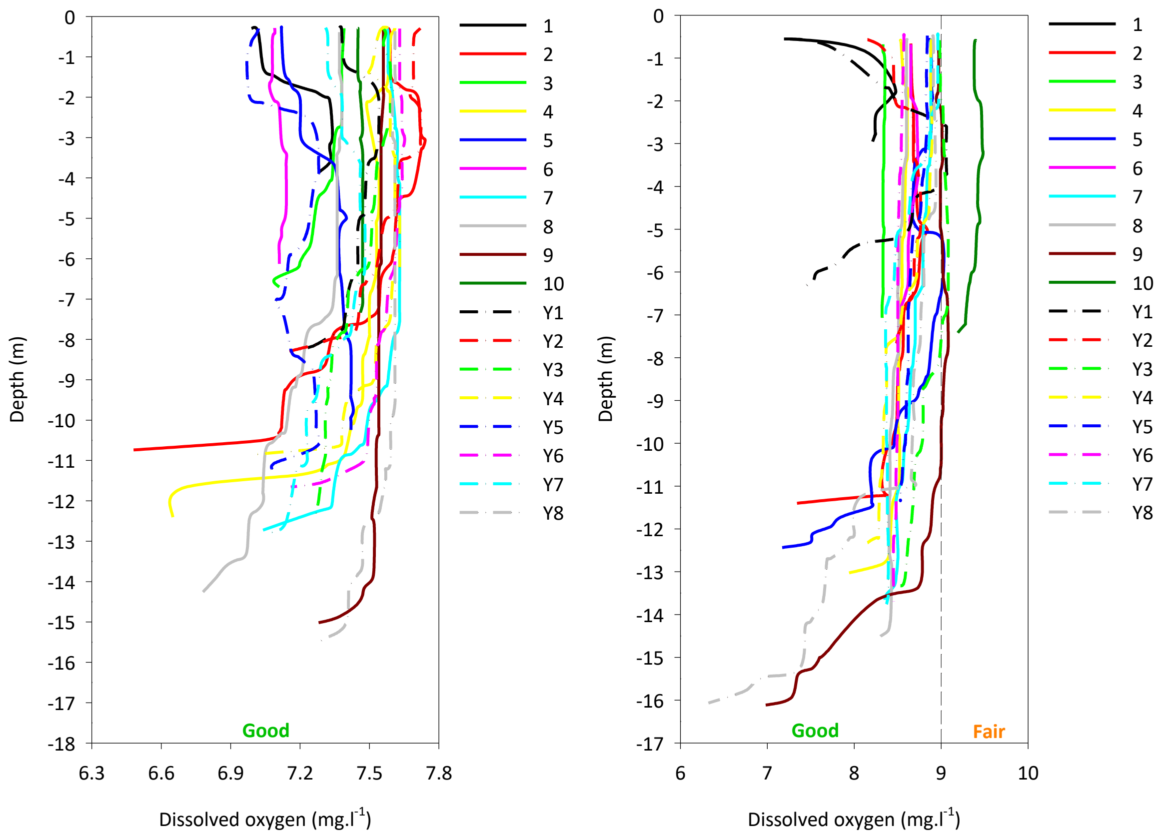


Figure 14: Dissolved oxygen concentration profiles for the water column in and near the Port of Port Elizabeth for the winter survey on 16 July 2019 (left) and the summer survey on 19 February 2020 (right) for the Long-Term Ecological Monitoring Programme. The vertical dashed line denotes the delineation between good and fair water quality as defined for the monitoring programme.

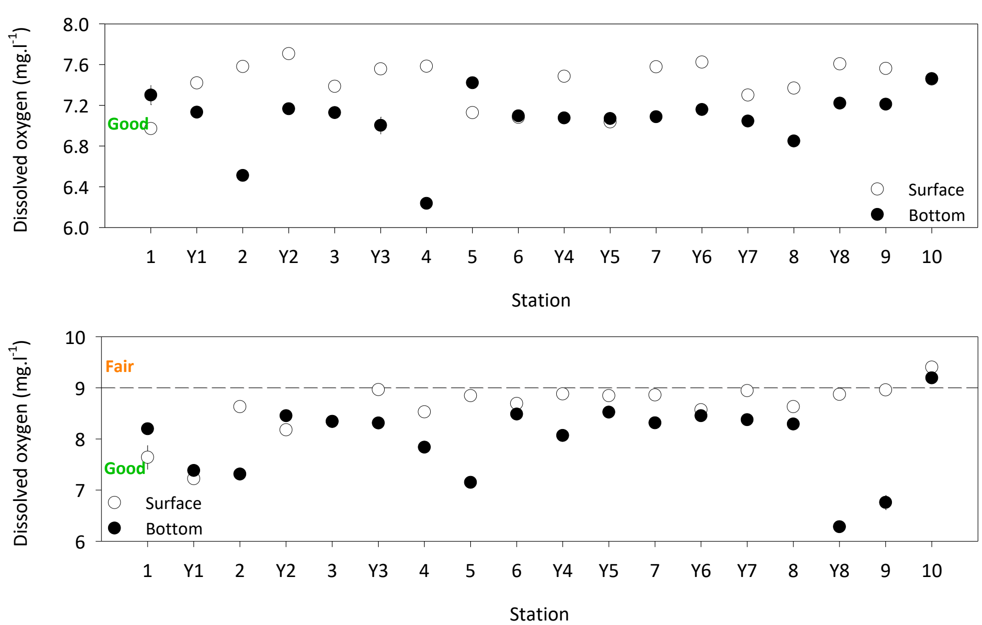


Figure 15:Comparison of dissolved oxygen concentration in surface and bottom waters in and near the Port of Port Elizabeth for the winter survey on 16 July 2019 (top) and the summer survey on 19 February 2020 (bottom) for the Long-Term Ecological Monitoring Programme. The horizontal dashed lines denote the delineation between good and fair water quality as defined for the monitoring programme.

The turbidity of the water column in the port is usually low. The highest turbidity is usually recorded in the low part of the water column (Figures 16 and 17), which undoubtedly reflects the resuspension of sediment by currents and vessel movements. The minimum and maximum suspended solids concentration measured in surface water in the port in surveys between 2015-2019 was 2 mg.l-1 and 17 mg.l-1 respectively, while the median and 75th percentile were 5 mg.l-1 and 7 mg.l-1 respectively. The suspended solids concentration was thus usually low to very low. The suspended solids concentration and turbidity in parts of the port will increase markedly when the flow in the Baakens River is high. The suspended solids concentration and turbidity also increase markedly when vessels are berthed or de-berthed due to tugboat propeller wash and when the port area is maintenance dredged (Figures 18 and 19). The Long-Term Ecological Monitoring Programme avoids to the extent possible the influence of port activities such as vessel berthing and de-berthing and dredging on the water column turbidity and suspended solids concentrations when water quality measurements are made, as these are temporary (albeit important) impacts. The turbidity and suspended solids concentration in the water column during these events will be far higher than those measured for the Long-Term Ecological Monitoring Programme.

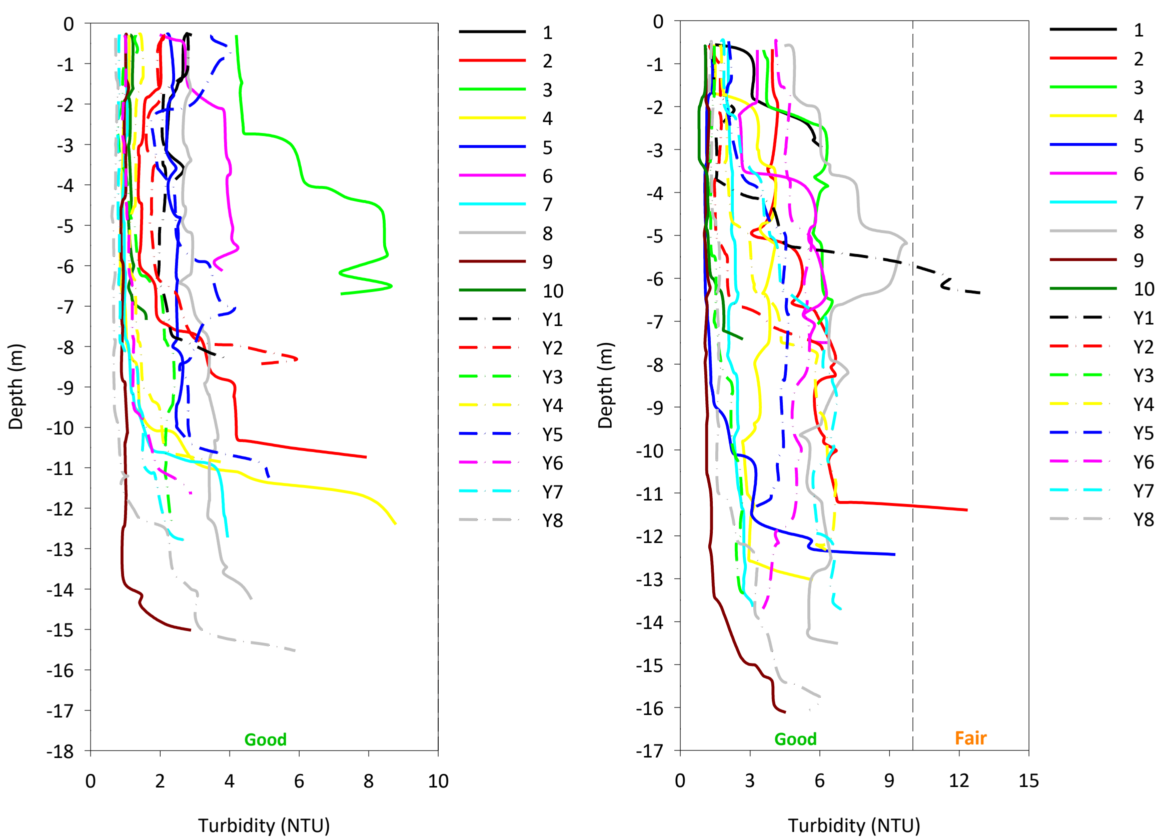


Figure 16: Turbidity profiles for the water column in and near the Port of Port Elizabeth for the winter survey on 16 July 2019 (left) and the summer survey on 19 February 2020 (right) for the Long-Term Ecological Monitoring Programme. The vertical dashed lines denote the delineation between good, fair, and poor water quality as defined for the monitoring programme.

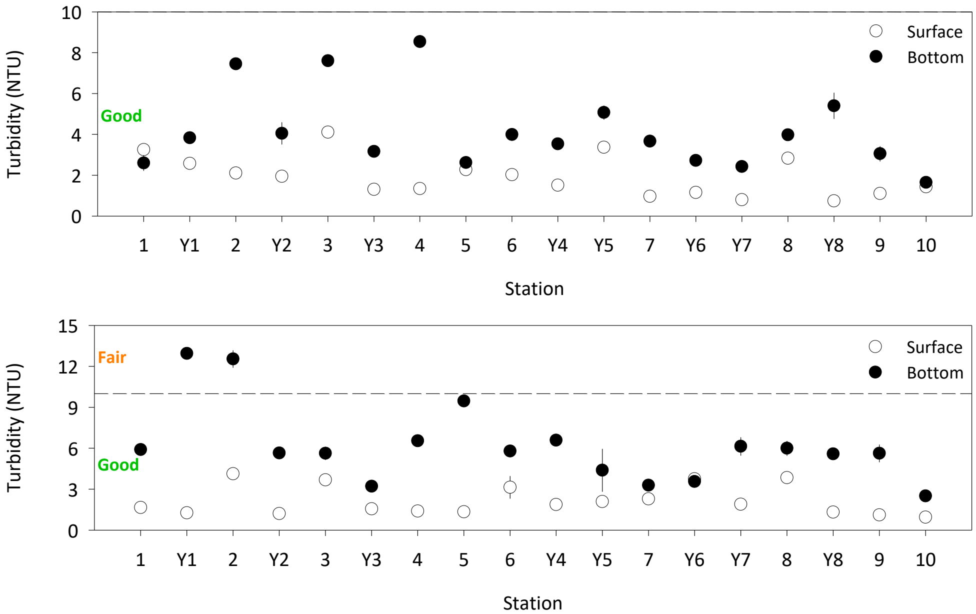
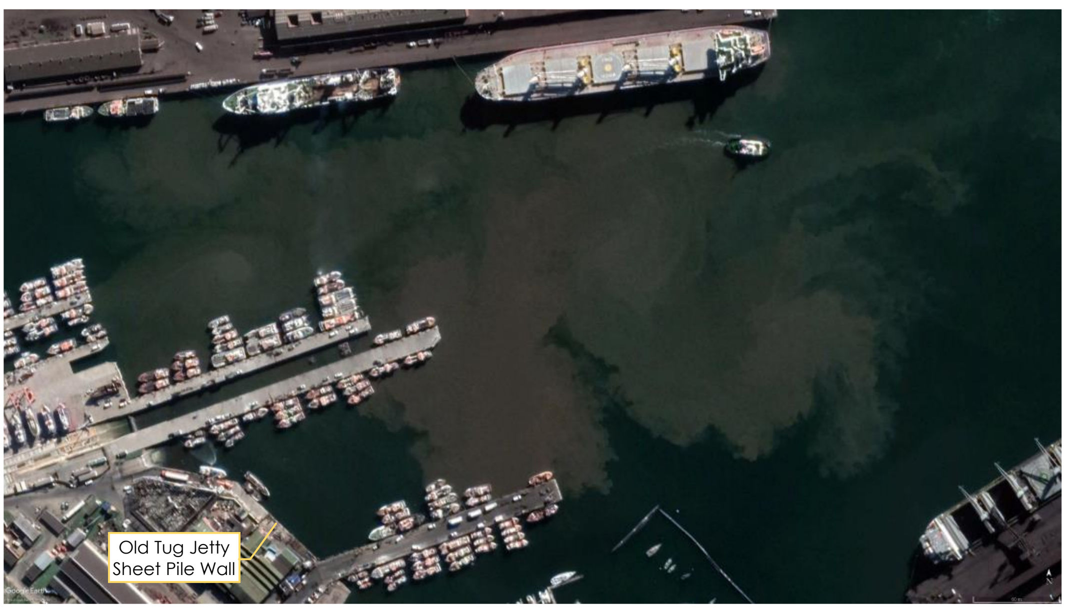


Figure 17: Comparison of the turbidity of surface and bottom waters in and near the Port of Port Elizabeth for the winter survey 16 July 2019 (top) and the summer survey on 19 February 2020 (bottom) for the Long-Term Ecological Monitoring Programme. The horizontal dashed lines denote the delineation between good, fair, and poor water quality as defined for the monitoring programme.



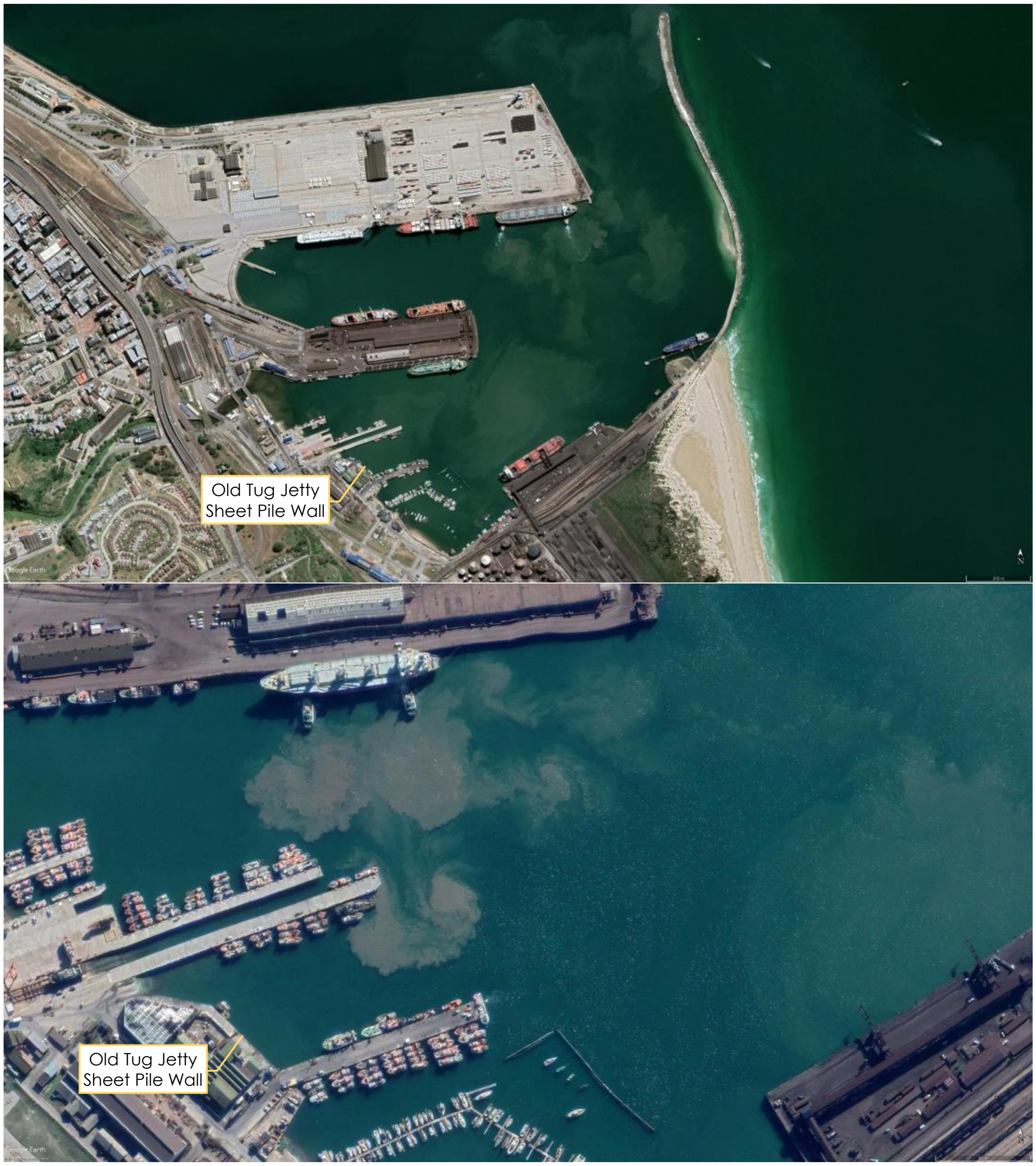


Figure 18: Aerial views of the Port of Port Elizabeth showing the influence of vessel propeller wash on the suspended sediment concentrations and associated turbidity in the water column.

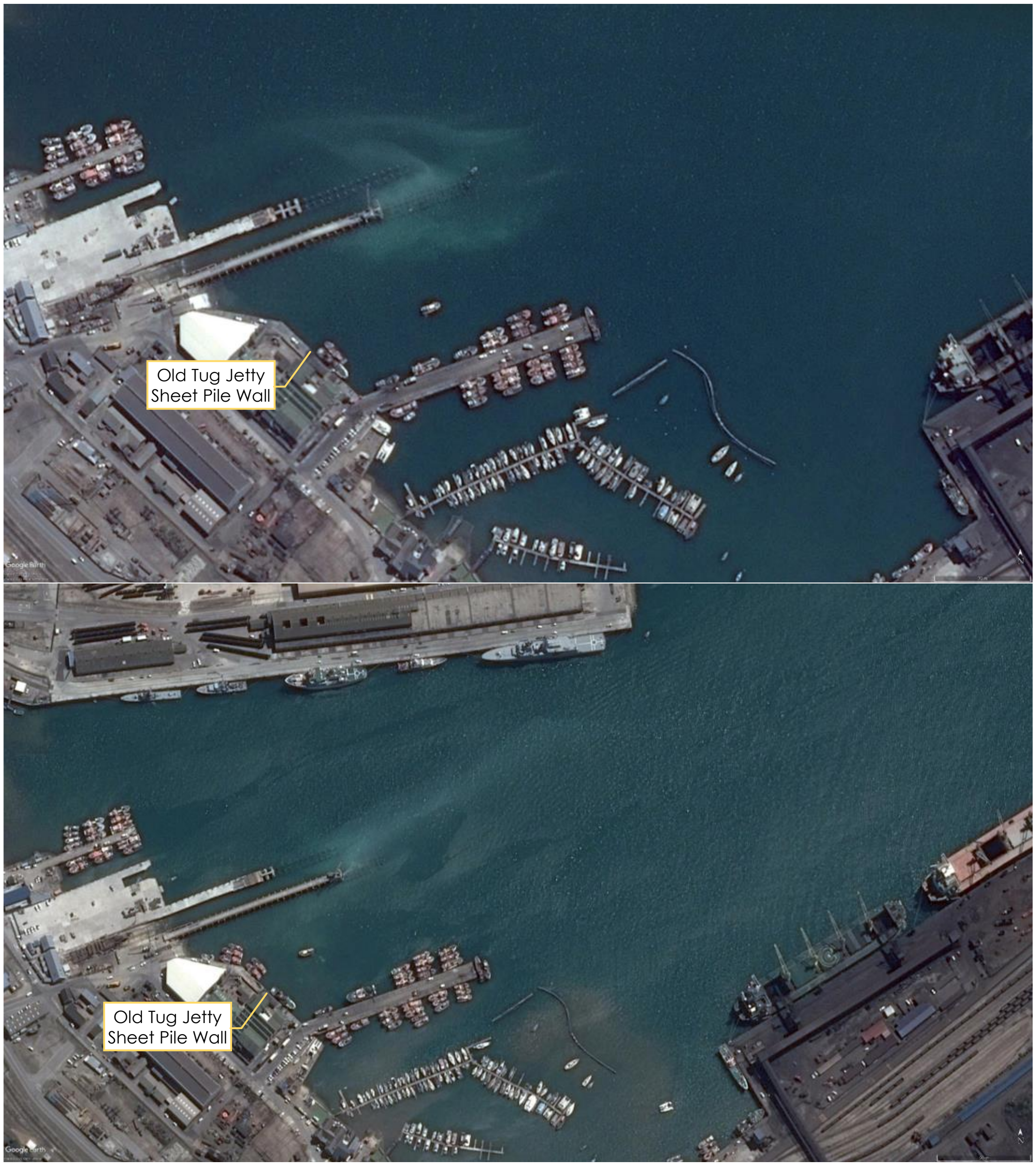


Figure 19: Aerial views of the Port of Port Elizabeth showing the influence of construction activities for the leading jetty rehabilitation on the suspended solids concentrations in the water column.

The 50th and 75th percentile of E. coli bacteria colony forming unit counts was 85 and 31 respectively, and for faecal streptococcus bacteria was 20 and 10. In other words, the colony forming unit counts were usually very low. However, the counts at some stations were periodically very high. The highest faecal indicator bacteria counts in surface water in the port were recorded in the southern basin near or relatively near the Baakens River inflow and near the Dom Pedro Quay (Stations 1, a, and 3 in Figure 20). The high counts near the Baakens River inflow probably reflect the inflow of sewage contaminated water via the river.

Nutrient concentrations, exemplified by dissolved inorganic nitrogen and orthophosphate in Figure 21, were variable over the period 2015-2019 (CSIR, 2016, 2017, 2018, 2019, 2020). The concentrations were usually low, but periodically high, most often at stations in the southern basin (Figure 25). The high nutrient concentrations in the southern basin probably reflect the inflow of sewage contaminated water via the Baakens River. The microalgal biomass in the port as deduced from the chlorophyll-a concentration, was typically low (Figure 22).

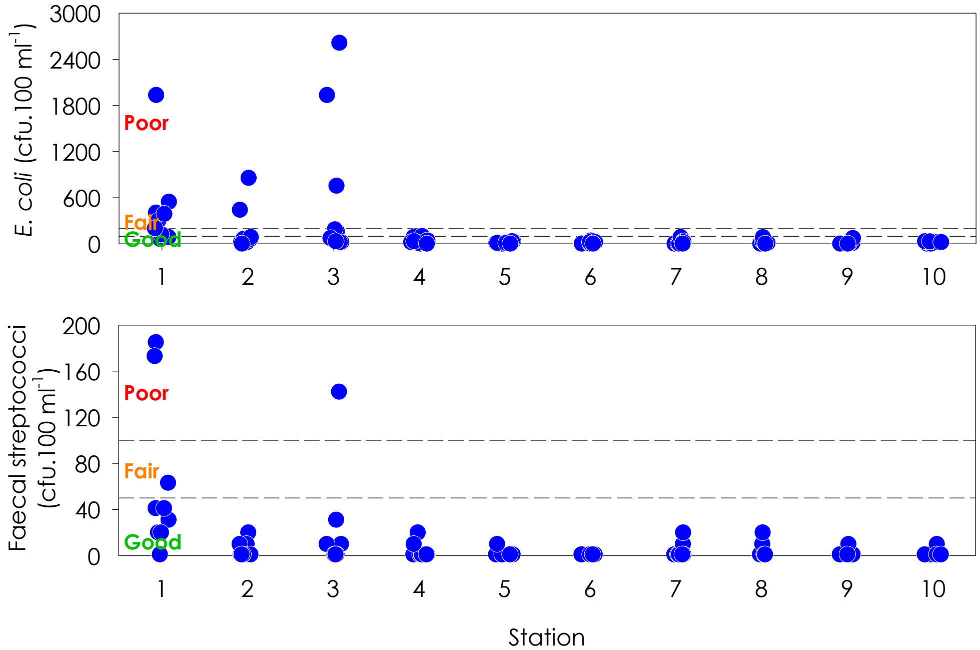


Figure 20: Faecal indicator bacteria colony forming unit counts in surface waters sampled in and near the Port of Port Elizabeth for surveys between 2015-2019 for the Long-Term Ecological Monitoring Programme. The horizontal dashed lines denote the delineation between good, fair, and poor water quality as defined for the monitoring programme.

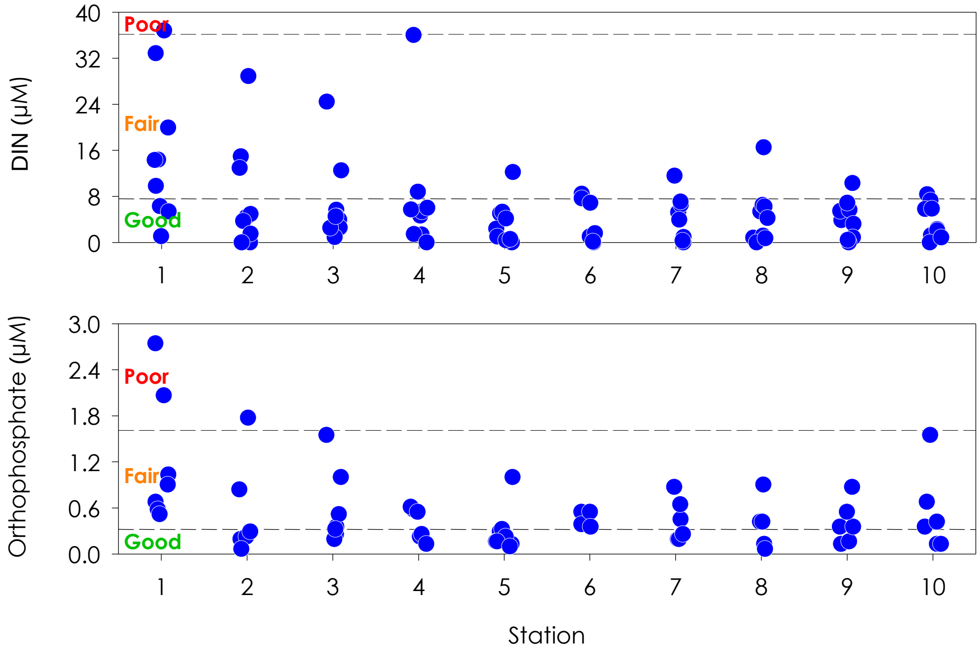


Figure 21: Nutrient concentrations in surface waters sampled in and near the Port of Port Elizabeth for surveys between 2015-2019 for the Long-Term Ecological Monitoring Programme. The horizontal dashed lines denote the delineation between good, fair, and poor water quality as defined for the monitoring programme.

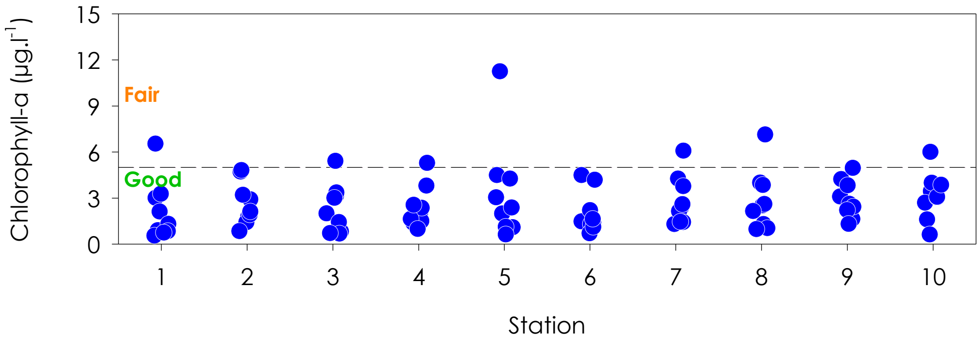


Figure 22: Chlorophyll-a concentrations in surface waters sampled in and near the Port of Port Elizabeth for surveys between 2015-2019 for the Long-Term Ecological Monitoring Programme. The horizontal dashed lines denote the delineation between good, fair, and poor water quality as defined for the monitoring programme.

Metal concentrations in the water column for the period 2015-2019 (CSIR, 2016, 2017, 2018, 2019, 2020)were typically very low to moderate (for some metals the concentration was usually below the method detection limit, or too low to measure accurately in the laboratory). The concentrations of some metals, most notably copper and zinc, periodically exceeded the updated South African Water Quality Guidelines for Coastal Marine Waters (DEA, 2018) (Figure 23). Evident in Figure 23 is that the mercury concentration exceeded the water quality guideline. However, it must be noted the recommended mercury guideline in the updated South African Water Quality Guidelines for Coastal Marine Waters is extremely low, at 0.016 µg.l-1. For comparison, the existing water quality guideline for mercury is at 0.4 µg.l-1. All mercury concentrations are lower than the existing guideline.

The findings for numerous water quality indicators analysed in the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth were included in an index to rate water quality in the port for the period 2015-2019 (CSIR, 2016, 2017, 2018, 2019, 2020). Water quality was always rated good or excellent apart from some stations in the southern basin (Figure 24). In these instances the fair or marginal water quality rating was largely a consequence of high faecal indicator bacteria counts.

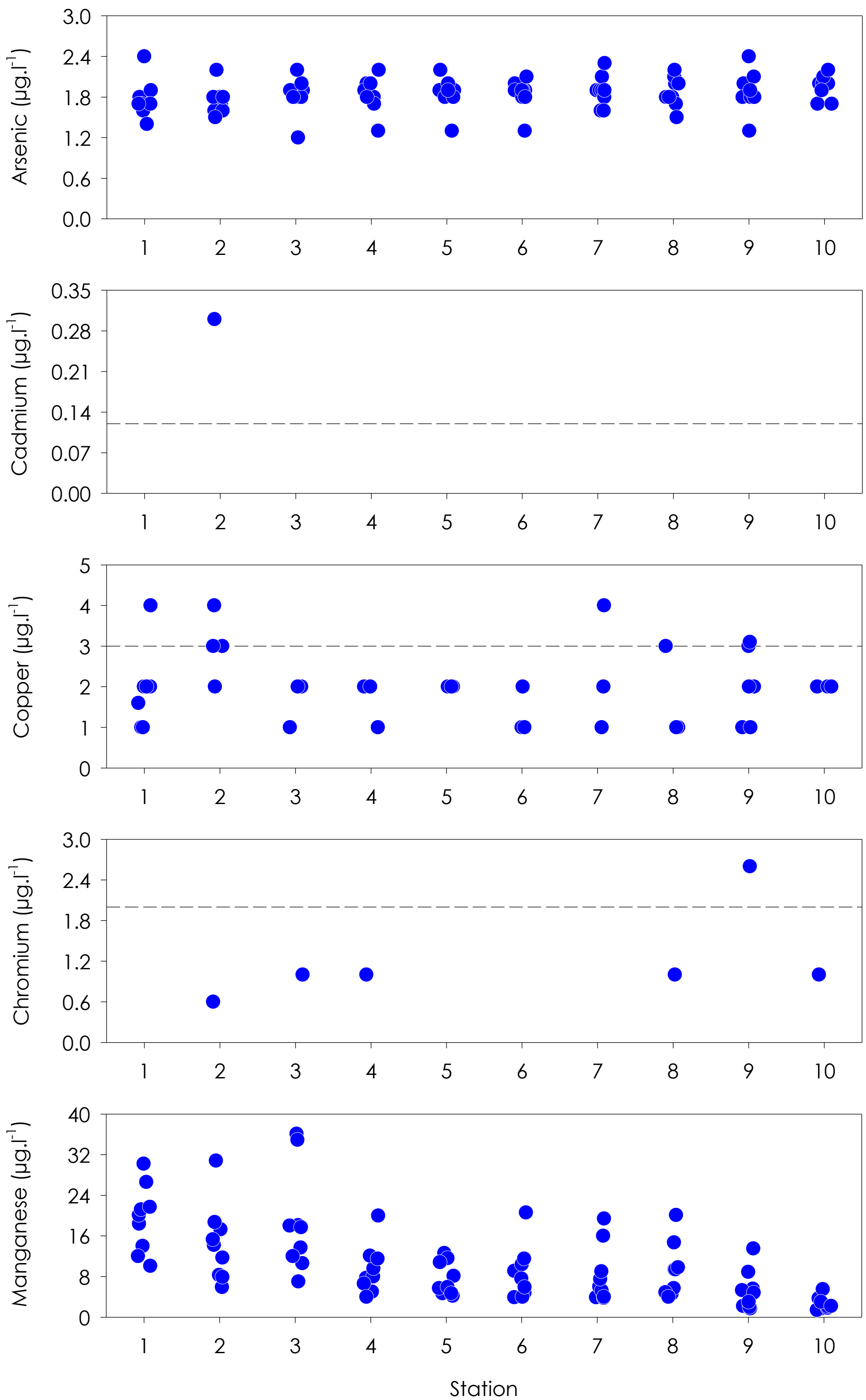


Figure 23: Metal concentrations in surface waters sampled in and near the Port of Port Elizabeth for surveys between 2015-2019 for the Long-Term Ecological Monitoring Programme. The horizontal dashed lines denote the updated South African Water Quality Guidelines for Coastal Marine Waters (DEA, 2018).

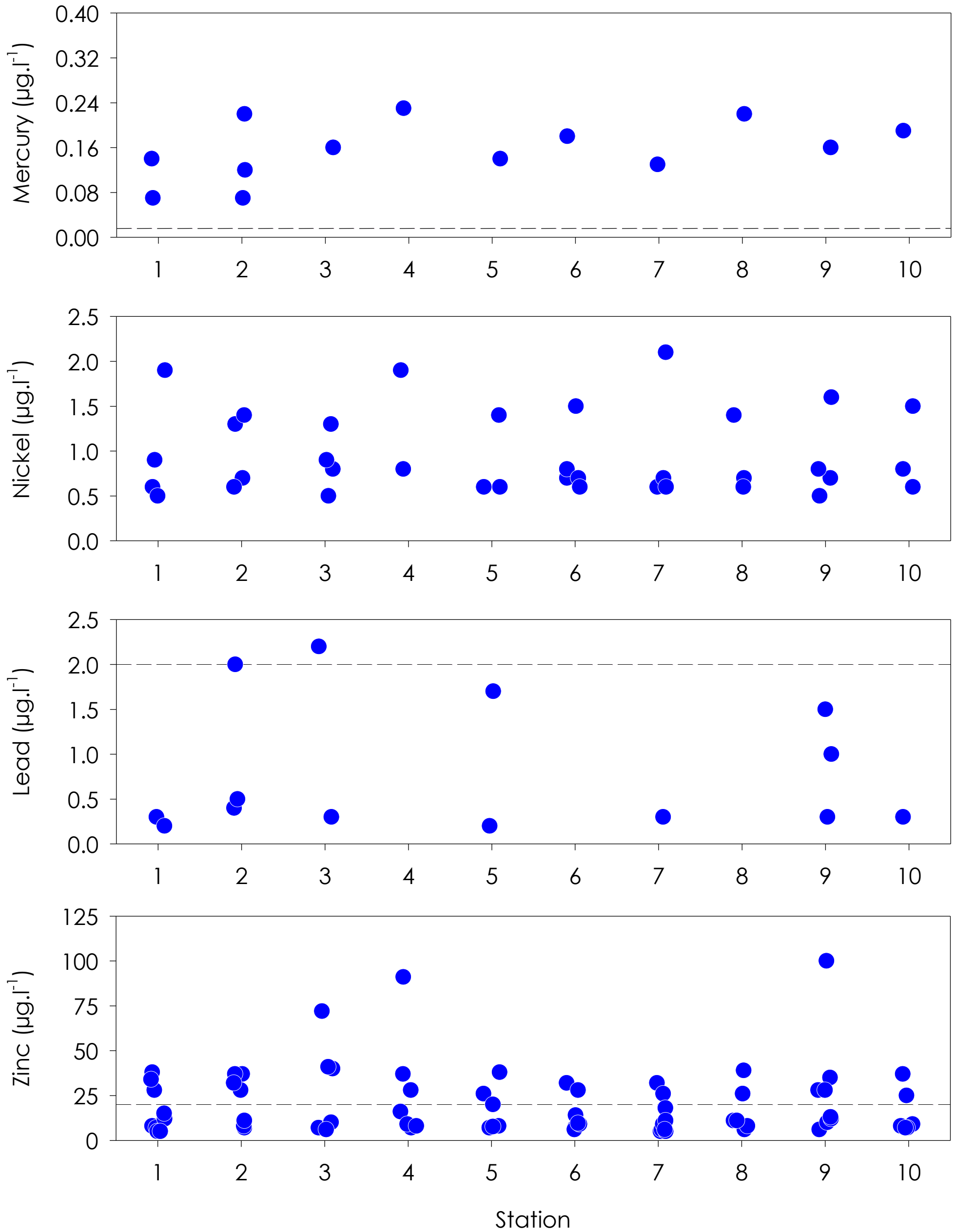


Figure 23 continued: Metal concentrations in surface waters sampled in and near the Port of Port Elizabeth for surveys between 2015-2019 for the Long-Term Ecological Monitoring Programme. The horizontal dashed lines denote the updated South African Water Quality Guidelines for Coastal Marine Waters (DEA, 2018). Absent data points reflect that the concentration was below the method detection limit (i.e. was too low to measure in the laboratory).

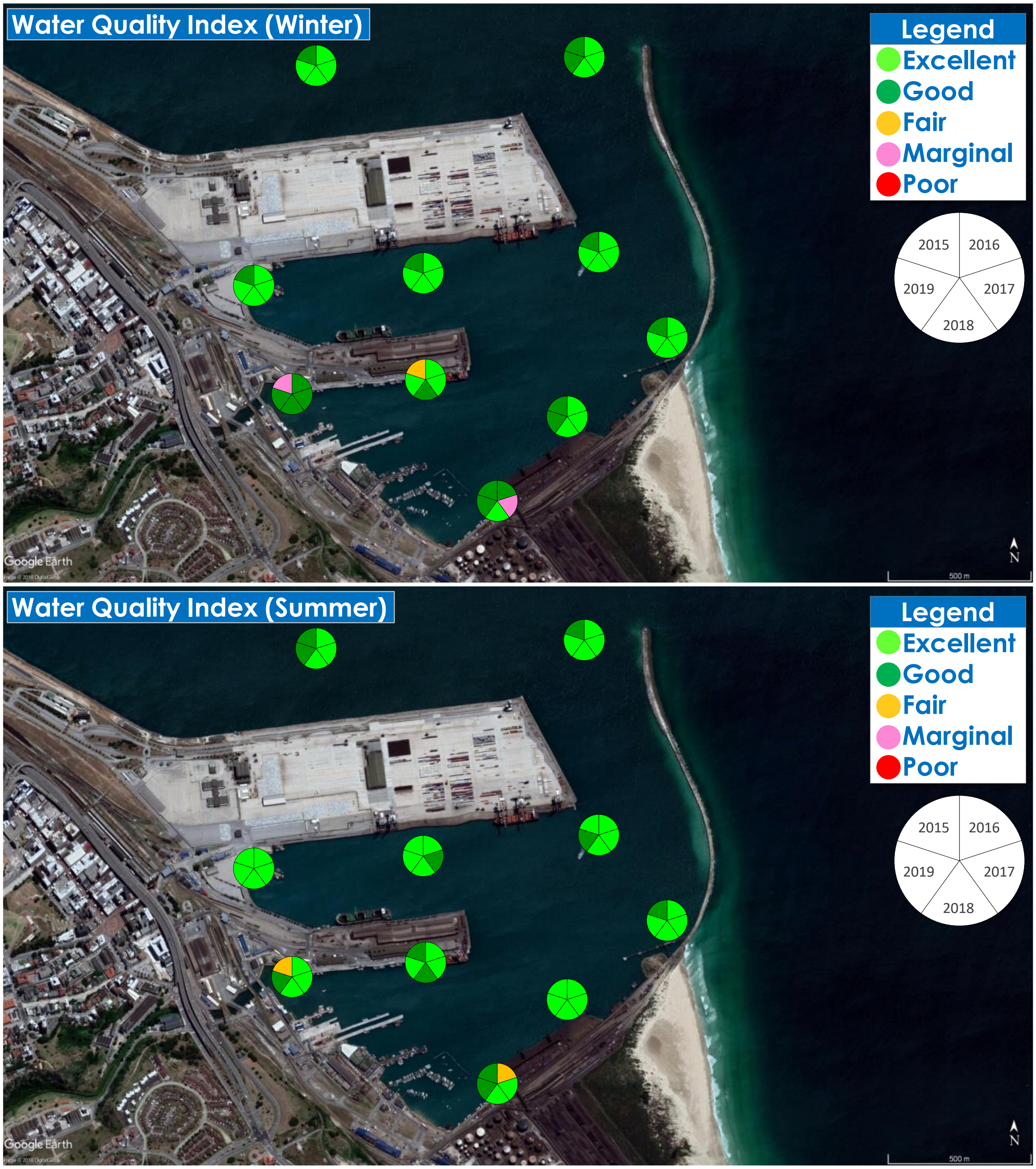


Figure 24: Water quality indices for surface water sampled in and near the Port of Port Elizabeth for the Long-Term Ecological Monitoring Programme between 2015-2019.

10.1.5 Sediment quality

The total organic content is a measure of the amount of particulate organic matter present in sediment. The organic matter may come from natural sources, such as the decomposing remains of plants and animals, or from anthropogenic sources, such as wastewater. Particulate organic matter is an important food source for many animals, such as benthic invertebrates that live in and on sediment (the infauna and epifauna respectively). If the mass-loading of particulate organic matter in sediment exceeds the rate at which it can be consumed by benthic invertebrate infauna and epifauna or degraded by bacteria, this can lead to the development of very low dissolved oxygen concentrations (hypoxia) or in extreme cases the lack of oxygen (anoxia) in sediment porewater (i.e. water between grains of sediment) and at the sediment-water interface. The depletion of dissolved oxygen usually comes about by bacteria that decompose particulate organic matter proliferating to such a degree they consume oxygen in the water at a rate faster than it can be replenished. As the dissolved oxygen concentration falls certain bacteria begin to reduce sulphate from the water column to fuel their metabolism, producing hydrogen sulphide as a by-product. Hydrogen sulphide is toxic to most forms of aquatic life at moderate to high concentrations. However, some bottom-dwelling invertebrates (e.g. capitellid polychaetes) thrive under, and their increased abundance is commonly used as an indicator of these conditions (e.g. Tomassetti and Porrello, 2005). As the input of particulate organic matter increases from natural to moderate levels the presence of these species demonstrates the transition from an oxic to hypoxic state. As the degree of particulate organic matter accumulation increases further, even sulphide-tolerant invertebrates are unable to survive and the sediment becomes progressively lifeless, until only single celled organisms such as protozoa, ciliates, and flagellates that can live in sulphide-rich sediment remain (Fenchel and Riedl, 1970). This results in the severe disruption of sediment-dwelling communities, with ripple-like impacts through an aquatic ecosystem (Pearson and Rosenberg, 1978; Diaz and Rosenberg, 1995; Gray et al., 2002). The total organic content of sediment thus provides important information towards understanding factors that might influence the structure and composition of benthic biological communities.
Many organic chemicals, such as hydrocarbons, and certain metals, such as cadmium and mercury, also preferentially adsorb (attach) onto particulate organic matter in sediment. The variation in the amount of particulate organic matter can thus often explain trends in the concentration of these chemicals in sediment. Adsorption to particulate organic matter also controls the bioavailability of chemicals, rendering them less toxic than were they to be in an unbound form in the sediment porewater or in the water column.

It is not possible to determine if there is an excess amount of particulate organic matter in sediment by comparing the total organic content amongst sediment samples because particulate organic matter accumulates in sediment in areas where the current strength is weak and is winnowed from sediment in areas where the current strength is strong. The amount of particulate organic matter in sediment will thus vary naturally depending on the prevailing conditions, but in uncontaminated sediment is typically lowest in sandy sediment and highest in muddy sediment. CSIR scientists have defined a baseline model that identifies the range in the total organic content that should be found in relatively uncontaminated sediment in the Port of Port Elizabeth. The baseline model can be used to identify if sediment has a total organic content exceeding the baseline. The baseline model is provided in Figure 21, with the total organic content in sediment sampled in the Port of Port Elizabeth in August 2022 superimposed. If the total organic content falls within the baseline model prediction limits, then the sediment is identified as not enriched with particulate organic matter. If the total organic content exceeds the upper prediction limit of the baseline model (i.e. the upper dashed line), then the sediment is identified as enriched. The total organic content in sediment sampled in some parts of the Port of Port Elizabeth in August 2022 was enriched with particulate organic matter, including at Stations PE1 and PE3 alongside the Old Tug Jetty quay area. In fact, the sediment at these stations was significantly enriched by particulate organic matter. The source of the particulate organic matter is uncertain, but may include fish processing factory wastes as Station PE3 was immediately alongside a offloading and processing area. Interestingly, despite the high total organic content the sediment was not anoxic (see Figure 26). The total organic content of sediment in the port was also analysed for the Long-Term Ecological Monitoring Programme for the period 2015-2019. The findings support those for the sediment analysed in August 2022 and are thus not discussed in detail here.

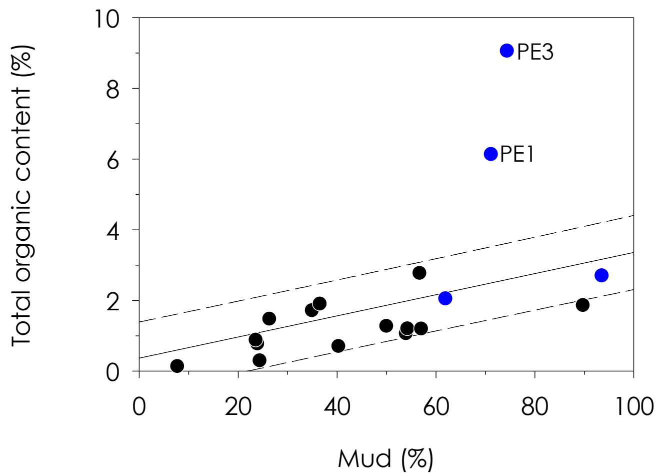


Figure 25: Baseline model for the total organic content in sediment in the Port of Port Elizabeth, with the total organic measured in sediment sampled in the port in August 2022 superimposed. Some data points are highlighted by station identifiers. The data points highlighted in blue represent sediment sampled alongside and near the Old Tug Jetty quay area.

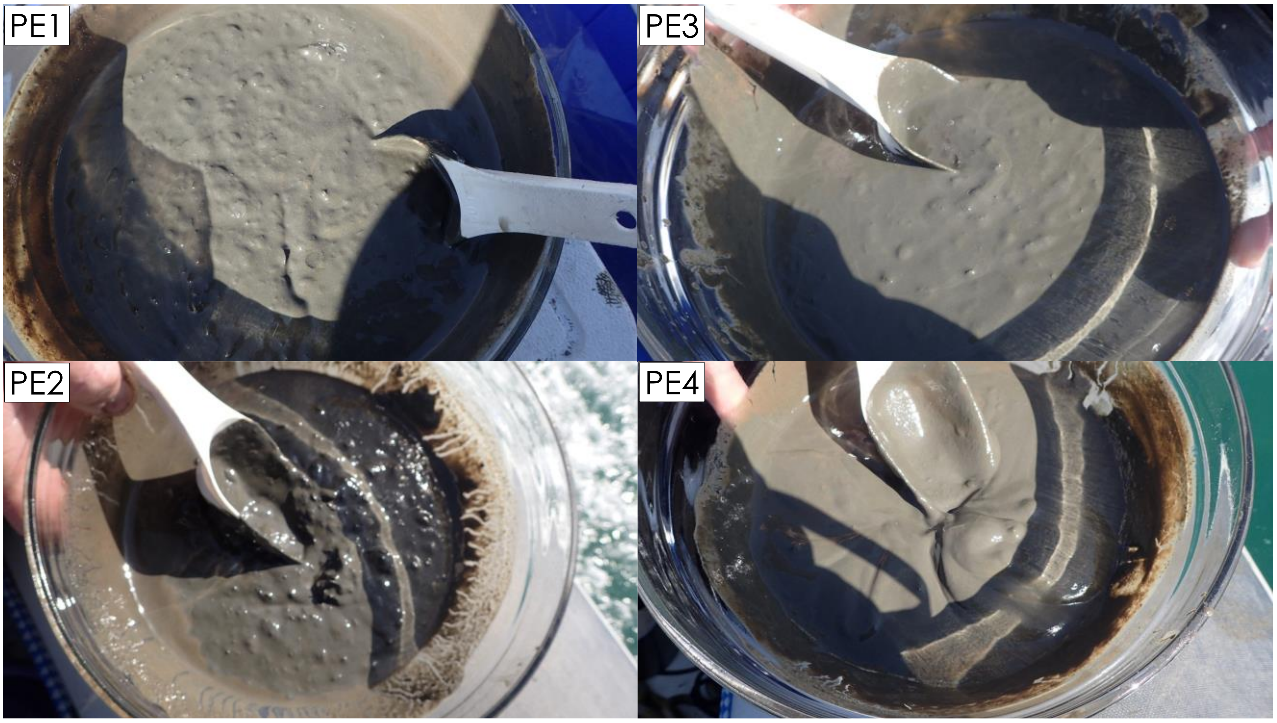


Figure 26: Photographs of sediment sampled at stations alongside and near the Old Tug Jetty quay area in the Port of Port Elizabeth in August 2022.

Many types of anthropogenic chemicals tend to accumulate in sediment rather than remain in solution in the water column. As a result, the concentrations of contaminants in sediment are usually several orders of magnitude higher in sediment than in the water column. If there is continued input, the concentrations of chemicals in sediment may eventually reach a state where they become toxic to sediment-dwelling organisms. Numerous studies on metal concentrations in sediment in the Port of Port Elizabeth have been performed in the last 20 years. The most recent survey was performed by the CSIR in August 2022 (CSIR, unpublished data). Sediment was sampled at 18 stations in the port, including alongside and near the Old Tug Jetty quay area (Figures 27 and 28). The sediment was analysed for its grain size, total organic content, and the concentrations of 15 metals. The toxicity of the sediment was also tested using the sea urchin embryo-larvae test under a sediment-water interface testing regime. The grain size of the sediment was discussed in Section 5.1.4 of the specialist report.. In summary, the mud is the dominant grain size class in sediment across a large part of the Port of Port Elizabeth. The Baakens River is probably an important source of fine-grained sediment to the port, but sediment undoubtedly also enters the port from other sources. The dominance of mud in the sediment across most of the port shows that current speeds in the port are low, allowing this fine-grained material to settle on the bottom. The findings of other studies are not discussed below as they were performed so long ago the findings no longer reflect the contemporary situation (e.g. Fatoki and Mathabatha, 2000), while the findings of more recent studies are consistent with the findings for the August 2022 study.

Figure 27: Aerial view of the Port of Port Elizabeth showing the positions where sediment was sampled in August 2022.

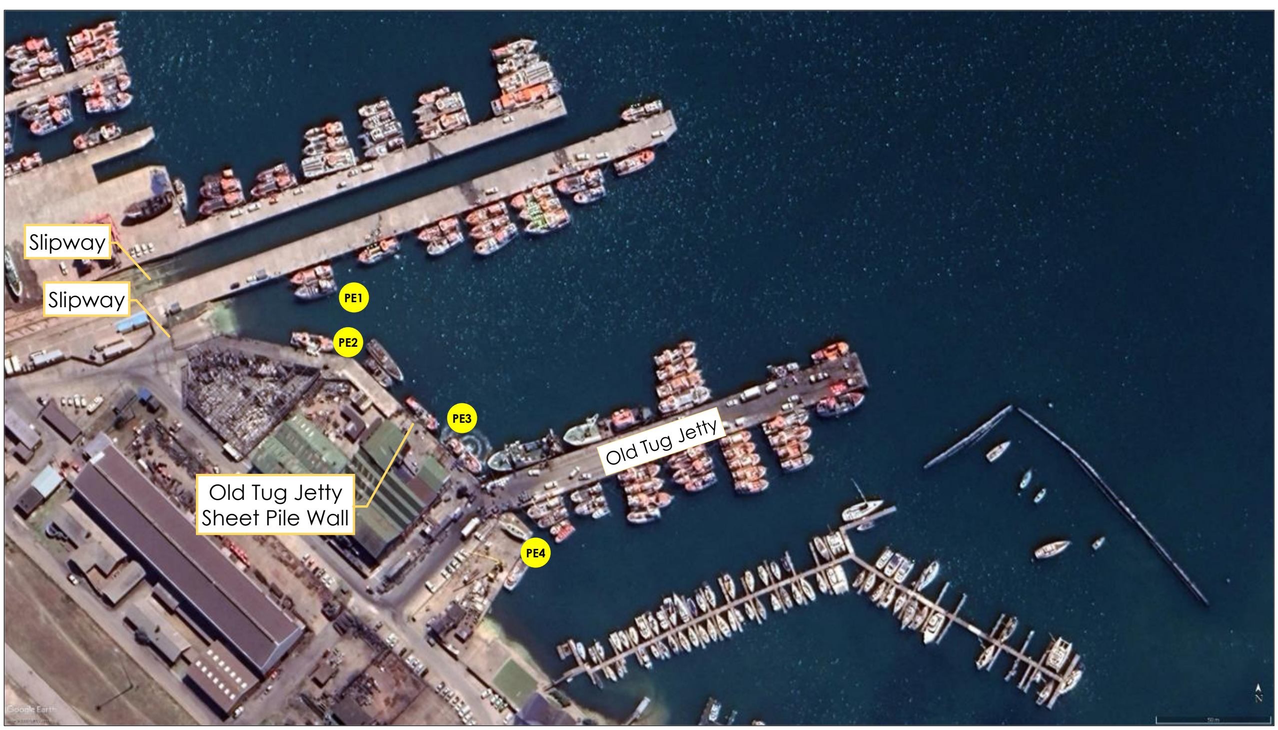


Figure 28: Aerial view of the Port of Port Elizabeth showing the positions the positions where sediment was sampled in the Old Tug Jetty quay area in August 2022.

It is not possible to determine if sediment is contaminated by metals by comparing metal concentrations amongst sediment samples because metals occur naturally in sediment and their concentration varies depending on the sediment grain size. To identify if sediment is metal contaminated the factors that control the natural concentrations of metals in sediment must be compensated for before naturally occurring concentrations can be discriminated from potentially anthropogenically enhanced (contaminated) concentrations. CSIR scientists have defined baseline models for 15 metals that identify the range of concentrations for the metals that should be found in relatively uncontaminated sediment in the Port of Port Elizabeth. The baseline models are used in the same way as discussed above for the total organic content baseline model. The baseline models are also used to compute an Enrichment Factor for each metal concentration. An Enrichment Factor indicates how many times a metal concentration is higher than the baseline. An Enrichment Factor <1 means the concentration falls within the baseline range while one that is >1 means the concentration exceeds the baseline and the sediment is referred to as being enriched by the metal. An Enrichment Factor of 2, for example, means a metal concentration is two times higher than the baseline concentration expected in relatively uncontaminated sediment. Metal enrichment does not imply contamination as there are biogeochemical processes that can lead to the natural enrichment of metals in sediment, although this is usually relevant to only a few metals. The higher an Enrichment Factor, the more metals there are enriched in sediment, and the closer enriched sediment is to known or strongly suspected anthropogenic sources of metals the more likely it is the enrichment reflects contamination.

The number of metals that were enriched in sediment at each of 18 stations sampled in the Port of Port Elizabeth in August 2022 (see Figure 27 and Figure 28) is provided in Figure 29. The Enrichment Factors for individual metals in the sediment are provided in Figure 30. The sediment sampled alongside or near the Old Tug Jetty quay area was enriched by the most, or amongst the most metals. The sediment at one or more of these stations was most significantly enriched by cadmium, copper, manganese, and zinc. The implication is that sediment alongside and near the Old Tug Jetty quay area is contaminated by the above metals. These findings can be compared to the findings of surveys for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth for the period 2015-2019. The positions of the stations where sediment was sampled for the latter monitoring programme are provided in Figure 32 The Enrichment Factors for individual metals and the number of metals that were enriched in sediment at each station are provided in Figure 33 and Figure 34The sediment at each station was enriched by at least one metal at some point in the period 2015-2019. The most frequent enrichment was usually at Stations 1, 2, 3, and 7. The magnitude of enrichment, as indicated by the Enrichment Factors, was very low at most stations. The highest magnitude of enrichment for many metals was for sediment sampled at Station 2 near the Old Tug Jetty quay area, while manganese usually presented the highest Enrichment Factors (i.e. the most significant metal contaminant of sediment was manganese). Cadmium, copper, manganese, lead, and zinc were always enriched in sediment sampled at Station 2.

There are clearly anthropogenic sources of certain metals in the area near Station 2 and the Old Tug Jetty quay, which probably includes vessel repair operations in the area but also probably the leaching of metals from antifouling coatings on vessel hulls. The loss of manganese ore particles during its loading onto vessels or from the manganese ore storage area in the port clearly accounts for the manganese contamination of sediment.

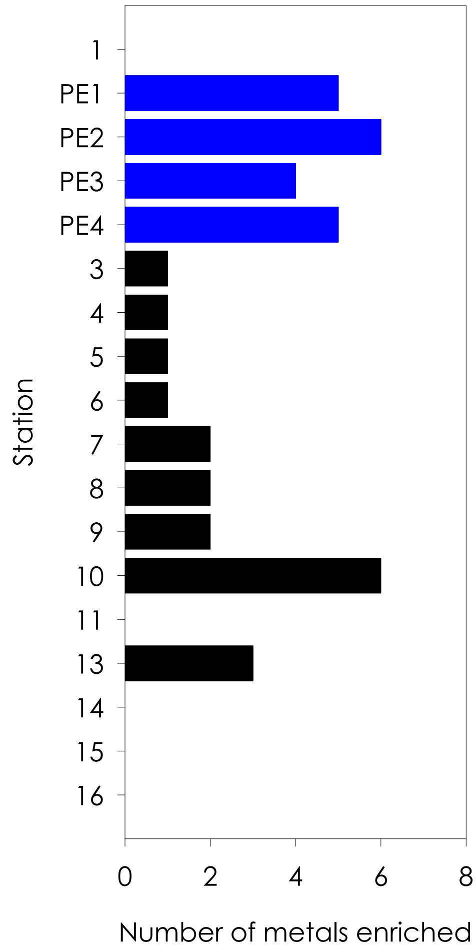


Figure 29: The number of metals enriched in sediment sampled in the Port of Port Elizabeth in January 2022. Stations alongside and near the Old Tug Jetty quay area are highlighted in blue

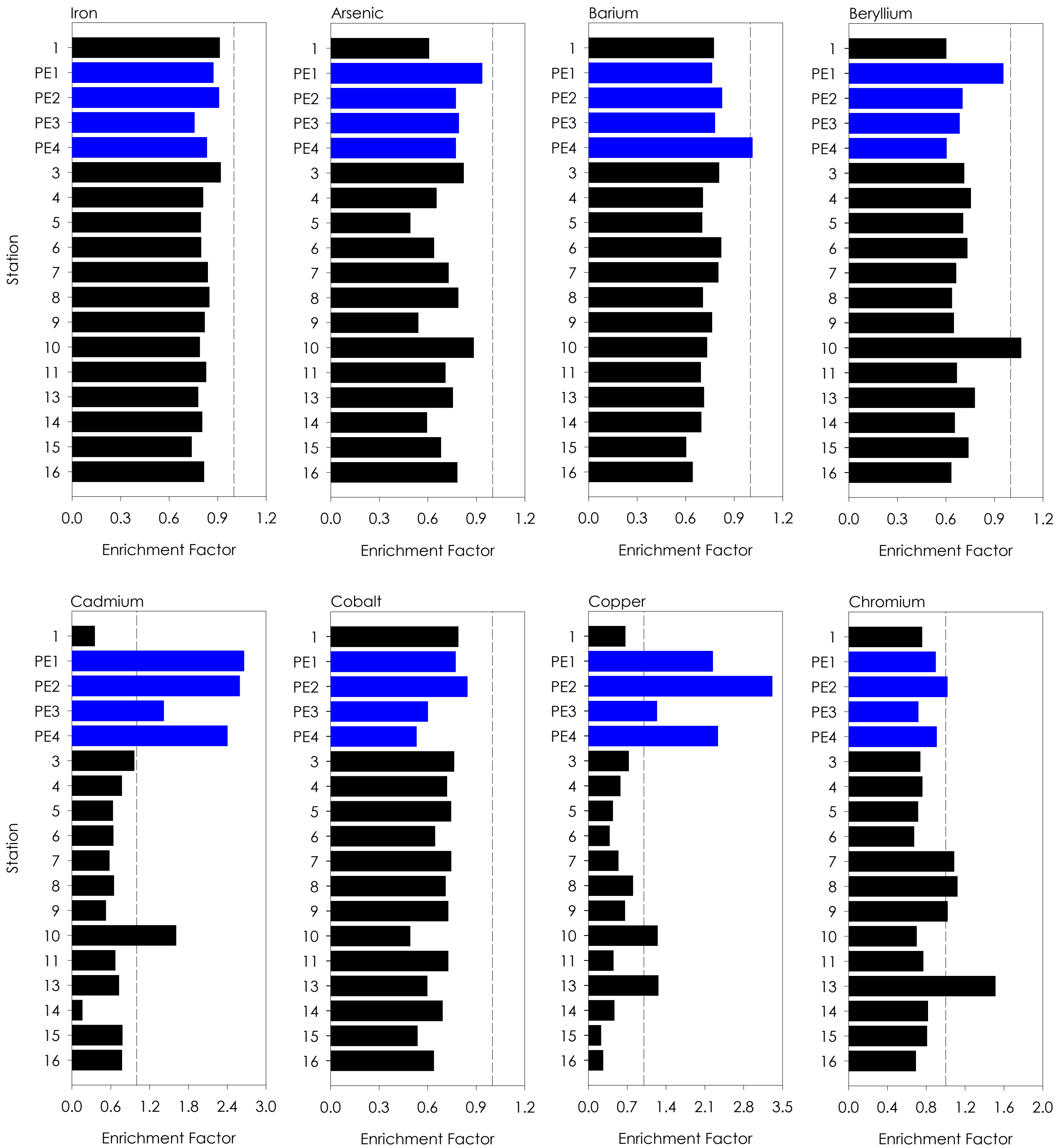


Figure 30: Enrichment Factors for metals in sediment sampled in the Port of Port Elizabeth in January 2022. The dashed lines represent an Enrichment Factor = 1. Enrichment Factors >1 indicate the metal was at a concentration exceeding the baseline and may indicate contamination. Stations alongside and near the Old Tug Jetty quay area are highlighted in blue.

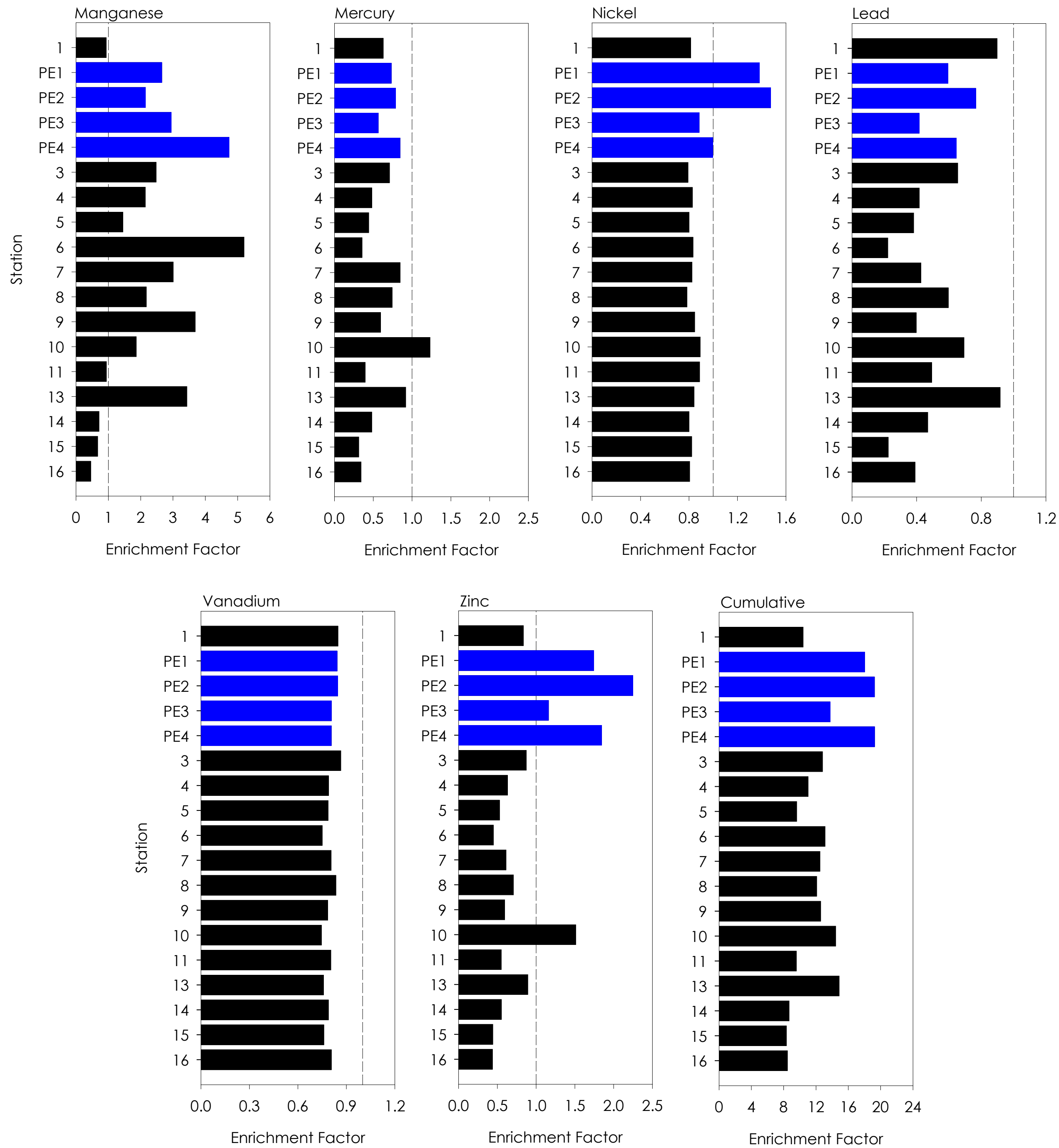


Figure 31: Enrichment Factors for metals in sediment sampled in the Port of Port Elizabeth in January 2022. The dashed lines represent an Enrichment Factor = 1. Enrichment Factors >1 indicate the metal was at a concentration exceeding the baseline and may indicate contamination. Stations alongside and near the Old Tug Jetty quay area are highlighted in blue.

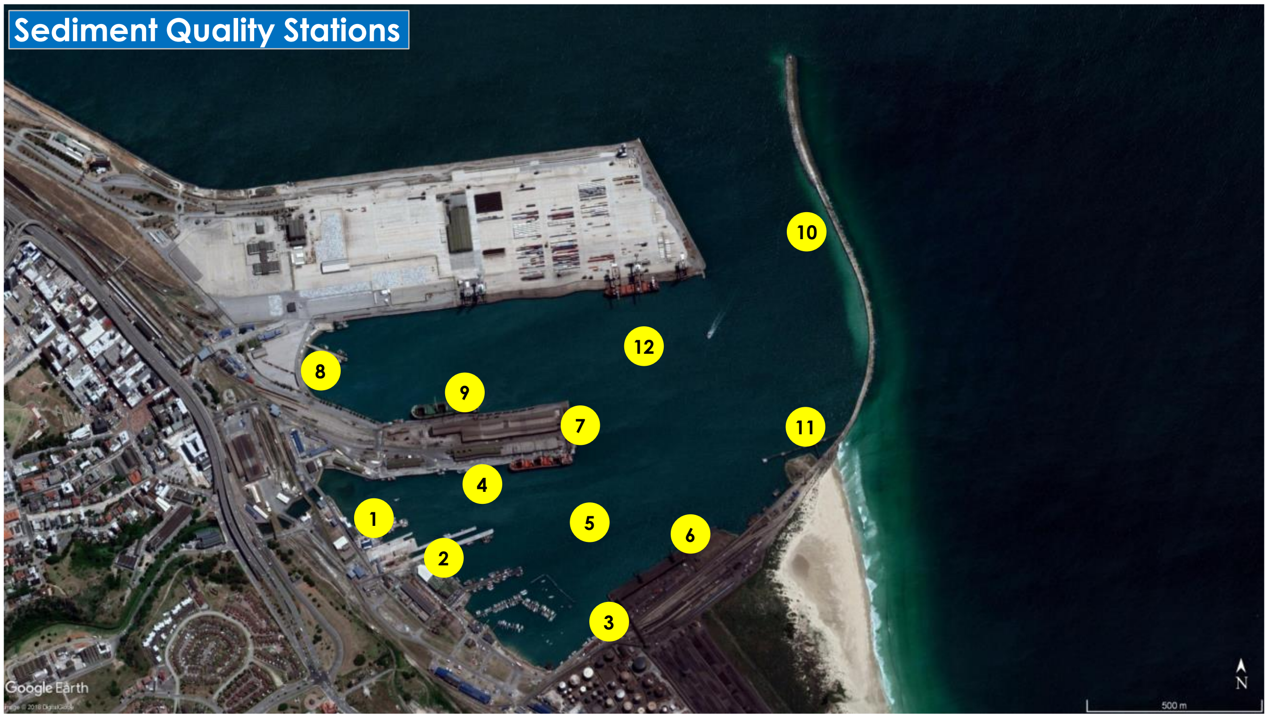


Figure 32: Aerial view of the Port of Port Elizabeth showing the positions where sediment was sampled in surveys between 2015-2019 for the Long-Term Ecological Monitoring Programme.

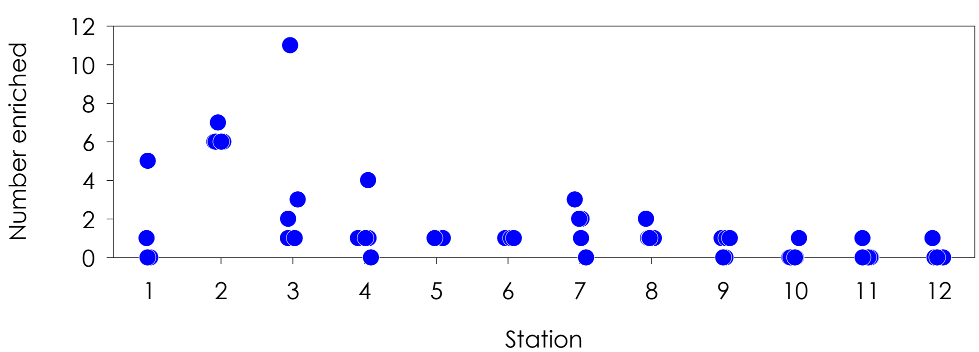


Figure 33: The number of metals enriched in sediment sampled in surveys between 2015-2019 for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth.

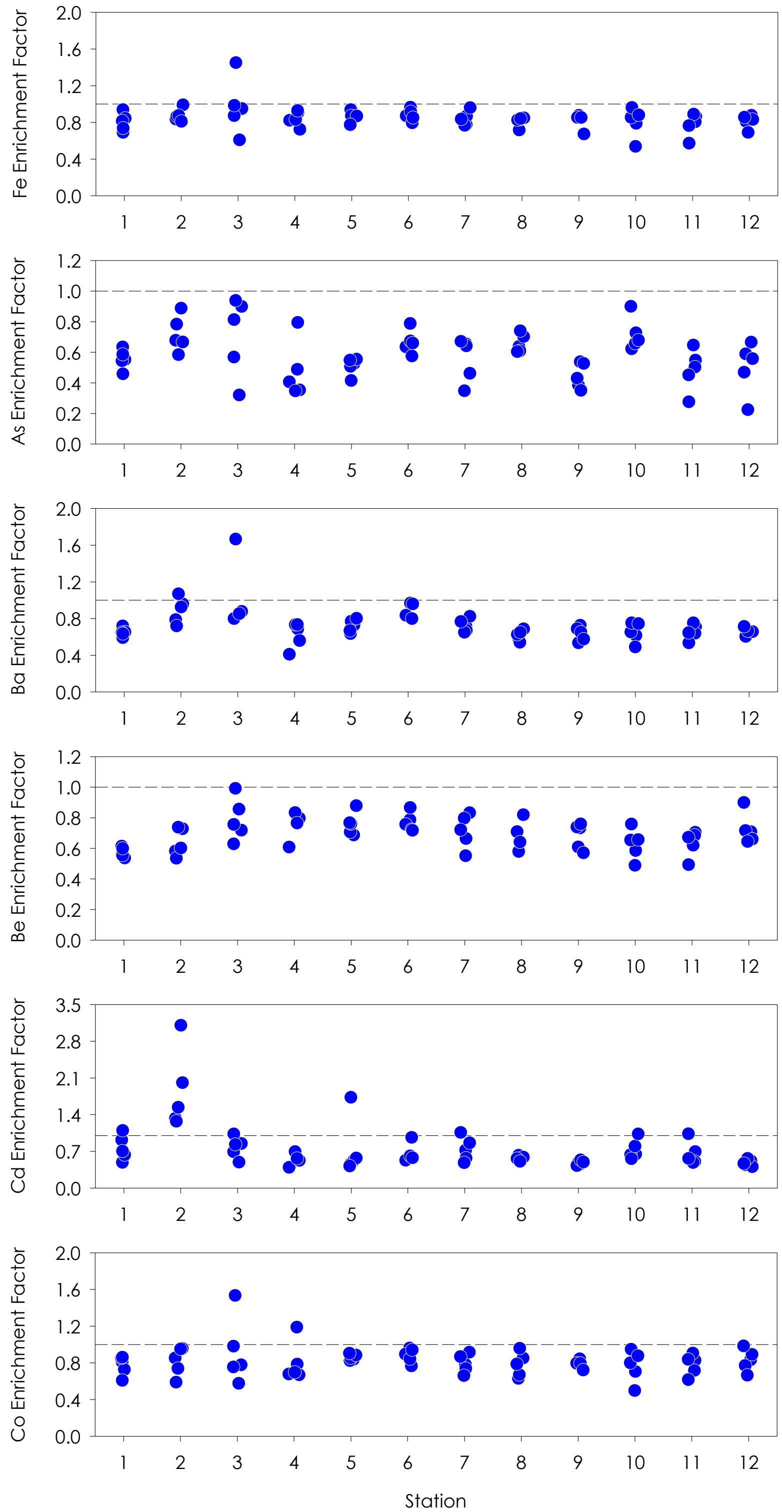


Figure 34: Enrichment Factors for metals in sediment sampled in surveys between 2015-2019 for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth. The dashed lines represent an Enrichment Factor = 1. Enrichment Factors >1 indicate the metal was at a concentration exceeding the baseline and may indicate contamination.

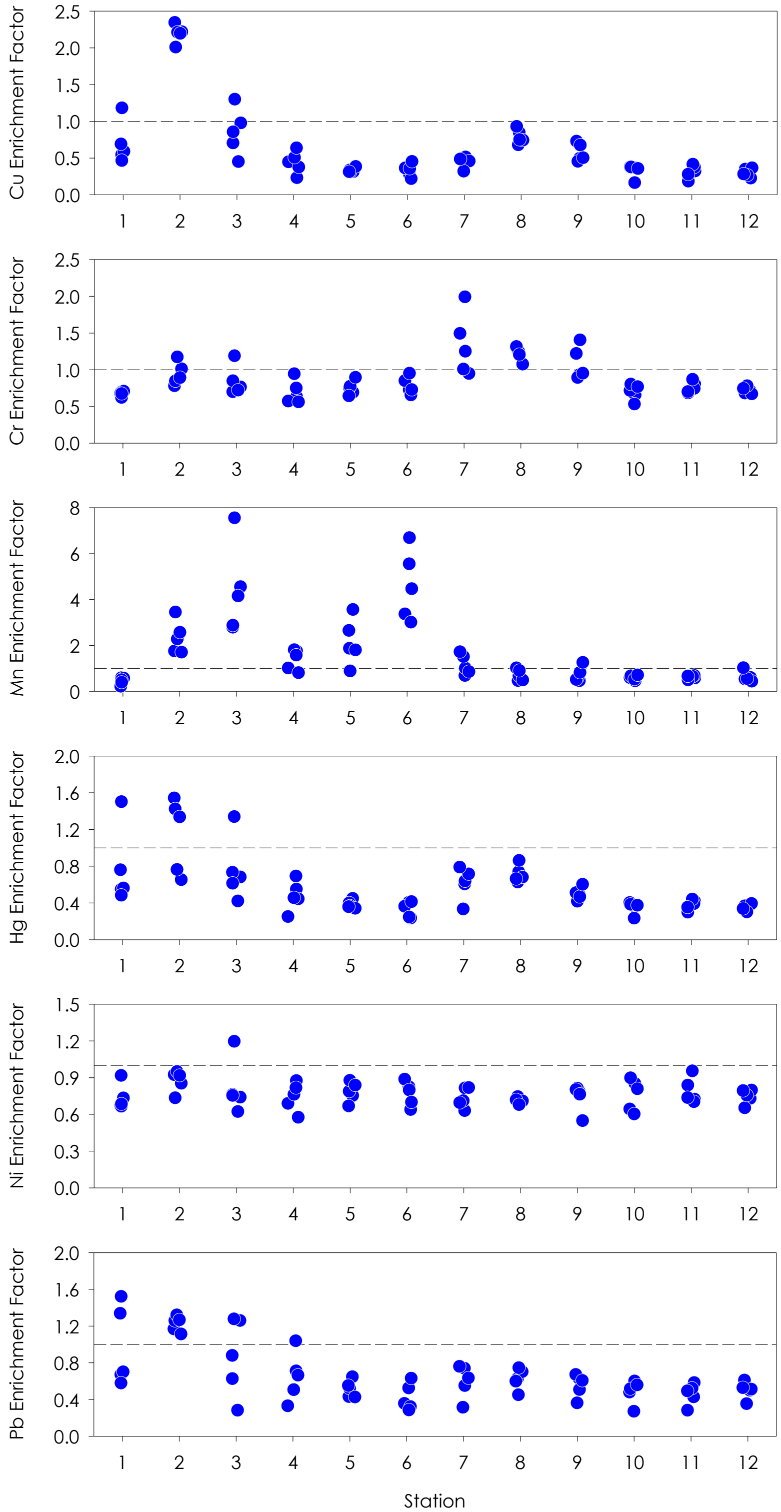


Figure 34 continued. Enrichment Factors for metals in sediment sampled in surveys between 2015-2019 for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth. The dashed lines represent an Enrichment Factor = 1. Enrichment Factors >1 indicate the metal was at a concentration exceeding the baseline and may indicate contamination.

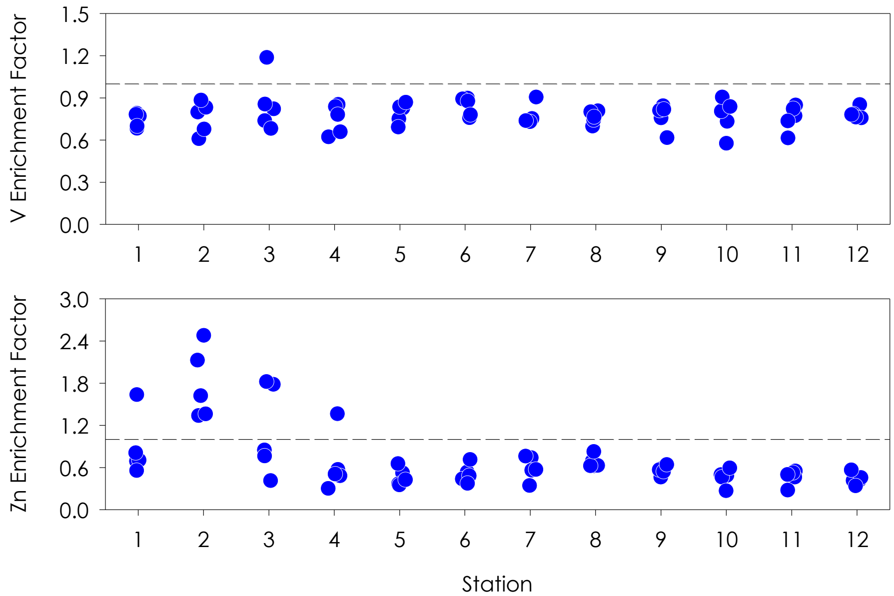


Figure 34 continued. Enrichment Factors for metals in sediment sampled in surveys between 2015-2019 for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth. The dashed lines represent an Enrichment Factor = 1. Enrichment Factors >1 indicate the metal was at a concentration exceeding the baseline and may indicate contamination.

Sediment sampled between 2015-2019 for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth was analysed for a range of organic chemicals and butyltins in addition to metals. Polycyclic aromatic hydrocarbons were found to be nearly ubiquitous in sediment, but the concentrations were usually low (Figure 35). The highest concentrations were found in sediment sampled at Station 2 near the Old Tug Jetty quay area. The sediment at most stations was contaminated by the organochlorine pesticides dieldrin and DDT and its metabolites. Dieldrin was found sporadically in sediment, at a low concentration DDT and its metabolites (collectively referred to as DDX) were found in the sediment at most stations, but not in each survey. The concentrations were low to moderate The sediment at each station sampled in the port was contaminated by polychlorinated biphenyls, but not necessarily in each survey The most significant contamination was found in the northern basin, most notably at Station 9. The sediment sampled at Station 2 near the Old Tug Jetty quay area had amongst the highest total concentrations. Kampire et al. (2015) also polychlorinated biphenyls in sediment sampled at each of nine sites in the Port of Port Elizabeth, but at lower concentrations than those reported in. However, the findings are not directly comparable since Kampire et al. (2015) analysed for a smaller suite of congeners. The sediment sampled at each station for the Long-Term Ecological Monitoring Programme was contaminated by butyltins, but not necessarily in each survey (Figure 35). The most significant contamination, as exemplified by tributyltin, was evident for sediment sampled at Station 2 near the Old Tug Jetty quay area. Tributyltin was historically widely used as the active biocide in antifouling coatings applied to the hulls of vessels and to the surfaces of other submerged manmade structures to limit the growth of marine fauna and flora (a process termed fouling). The use of tributyltin has been banned in most countries. It is probable the butyltin concentrations in sediment sampled at Station 2 reflect the inclusion of antifouling coating flakes sloughed from vessels berthing there or undergoing repairs on the quayside (Refere to Figure *35*).

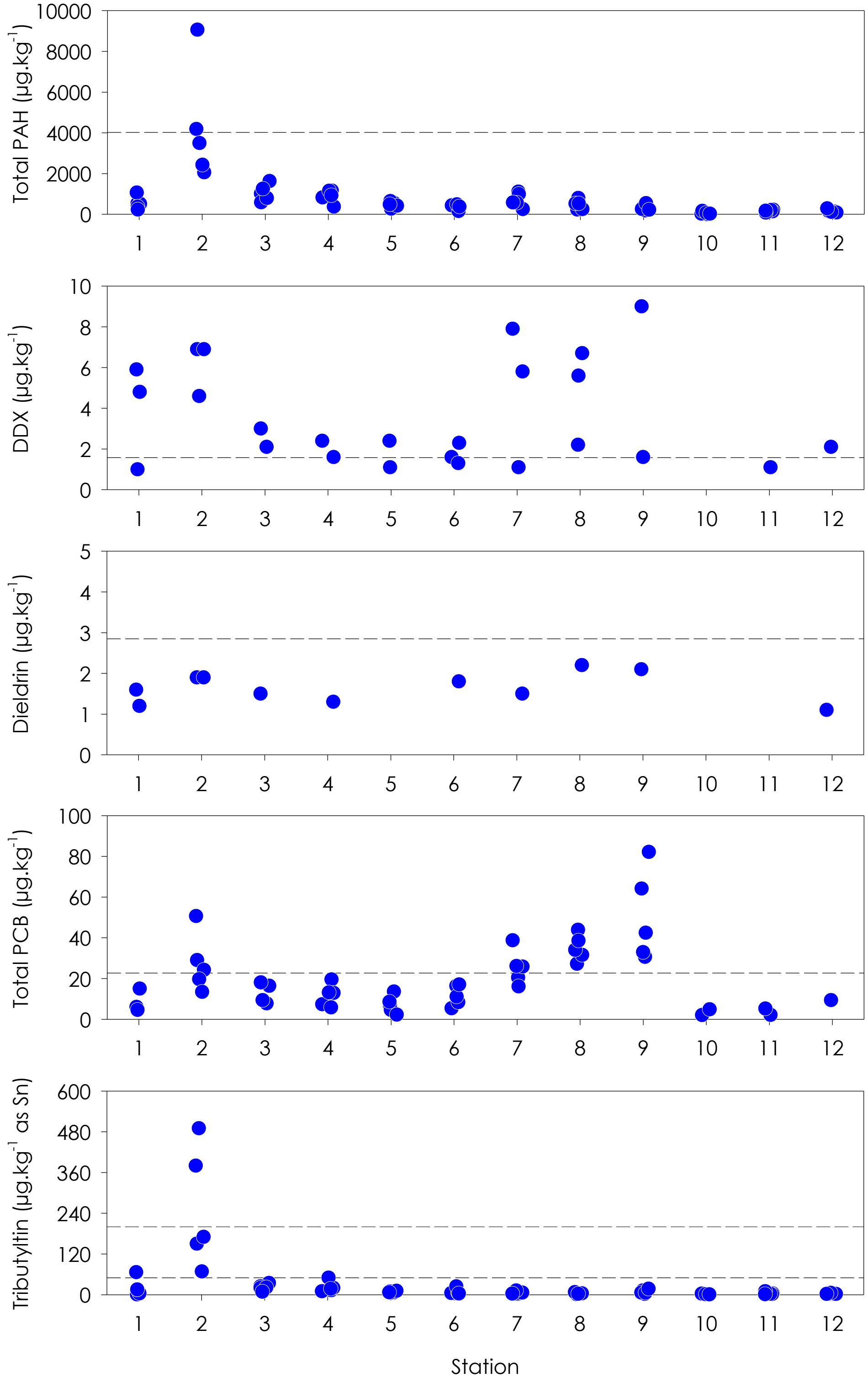


Figure 35: Total polycyclic aromatic hydrocarbon (PAH), DDT and metabolites (DDX), total polychlorinated biphenyl (PCB), and tributyltin concentrations in sediment sampled in the Port of Port Elizabeth for the Long-Term Ecological Monitoring Programme between 2015-2019. The horizontal dashed lines denote sediment quality guidelines that are used elsewhere in the world to

estimate the toxicological significance of chemical concentrations in sediment to sediment-dwelling organisms (PAH, DDX, and PCB guidelines from Long et al., 1995; dieldrin guideline from MacDonald et al., 2002; tributyltin guideline from OSPAR, 2011).

The findings for various sediment quality indicators in the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth were included in a sediment quality index to classify sediment quality in the port for the period 2015-2019. The index classifies sediment quality into five categories, namely excellent, good, fair, marginal, or poor. The sediment quality classification at most stations was variable amongst surveys (Figure 36). At Station 2 near the Old Tug Jetty quay area the sediment quality was classified marginal or poor. It is important to note that the criteria used to classify sediment quality sediment through the index were far more conservative than the sediment quality guidelines used in South Africa or elsewhere in the world (the criteria were one-half the guideline values). If the sediment quality guidelines used in South Africa or elsewhere in the world were included in the index than the sediment quality at most stations would be rated good or excellent, but fair in some surveys for Station 2.

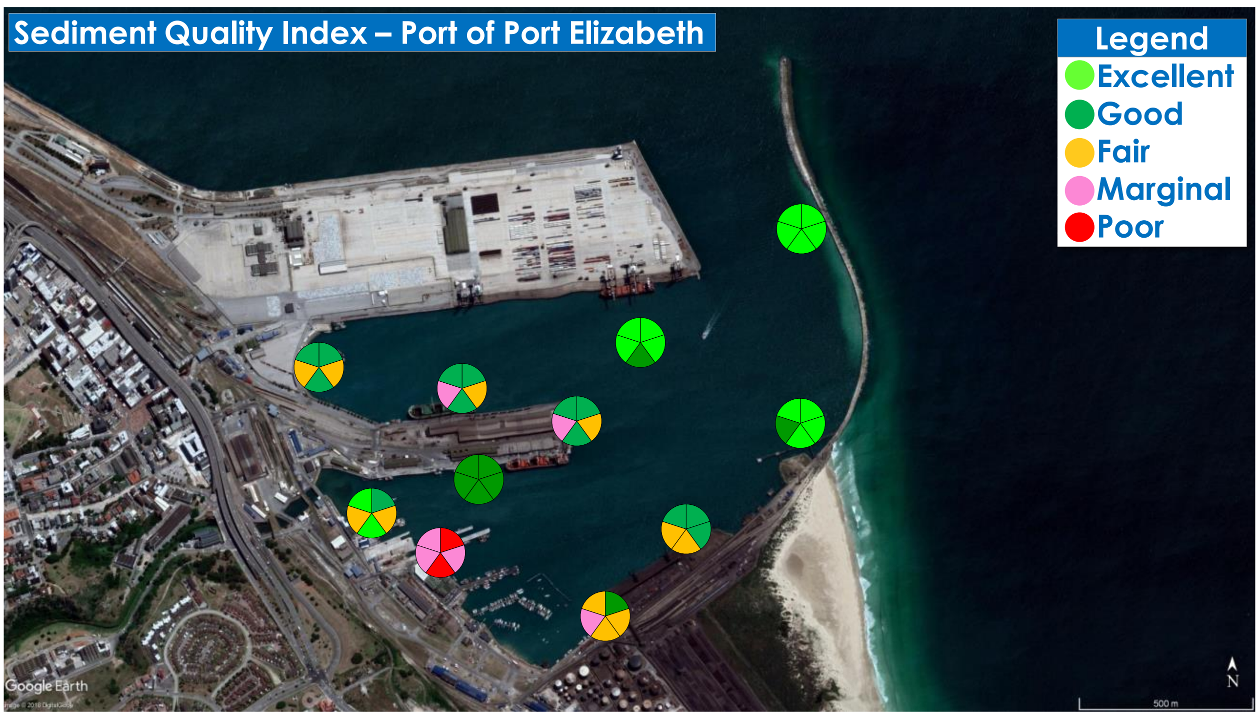


Figure 36: Sediment quality indices for sediment sampled for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth between 2015-2019.

The Department of Forestry, Fisheries and the Environment has defined sediment quality guidelines that it uses to decide if sediment identified for dredging in South African ports is suitable for open water disposal. However, there are only guidelines for metals. There are three guidelines, known as the Warning Level, Level I and Level II. The Warning Level provides a warning of incipient metal contamination but is not used for decision-making. Sediment with metals at a concentration below the Level I is considered suitable for open water disposal. Sediment with metals at a concentration between the Level I and Level II is considered cause for concern, with the degree of concern increasing as the concentrations approach the Level II. Further testing may be requested to determine if metals in the sediment pose a toxic risk to sediment-dwelling organisms, but in practice this has not been implemented. Sediment with metals at a concentration exceeding the Level II is considered unsuitable for open water disposal unless other evidence (e.g. toxicity testing) shows the metals are not toxic to sediment-dwelling organisms due, for example, to the metals being present in metal flecks or metal-impregnated paint flakes and the entire concentration thus not being in a bioavailable form. Three copper and two zinc concentrations in sediment sampled in the Port of Port Elizabeth August 2022 exceeded the Warning Level, in each case at one of the stations alongside or near the Old Tug Jetty quay area. No metal concentrations exceeded the Level I or Level II. These findings suggest there is a low probability that metals in the sediment were adversely affecting sediment-dwelling organisms through toxic effects. The sediment is thus considered suitable for open water disposal. As a point for comparison, no metal concentrations in sediment sampled for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth in the period 2015-2019 exceeded the Level I or Level II.

The South African sediment quality guidelines do not provide guidelines for chemicals other than metals. The concentrations of organic chemicals must thus be compared to guidelines used elsewhere in the world. The sediment quality guidelines are like the South African guidelines in that they also define two guidelines, which have a similar narrative intent as the South African Level I and Level II in the context of estimating the likelihood of toxic effects to sediment-dwelling organisms. In two surveys, the total polycyclic aromatic hydrocarbon concentration in sediment sampled at Station 2 near the Old Tug Jetty quay area exceeded the lower of sediment quality guidelines commonly used to estimate the toxicological implications of chemicals in sediment in North American coastal waters, but all concentrations were well below the upper guideline. The DDX concentrations in sediment sampled at numerous stations in several surveys exceeded the lower of two sediment quality guidelines commonly used to assess the potential toxicological significance of these chemicals in sediment in North American coastal waters but were below the upper guideline. The total polychlorinated biphenyl concentration in the sediment sampled at a few stations in several surveys exceeded the lower of two sediment quality guidelines commonly used to assess the potential toxicological significance of these chemicals in sediment in North American coastal waters but were well below the upper guideline. The tributyltin concentrations in sediment sampled at Station 2 near the Old Tug Jetty quay area exceeded the lower, and occasionally the upper of two sediment quality guidelines used to assess the potential toxicological significance of these chemicals in sediment in parts of Europe. The comparison of organic chemical concentrations to sediment quality guidelines thus suggests a possibility for toxic effects to sediment-dwelling organisms.

The concentrations of chemicals in sediment are not a good predictor of toxic effects to sediment-dwelling organisms because contaminants can be complexed to various phases in sediment to a degree that this essentially renders them non-bioavailable and thus unable to exert a toxic effect. It is for this reason that the sediment sampled in the Port of Port Elizabeth in August 2022 was tested for toxicity to sea urchin embryo-larvae, using a sediment-water interface testing regime. The sediment at 13 of the 18 stations was not toxic to sea urchin embryo-larvae. The sediment at four of the remaining five stations was very slightly toxic, and at one station was marginally toxic. The sediment at one station sampled alongside the Old Tug Jetty quay area was very slightly toxic.

10.2 BIOLOGICAL ENVIRONMENT

10.2.1 Phytoplankton

Phytoplankton community has been sampled by van Zyl (2017) at seven stations in the Port of Port Elizabeth at monthly intervals for a 14-month period. The phytoplankton community was generally dominated by diatoms. There was no seasonality in phytoplankton abundance. Fewer phytoplankton cells were found in Port of Port Elizabeth compared to stations sampled in the Port of Ngqura, but the number of cells was higher than at station sampled in Algoa Bay.

The CSIR measured chlorophyll-a concentrations in the port for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth, as discussed above (CSIR, 2016, 2017, 2018, 2019, 2020). Chlorophyll-a is used as surrogate for phytoplankton biomass. The chlorophyll-a concentration in the Port of Port Elizabeth (see Figure 26) is similar to the range of ~1-6 µg.l-1 recorded in the western part of Algoa Bay near the Port of Port Elizabeth by Schumann and Campbell (1999) and Campbell (2000). The chlorophyll-a concentration is periodically high, showing that on occasion phytoplankton in the port reach bloom status.

10.2.2 Macroalgae

No information on macroalgae in the Port of Port Elizabeth could be found in the scientific or other literature. A visual survey of the port for the purposes of this Environmental Impact Assessment revealed that macroalgae are virtually absent in the area near the Old Tug Jetty quay area and are almost exclusively restricted to floating structures elsewhere in the port (e.g. walk-on moorings, yacht hulls), but even in these cases their species diversity, abundance, and growth is sparse. The reason is uncertain but might reflect a high degree of grazing and poor light regimes in the water column. The ports primary production is thus almost exclusively driven by phytoplankton in the water column.

10.2.3 Zooplankton and nektonic invertebrates

No information on zooplankton or nektonic invertebrates in the Port of Port Elizabeth could be found in the scientific or other literature.

10.2.4 Ichthyoplankton

No surveys on ichthyoplankton in the Port of Port Elizabeth could be found in the scientific or other literature.

10.2.5 Sediment benthic invertebrate communities

Benthic macrofaunal communities were analysed in the sediment sampled at 12 stations in the Port of Port Elizabeth in surveys between 2015-2019 for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth (CSIR, 2016, 2017, 2018, 2019, 2020). The stations where the sediment was sampled are identical to those where sediment was sampled for physical and chemical analysis (see Figure 32). The fauna were identified to the family level. The station nearest the Old Tug Jetty quay area is Station 2. The benthic macrofaunal community at virtually all stations was dominated by annelid worms, with gastropods and/or ostracods contributing importantly at many stations. An example of the fauna recorded, their abundance, and their contribution to the total abundance is provided for the 2019 survey of the Long-Term Ecological Monitoring Programme in Figure 37 and Figure 38. The abundance, number of taxa, and species diversity of the benthic macrofaunal communities sampled for the period 2015-2019 are provided in Figure 39. As is evident in Figure 37 and Figure 38, there was little difference in the number of taxa recorded and the species diversity amongst stations, but the total abundance varied quite widely amongst surveys at some stations and between certain stations in different surveys. There is thus no clear evidence that the chemical contamination of sediment is of such a magnitude that this is adversely impacting on the benthic macrofauna.

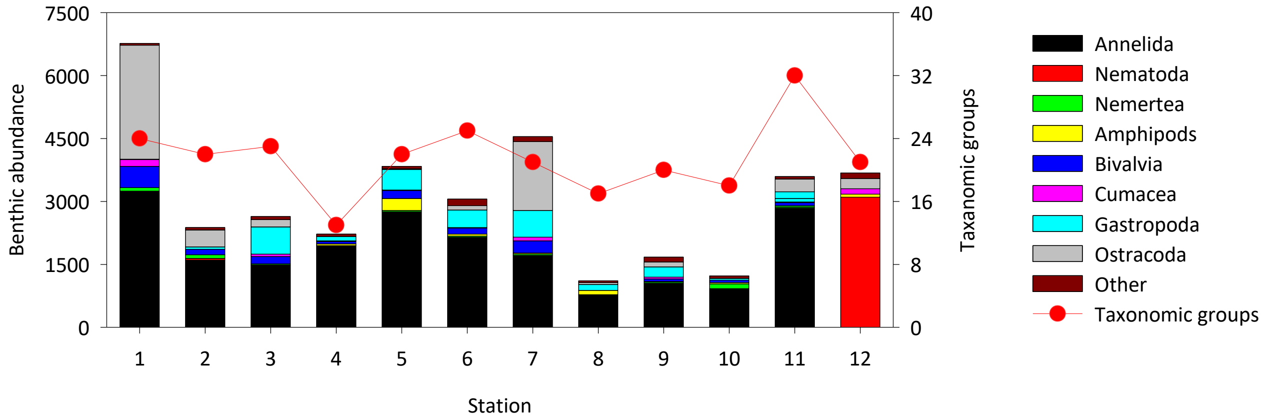


Figure 37: Abundance and number of taxonomic groups comprising the benthic macrofaunal community at each station sampled in the Port of Port Elizabeth in 2019 for the Long-Term Ecological Monitoring Programme.

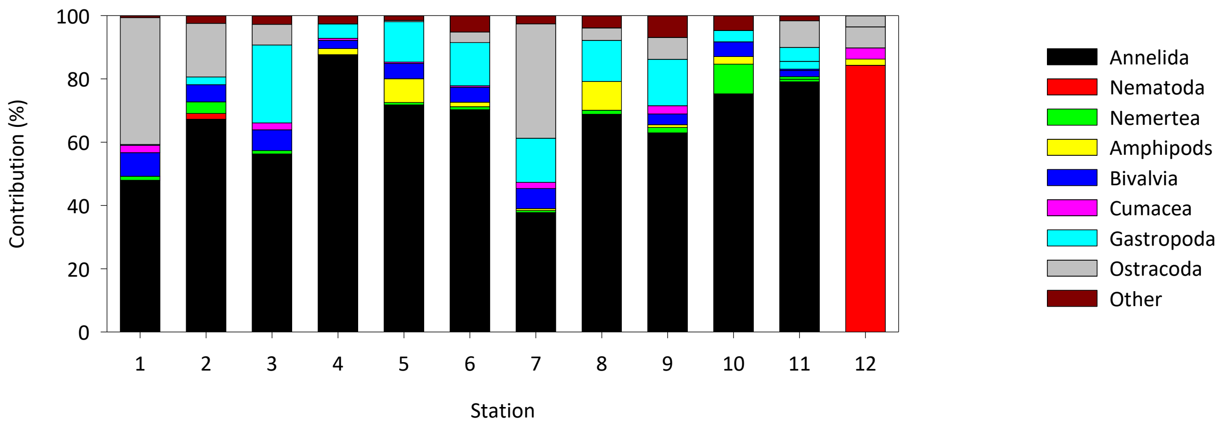


Figure 38: Contribution of various taxonomic groups to benthic macrofaunal abundance at each station sampled in the Port of Port Elizabeth in 2019 for the Long-Term Ecological Monitoring Programme.

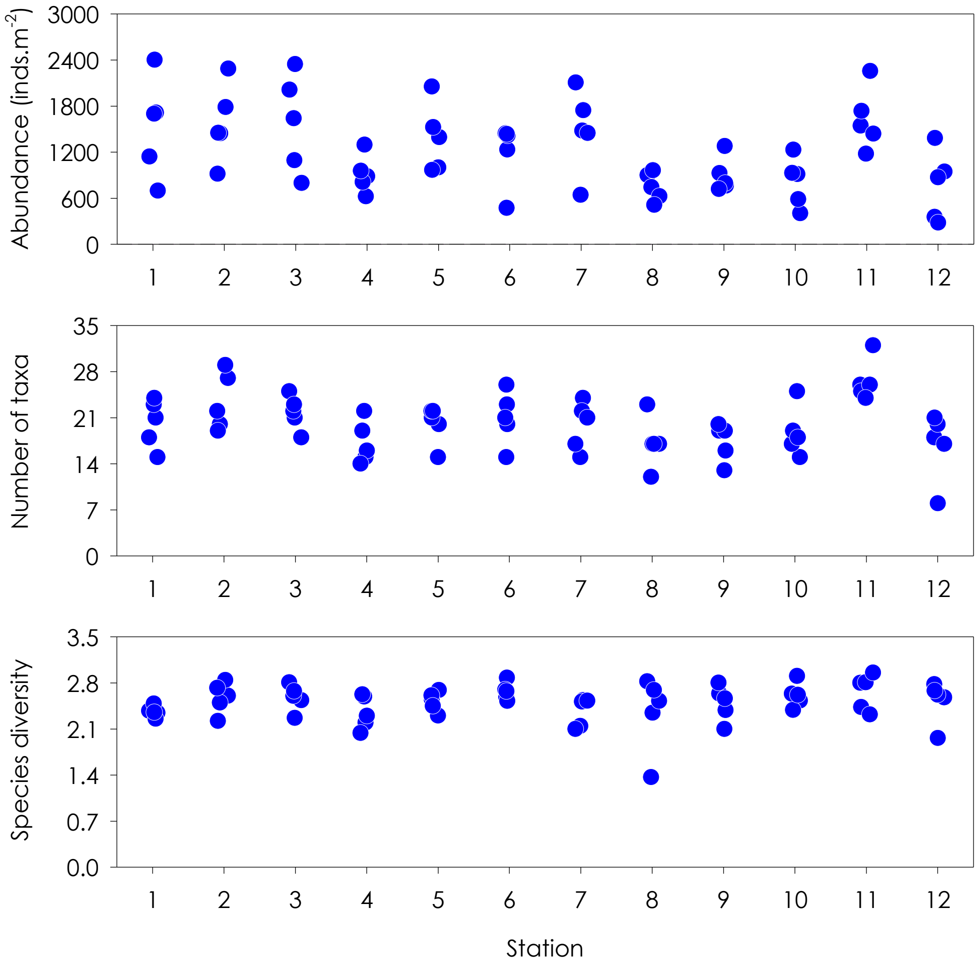


Figure 39: Univariate indices for benthic macrofauna in sediment sampled in the Port of Port Elizabeth for the Long-Term Ecological Monitoring Programme between 2015-2019.

10.2.6 Biological communities on hard substrates

No information on biological communities that colonise hard structures in the Port of Port Elizabeth could be found in the scientific or other literature. Hard structures in the port are encrusted by a range of fauna, including barnacles, mussels, sponges, bryozoans, and ascidians. The encrusting fauna on the sheet pile wall at the Old Tug Jetty is rather depauperate when compared to communities on hard structures elsewhere in the port, but especially when compared to pile on jetties (Figure 40) and on walk-on moorings at the Algoa Bay Yacht Club. The reason the communities are so different is uncertain, but in the case of the sheet pile wall might reflect a toxic impact due to the corrosion of the metal sheet pile or that the fauna prefer not to colonise metal for some other reason.

Loureiro *et al*. (2021) recorded 20 fauna that colonised plastic settlement plates deployed from walk-on moorings at the Algoa Bay Yacht Club in the port, including porifera (sponges), annelid worms, barnacles, bryozoans, and ascidians. Ten of the taxa recorded were identified as alien. Peters *et al*. (2017) recorded a further three alien species in the port by scraping the fauna from hard structures and later identifying them in the laboratory. It is unlikely these studies have documented the total number of alien species that have colonised hard structures (and indeed other habitats) in the port. However, apart from the mussel *Mytilus galloprovincialis* none has become invasive.

Figure 40: Photos showing encrusting organisms on the sheet pile quay wall at the Old Tug Jetty (top) and on piles near the Old Tug Jetty (bottom).

10.2.7 Faunal Species

Historically, the fauna of the study area matched the plant diversity. Large game, such as elephant, buffalo and lion, were all present. Leopard roamed the Baakens River valley until a century ago and hippopotamus frequented the major river systems. All the larger predator species have been exterminated and most large antelopes (kudu, bushbuck etc.) are now confined to nature conservation areas at the fringes of the metro. An exception to this trend is the continued occurrence of marine mammals along the coast. Nine species of whales, dolphins and seals are relatively common in the area, albeit some only seasonally (Klages 2002). Most smaller mammals have persisted to this day, continuing in finding sufficient habitat on smallholdings and in the more rural parts of the NMBM. The metro boasts an impressive bird and reptile list, which is a reflection of the variety of vegetation types present.

The NMBM is situated at the eastern extreme of the Cape Floral Kingdom, which has been identified as one of the global biodiversity hotspots since it will be hit very hard by climate change. Drought, increased intensity and frequency of fire and climbing temperatures may well mean an untimely end to the fascinating diversity of flora and fauna in the municipal area.

The animal species sensitivity of the site is rated as medium sensitivity according to NWBEST as shown in ***Figure 41***. Animals that are expected to occur in the area include:

- *Mammalia-Chlorotalpa duthieae*
- *Sensitive species 8*
- *Invertebrate-Aneuryphymus montanus*

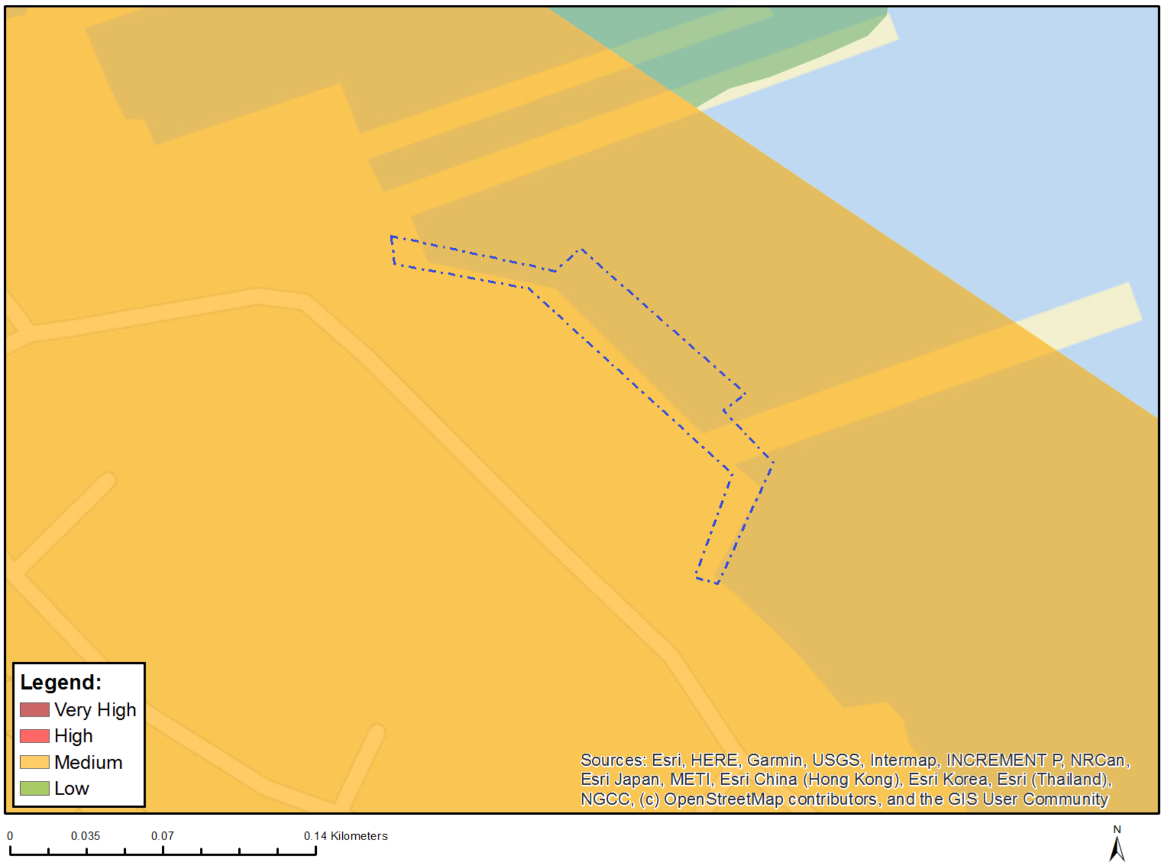


Figure 41: Animal Species sensitivity

10.2.7.1 Fish

No surveys on fish in the Port of Port Elizabeth could be found in the scientific or other literature. Dicken (2010) sampled the fish community in the pre-operational Port of Ngqura using tackle. Although the Port of Ngqura is relatively far from the Port of Port Elizabeth, some of the fish recorded by Dicken (2010) in the Port of Ngqura could reasonably be expected to frequent the Port of Port Elizabeth. Dicken (2010) recorded 47 species of fish distributed across 27 families, most of which were marine as opposed to estuarine species. Fish recorded include Cape stumpnose, pufferfish, kob, elf, garrick, subtropical kingfish, and queen mackerel. The study highlighted an unexpected abundance and diversity of shark species in the port, including bronze whalers, hammerheads, various cat sharks, dusky sharks, and gully sharks. The dolosse provided a habitat within which the highest number species were recorded (43 species) in comparison to the quay wall (24 species) and sandy shore (21 species). In terms of abundance the former substrates were equal with the shore habitat being less productive. As stated above, the fish recorded by Dicken (2010) were sampled using tackle. This sampling approach will obviously not sample species that as adults are small, such as gobies, as well as herbivorous fish that are generally not partial to being caught using tackle (*e.g.* several mullet species – only one species was recorded).

Although a fish survey for this Environmental Impact Assessment was not performed since it would have had to be destructive in type (*i.e.* through netting or using fish toxins), two large rays were observed from a walk-on mooring at the Algoa Bay Yacht Club near the Old Tug Jetty quay area. Juvenile and post-larval fish were also evident alongside some hard structures in the port, showing the port does play a nursery role. Discussions with the skippers of small vessels in the port revealed that rays are common in this part of the port. Sharks are also known to frequent the port, but the species could not be verified. A spotted grunter was observed in the area where the Baakens River flows into the port and these fish might be quite common in the port considering they target burrowing prawns whose burrows were evident in this area.

10.2.7.2 Marine reptiles

No information on marine reptiles (*e.g.* turtles) in the Port of Port Elizabeth could be found in the literature. Turtles are known to enter the port, but the species are uncertain and are not regularly sighted (Peter Deyzel, personal communication).

10.2.7.2.1 Birds

No information on birds in the Port of Port Elizabeth could be found in the scientific or other literature. During the field survey for this Environmental Impact Assessment a number of birds were observed in the port, although not near the Old Tug Jetty quay area. The birds included Cape cormorants, Kelp gulls, terns, and a heron. Of these, Kelp gulls were by the most common. African penguins reportedly periodically enter the port, although not often (Peter Deyzel, personal communication).

10.2.8 Aquatic Ecology

The coastal zone of Nelson Mandela Bay provides an array of recreational and sustainable resource utilisation opportunities and underpins a substantial segment of the municipality's economy. The Swartkops Estuary lies about 8 km north of the Port Elizabeth City Centre and is an important nursery for marine fish, including several angling species. The estuary forms the basis of an informal bait collecting industry and is ranked as South Africa's top temperate estuary in terms of subsistence value (Turpie & Clark, 2007). The bait collecting industry is also, however, responsible for destruction of the mudflats, leading to significant impacts on the functioning of the system (Baird et al., 1988). The functioning of the estuary is also threatened by pollution, enrichment, sand mining, overfishing, insufficient inflow of freshwater due to damming, and inappropriate development. Relevant sections of the Swartkops River and Estuary are currently proposed for declaration as either a Protected Environment or Nature Reserve in terms of the NEM: Protected Ares Act, 2003 (Act No. 57 of 2003). Declaration thereafter as a RAMSAR site is also being considered. Under the auspices of the Department of Water and Sanitation (DWS), a Catchment Management Forum has been formed with the objective of safeguarding the welfare of the Swartkops River and Estuary from source to sea (T Potts 2014, pers. comm., 30 Oct).

The foredune vegetation along the Nelson Mandela Bay coastline helps to buffer against the high energy influences of the tides, wind and waves. These systems are sensitive to disturbance and are susceptible to the formation of blow-outs. The coastal area is often targeted for development, primarily due to the desirability of ocean views. The protection of the coastal foredune system is important in order to safeguard the scenic attributes of the coastal zone and to provide protection against the natural coastal agents of change, particularly in light of the implications of global sea-level rise.

The Alexandria Dunefield has its beginnings at the north-eastern extent of the municipal area. The dunefield is considered to be one of the largest and most pristine active coastal dunefields in the world. Larger and more extensive dunefields are only found in desert areas. As such, it has been incorporated into the Addo Elephant National Park and was nominated by South African National Parks as a World Heritage Site (UNESCO, 2009).

The Maitlands Dunefield, between the resort villages of Beachview and Blue Horizon Bay on the southwestern part of the Nelson Mandela Bay coastline, supports what is believed to be the highest density of black oystercatcher in the country (Bornman & Klages, 2003). The black oystercatcher is Near Threatened and is highly susceptible to disturbance during its breeding cycle. The Maitland area, in general, is one of the most visually spectacular areas in the municipality and has significant value in terms of recreation and tourism. Although the prohibition of off-road vehicles on the dunefields has substantially reduced threats to these systems, they continue to be threatened principally by encroachment of invasive alien plants and are vulnerable to insensitive recreational use.

The receiving area of the proposed project is within the mouth of the Baakens River, which is one of the major freshwater ecosystems in the NMBMM. The Baakens River mouth is in the Port Elizabeth harbour adjacent to the central business district of the City.

A number of ecological corridors were identified as part of the NMBM conservation assessment. These corridors were designed to promote connectivity between natural areas in order for ecological processes (such as migration and seed dispersal) to continue. While all of the identified corridors are important, the Baakens River Valley, which forms an east-west corridor through the urban expanse of the Municipal area, deserves a special mention. It is the Municipality’s most extensive corridor through fynbos habitats and is of critical importance for the continuation of ecological processes that sustain biodiversity. The area also provides numerous ecosystem services, playing an important role in flood attenuation, storm water management, environmental education and nature-based recreation.

According to NWBEST, the aquatic biodiversity of the proposed site is low.

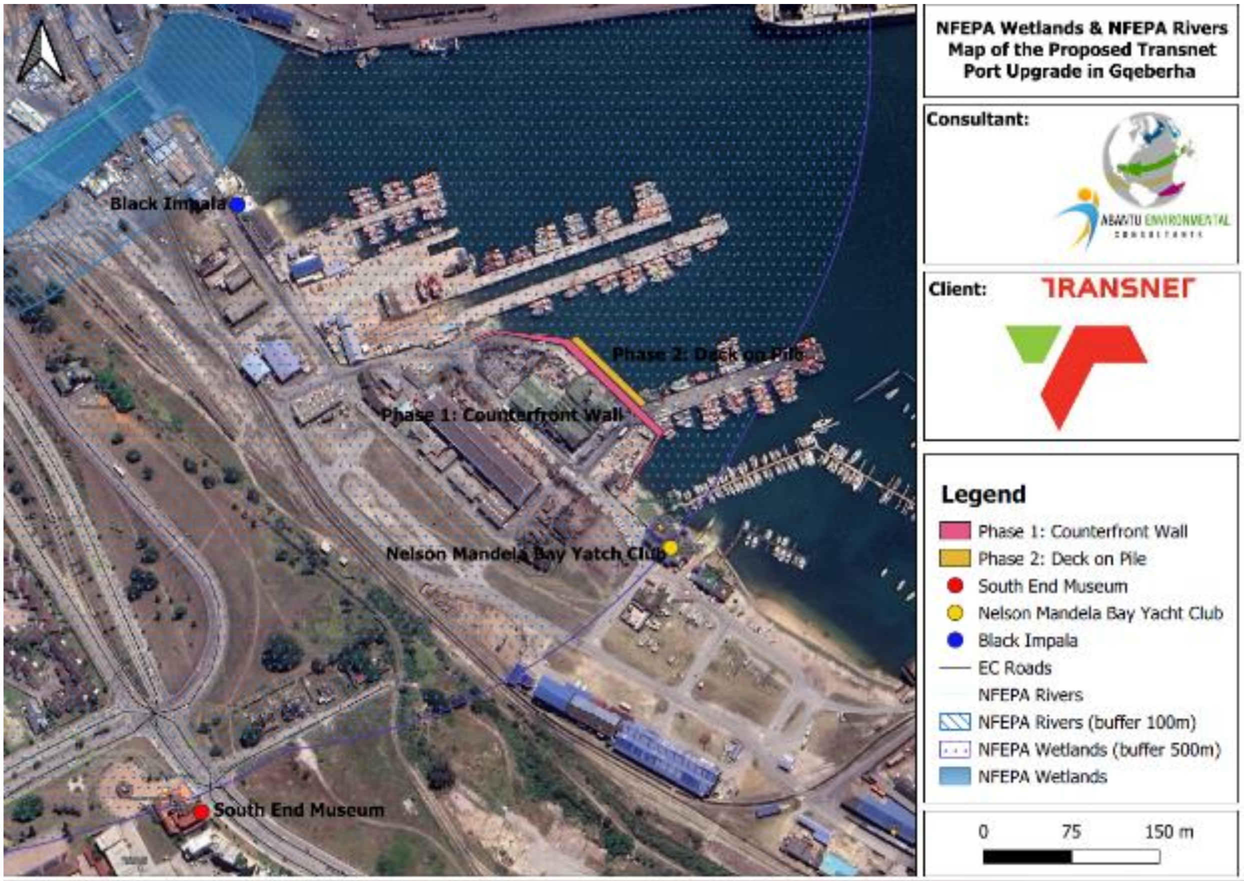


Figure 42: NFEPA Wetlands and Rivers

10.2.9 Geology and Soils

According to the 1:250 000 geological map (3324 PORT ELIZABETH) and 1:50 000 geological map (3325 DA & DD, 3425 BA) published by the Council of Geoscience, the investigation area is underlain by a combination of land-fill material and Quaternary alluvial sand, gravel, cobbles and boulders. This material is underlain, at depth, by the Peninsula Formation of the Table Mountain Group. The local geology underlying the area is presented in **Figure *43***. The proposed rehabilitation section (old tug jetty sheet pile wall) lies within the geological environment dominated by the Nanaga Formation, underlain by the Alexandria Formation thinly as a horizontally laminated calcareous sandstone. The areas' minor geological sections lie at the north and south extremes of about 5km to the study portion and comprise the Peninsula Formation (Olowabi et al, 2022).

The land-fill material, which consists of building rubble, crushed stone and sand was used to reclaim large areas surrounding the Port Elizabeth Harbour, according to Le Roux (2000). The Port Elizabeth Harbour is situated in the mouth of the Baakens River, which serves as the source of deposition of alluvial material, along with the fringe of the Indian Ocean. According to Le Roux (2000), the Ordovician-aged Peninsula Formation consists of light grey, medium- to course-grained quartzite with minor lenticular shale layers. The quartzite is typically well bedded. Deposition of the Peninsula Formation is believed to have occurred on a shallow marine shelf.

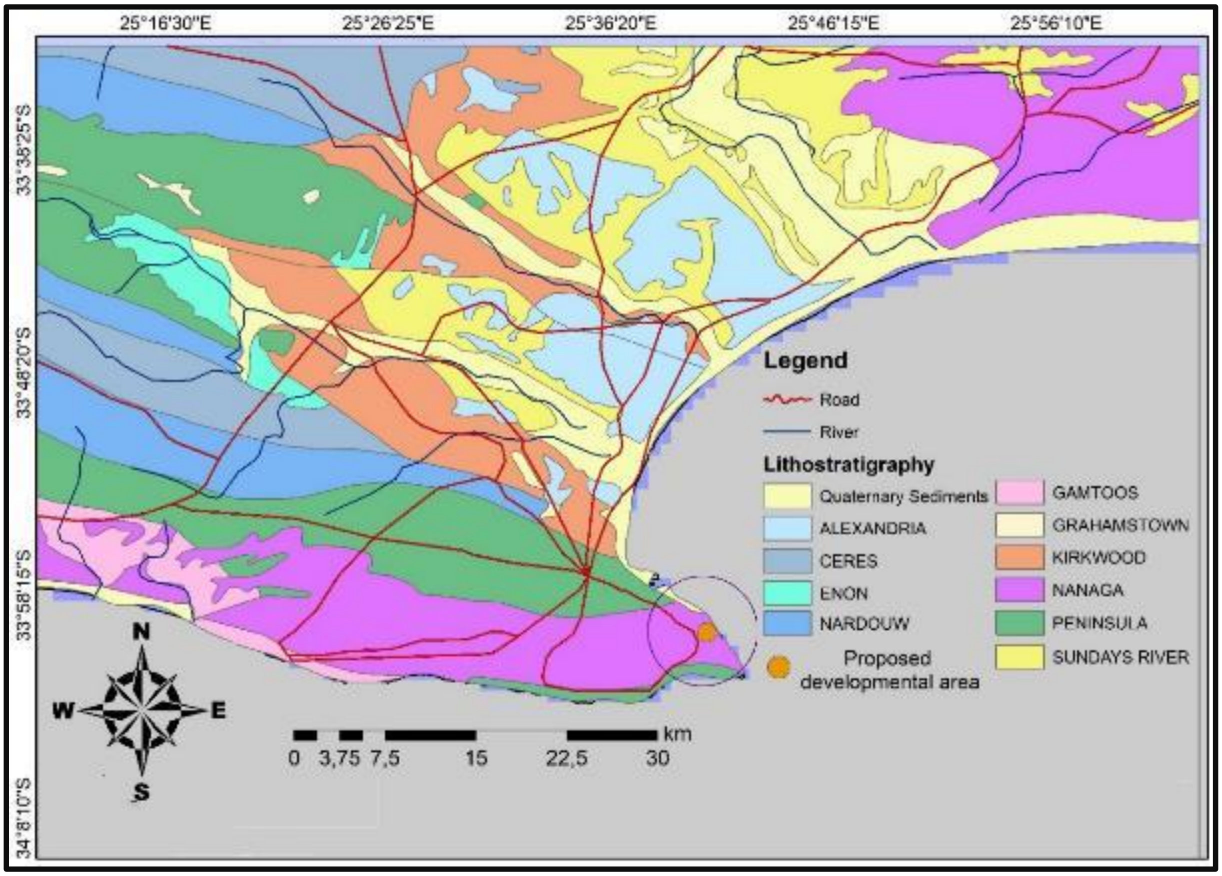


Figure 43: Geology of the project area

No large faulting is known to occur in the proximity of investigation area. An unconformity is found between the older Peninsula Formation rocks and the younger alluvial deposits. According to the 1:500 000 hydrogeological map (3324 PORT ELIZABETH) published by the Department of Water Affairs and Forestry, the investigation area has historically received a mean annual precipitation of 800 to 1000mm, with boreholes in the area potentially yielding 0.5 - 2.0 litres/second.

According to the 1:6 000 000 Seismic Hazard Map of Southern Africa, the site falls within a level five area on the Modified Mercalli Scale (MMS). Peak horizontal ground acceleration of 50-100cm/s2 has been recorded, with a 10% probability of this being exceeded at least once in a 50 year period (PRDW, 2019).

10.2.10 Marine and Benthic Environment

The bathymetry of the Port of Port Elizabeth is maintained fairly constant by maintenance dredging to ensure safe navigation conditions for vessels. The area near the Old Tug Jetty quay area is relatively shallow, being about -2.0 -3.0 m Chart Datum in the shallower parts to about -4-4.5 m Chart Datum in the deeper parts (***Figure 44***).

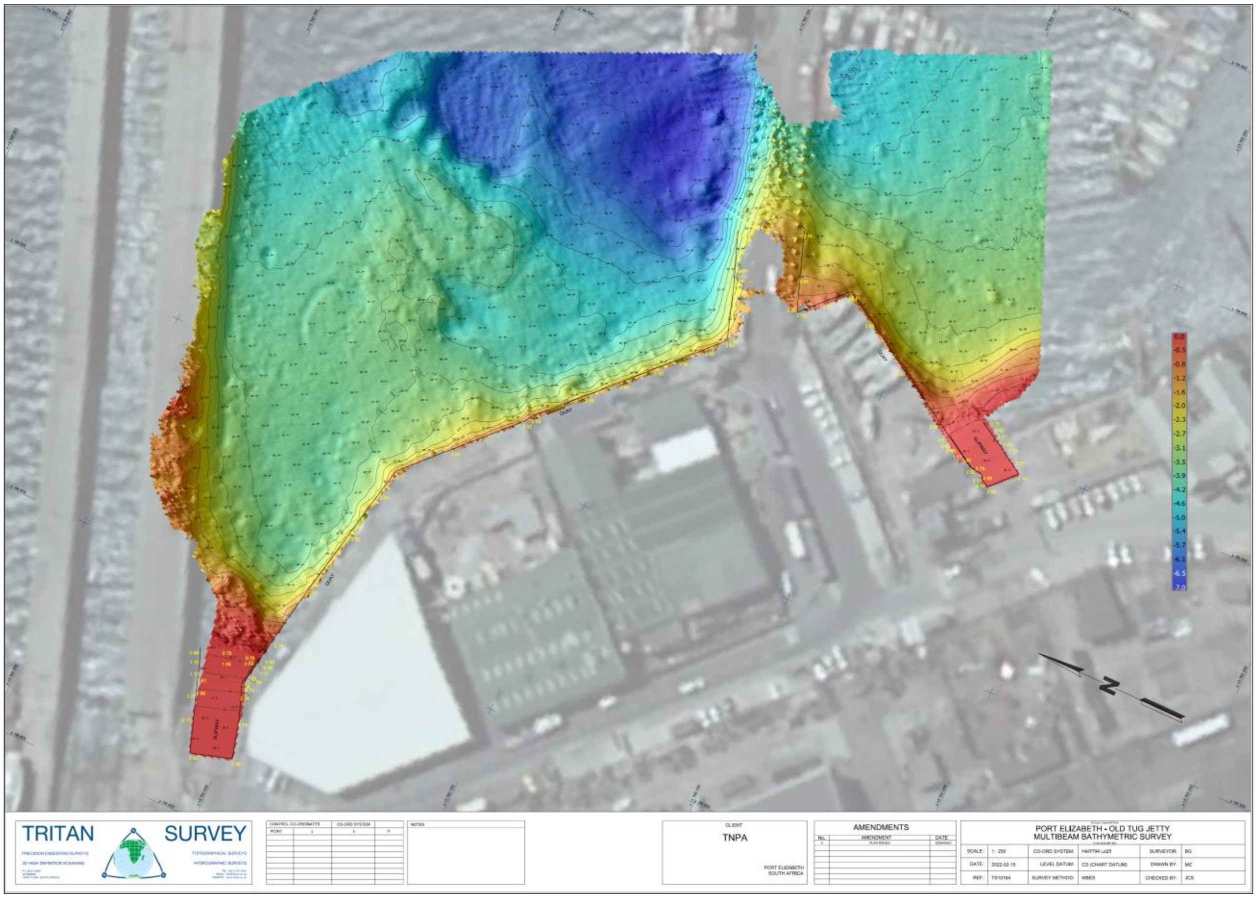


Figure 44: Bathymetric profile for the area near the Old Tug Jetty in the Port of Port Elizabeth.

The bottom across most of the Port of Port Elizabeth is 'soft' in type, that is, it is comprised of unconsolidated sediment. In some parts of the port, most notably near Berths 102 and 103, the substrate is a mix of sediment and sandstone-like gravel. The most spatially comprehensive recent analysis of the grain size of sediment was performed in August 2019 by the CSIR, when the sediment was sampled at 28 positions (hereafter called stations) in and near the port (***Figure 45***).

Figure 45: Aerial view of the Port of Port Elizabeth showing the positions where sediment was sampled in 2019.

The grain size of the sediment sampled is provided in ***Table 14***, while its texture based on the contribution of gravel, sand, and mud is illustrated in ***Figure 46***. The grain size of the sediment varied widely across the port. The mud fraction, for example, contributed between 1.30-85.31% of the bulk weight of the sediment, that is, the sediment ranged from sandy to muddy. The sediment at most stations was texturally classified as mud, sandy-mud, or muddy-sand. Mud was the dominant grain size class at 15 stations, fine-grained sand at nine stations, and medium grained sand at two stations. The sediment at none of the stations was strictly defined as mud (i.e. mud size sediment contributing >90% of bulk sediment weight). Gravel, very coarse-grained and coarse-grained sand were generally poorly represented.

Table 14: Grain size composition and total organic content of sediment sampled in the Port of Port Elizabeth in 2019. VCS = very coarse-grained sand, CS = coarse-grained sand, MS = medium-grained sand, FS = fine-grained sand, VFS = very fine-grained sand, Mean = mean grain size, TOC = total organic content.

Station	Gravel	VCS	CS	MS	FS	VFS	Mud	Mean	TOC
1	0.04	0.13	0.70	16.92	28.33	9.93	43.94	0.12	3.08
2	0.08	0.24	0.41	1.63	10.24	7.32	80.08	0.07	2.69
3	0.07	0.34	0.54	1.36	16.41	5.36	75.93	0.06	2.47
4	0.11	0.11	0.38	3.60	29.04	8.05	58.72	0.07	2.47
5	0.00	0.00	0.20	3.21	35.07	5.28	56.25	0.08	2.05
6	0.13	0.35	0.84	7.54	39.18	5.63	46.32	0.11	1.50
7	0.00	0.13	0.25	2.29	40.35	14.29	42.70	0.11	1.31
8	0.37	0.37	1.01	35.10	35.37	4.77	23.01	0.15	0.59
9	1.26	0.80	2.33	17.48	44.53	6.04	27.54	0.13	5.80
10	0.00	0.05	1.41	30.20	49.02	5.27	14.05	0.22	0.62
11	0.23	0.53	1.59	15.74	50.47	4.76	26.69	0.13	8.75

12	0.00	0.12	1.47	9.92	40.49	5.11	42.90	0.11	2.08
PE1	0.58	0.61	1.13	33.67	43.23	5.42	15.36	0.19	0.60
PE2	1.76	2.77	8.92	27.66	27.60	3.82	27.46	0.16	0.86
PE3	1.65	0.89	1.44	6.52	29.44	5.93	54.13	0.08	1.82
PE4	0.42	0.15	0.80	38.42	33.99	3.96	22.26	0.15	0.69
PE5	0.10	0.53	2.12	22.72	33.81	4.83	35.89	0.13	0.84
PE6	0.00	0.08	0.42	6.43	44.06	5.75	43.27	0.10	0.97
PE7	0.00	0.09	0.65	10.69	37.17	4.10	47.30	0.11	1.74
PE8	0.63	0.41	0.86	6.44	37.04	4.55	50.09	0.08	1.04
PE12	0.00	0.06	0.15	11.13	67.16	5.82	15.69	0.16	0.73
PE14	0.00	0.10	0.20	0.79	12.77	4.31	81.83	0.06	2.27
PE15	0.00	0.10	0.21	1.41	23.31	13.07	61.89	0.07	1.85
PE16	0.24	1.44	7.39	59.85	27.84	1.94	1.30	0.29	0.15
PE17	0.00	0.00	0.17	0.38	7.64	6.51	85.31	0.05	3.12
PE18	0.11	0.22	0.33	1.80	12.75	5.40	79.40	0.06	2.88
PEBG 1	0.00	0.16	0.74	30.96	61.31	4.72	2.11	0.21	0.20
PEBG 2	0.09	0.32	2.32	31.23	55.42	8.02	2.59	0.21	0.19

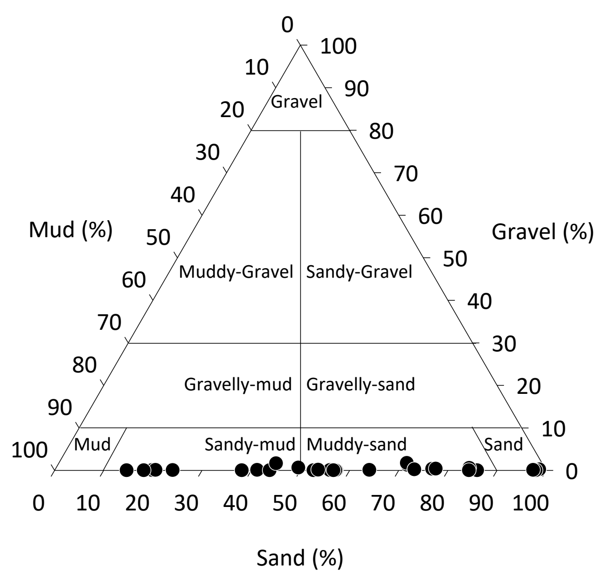


Figure 46: Ternary plot of the grain size composition of sediment sampled in the Port of Port Elizabeth in 2019.

In August 2022, sediment was sampled at the stations provided in **Error! Reference source not found.**and REF _Ref129655250 \h * MERGEFORMAT **Error! Reference source not found.** for this Environmental Impact Assessment and for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth. The grain size and total organic content of the sediment is provided in ***Table 15***.

Table 15: Grain size composition and total organic content of sediment sampled in the Old Tug Jetty area in the Port of Port Elizabeth in August 2022. VCS = very coarse-grained sand, CS = coarse-grained sand, MS = medium-grained sand, FS = fine-grained sand, VFS = very fine-grained sand, Mean = mean grain size, TOC = total organic content, NS = no sediment sampled due to the presence of stones and gravel.

Station	Gravel (%)	VCS (%)	CS (%)	MS (%)	FS (%)	VFS (%)	Mud (%)	TOC (%)
PE1	0.66	0.66	1.15	4.16	16.83	5.43	71.11	6.14
PE2	0.92	1.71	2.58	9.55	18.40	4.94	61.90	2.05

PE3	1.51	1.36	1.43	2.87	13.34	5.16	74.32	9.06
PE4	0.00	0.00	0.20	0.27	2.78	3.26	93.48	2.71
1	0.00	0.36	1.69	24.03	55.97	10.28	7.67	0.14
3	0.00	0.30	1.01	20.54	46.60	7.21	24.33	0.30
4	0.00	0.04	0.50	4.25	35.20	6.10	53.91	1.07
5	0.04	0.11	0.53	14.66	45.66	4.09	34.90	1.72
6	0.00	0.09	0.47	4.59	35.34	5.32	54.19	1.21
7	0.17	0.09	0.17	1.25	34.65	13.71	49.96	1.28
8	0.07	0.22	0.56	18.25	38.07	6.32	36.50	1.91
9	0.00	0.08	0.34	4.20	47.69	7.43	40.26	0.71
10	0.00	0.00	0.14	0.14	3.58	6.44	89.69	1.87
11	1.14	1.55	3.35	26.18	40.63	3.28	23.87	0.78
12	NS	NS	NS	NS	NS	NS	NS	NS
13	0.30	0.26	0.73	5.35	29.54	6.85	56.98	1.20
14	5.35	2.23	5.56	21.04	38.26	4.04	23.52	0.89
15	0.13	0.04	0.22	3.75	32.37	6.84	56.65	2.77
16	0.00	0.04	0.14	14.77	53.71	5.07	26.28	1.48

Photos of the sediment sampled at stations alongside and near the Old Tug Jetty quay area are provided in Figure 26. The sediment at each site was dominated by mud sized material. The sediment at Stations PE1 and PE3 was slightly anoxic, but this was not pronounced as evident in the colour of the sediment and the only feint aroma of hydrogen sulphide detected in the field. Previous surveys have, however, provided evidence for the sediment being anoxic at Station PE1.

Other surveys, including surveys for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth and for maintenance dredging permit applications, examined the grain size of sediment at fewer stations in the port compared to the surveys made in 2019 and 2022. The findings of these studies support the findings the surveys made in 2019 and 2022.

In summary, the mud is the dominant grain size class in sediment across a large part of the Port of Port Elizabeth. The Baakens River is probably an important source of fine-grained sediment to the port, but sediment undoubtedly also enters the port from other sources. The dominance of mud in the sediment across most of the port shows that current speeds in the port are low, allowing this fine-grained material to settle on the bottom.

10.2.11 Vegetation

No vegetation will be affected by the proposed rehabilitation of the Old Tug Jetty Sheet pile wall.

10.2.12 Critical Biodiversity Areas

The site falls within a Critical Biodiversity Area (CBA 2). According to the NMBMM Bioregional Plan, CBAs include All Critically Endangered habitats, ecological process areas, ecological corridors, habitats for Species of Special Concern, and some Endangered, Vulnerable or Least Threatened habitats. Such areas must be managed for biodiversity conservation purposes and incorporated into the protected area system. Site verification has revealed that the site area is significantly transformed and there is no terrestrial habitats on site, the aquatic environment provides habitat to some birds and marine animals however the sensitivity is low due to the current anthropogenic activities taking place in the marine environment.

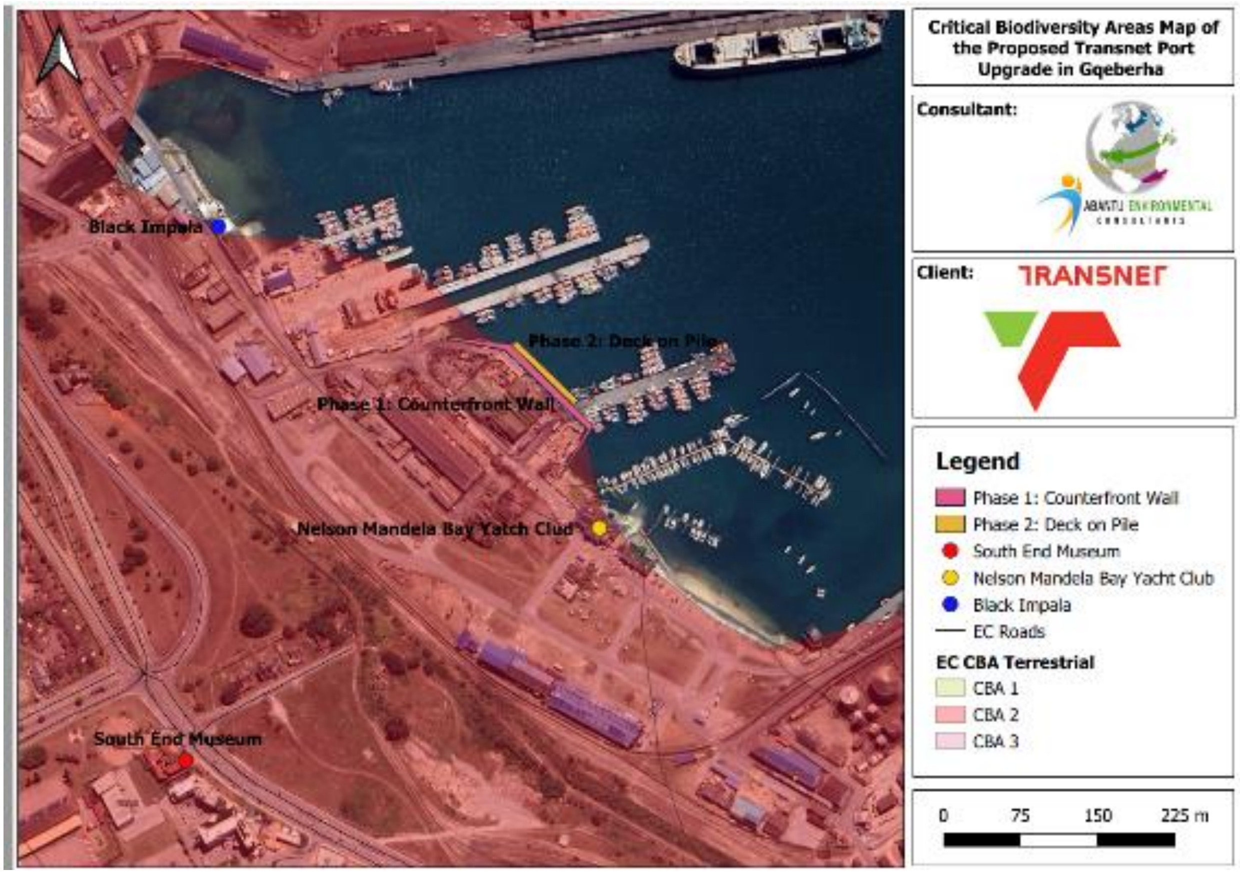


Figure 47: Critical Biodiversity Areas

10.2.13 Protected Areas

The existing network of conservation areas within the NMBM area totals approximately 10,500 ha, or approximately 5 % of the municipal area. Of this, 4,700 ha (2 % of the municipal area) is recognised as protected areas in terms of the National Environmental Management: Protected Areas Act 2003 (Act No. 57 of 2003). The remaining conservation areas (approximately 5,800 ha in extent) have weak legal protection and are not necessarily managed for biodiversity conservation purposes. The Protected Area system of the NMBM is supported by the proximity of mega reserves in the Kouga (Baviaans Wilderness Area) and Sundays River Valley (Greater Addo National Park) and the NMBM Moss plays a vital role in connectivity between the systems.

The current protected area system in the Municipal area is therefore highly deficient, particularly in terms of its limited size and connectivity, and urgently requires expansion in order to achieve biodiversity targets (SRK Consulting, 2010). Due to the extent of remaining natural habitat, the NMBM is unique amongst the Metropolitan Municipalities in terms of opportunities for expanding the protected area network to the benefit of biodiversity as well as its people. As illustrated in **Figure 48**, the site is located within 5km of a formal Protected Areas, Cape Recife Nature Reserve and the Nelson Mandela University Private Nature Reserve.

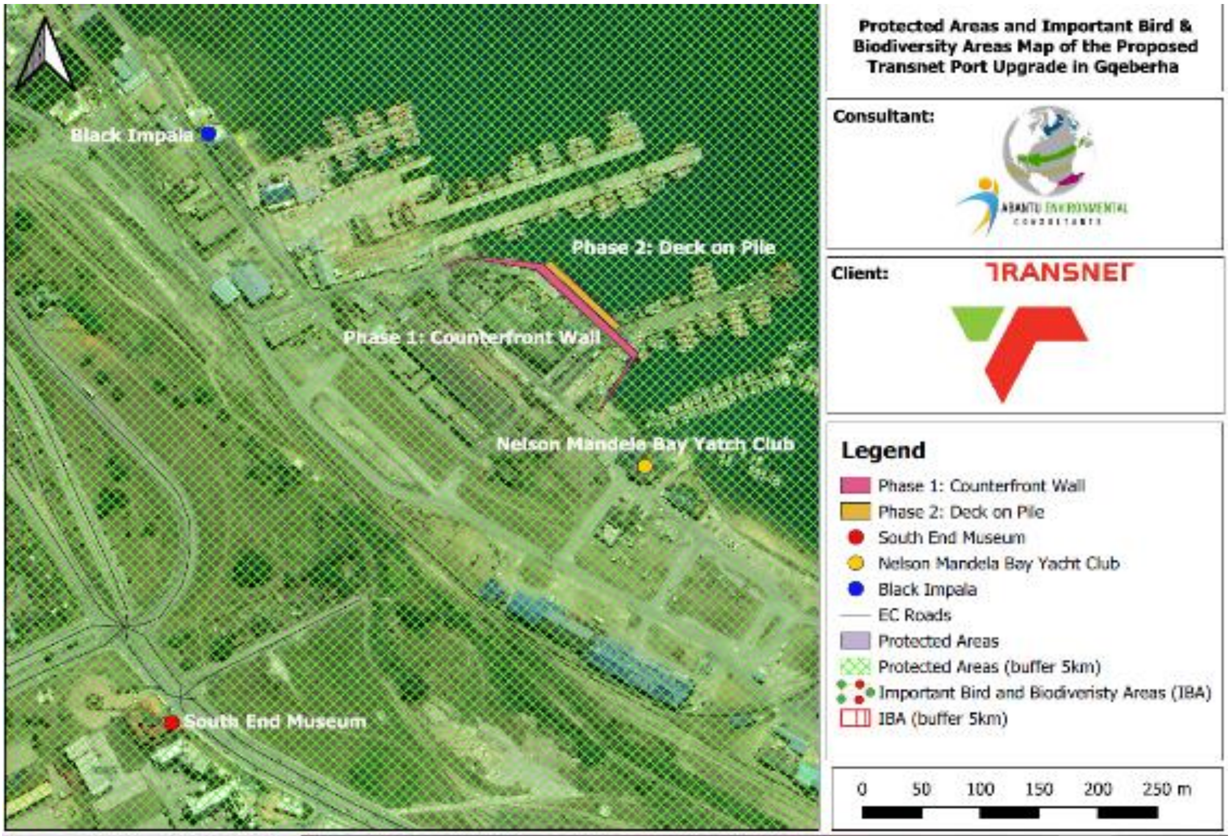


Figure 48: Protected Areas

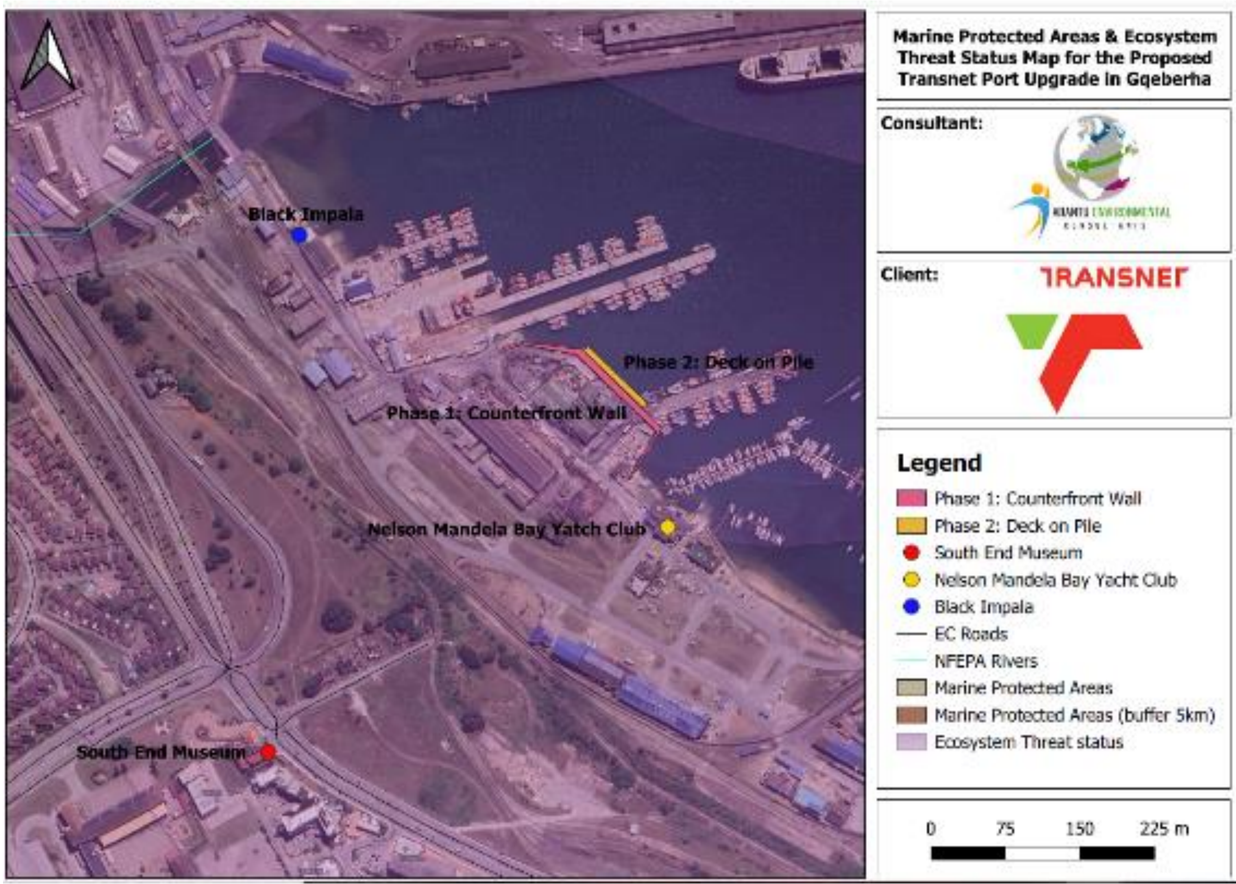


Figure 49: Marine Protected Area

10.2.14 Palaeontology

The map below is sourced from South African Heritage Resources Agency Information system (SAHRIS). According to the SAHRIS Palaeontological sensitivity map, the site is located in an area of very high sensitivity (***Figure 50***) and requires a field assessment and a protocol for finds.

Figure 50: Palaeontological sensitivity (Site infrastructure indicated in green) (www.sahris.sahra.org.za)

Legend:

Color	Sensitivity	Required Action
Red	Very High	Field assessment and protocol for finds is required
Orange/Yellow	High	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely
Green	Moderate	Desktop study is required
Blue	Low	No palaeontological studies are required however a protocol for finds is required
Grey	Insignificant/Zero	No palaeontological studies are required
White/ Clear	Unknown	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

10.2.15 Archaeology and Heritage Resources

According to the screening tool report generated from the National Web Based Environmental Screening Tool, the archaeological sensitivity of the site is very high because it is located within 2km of a Grade II Heritage Site.

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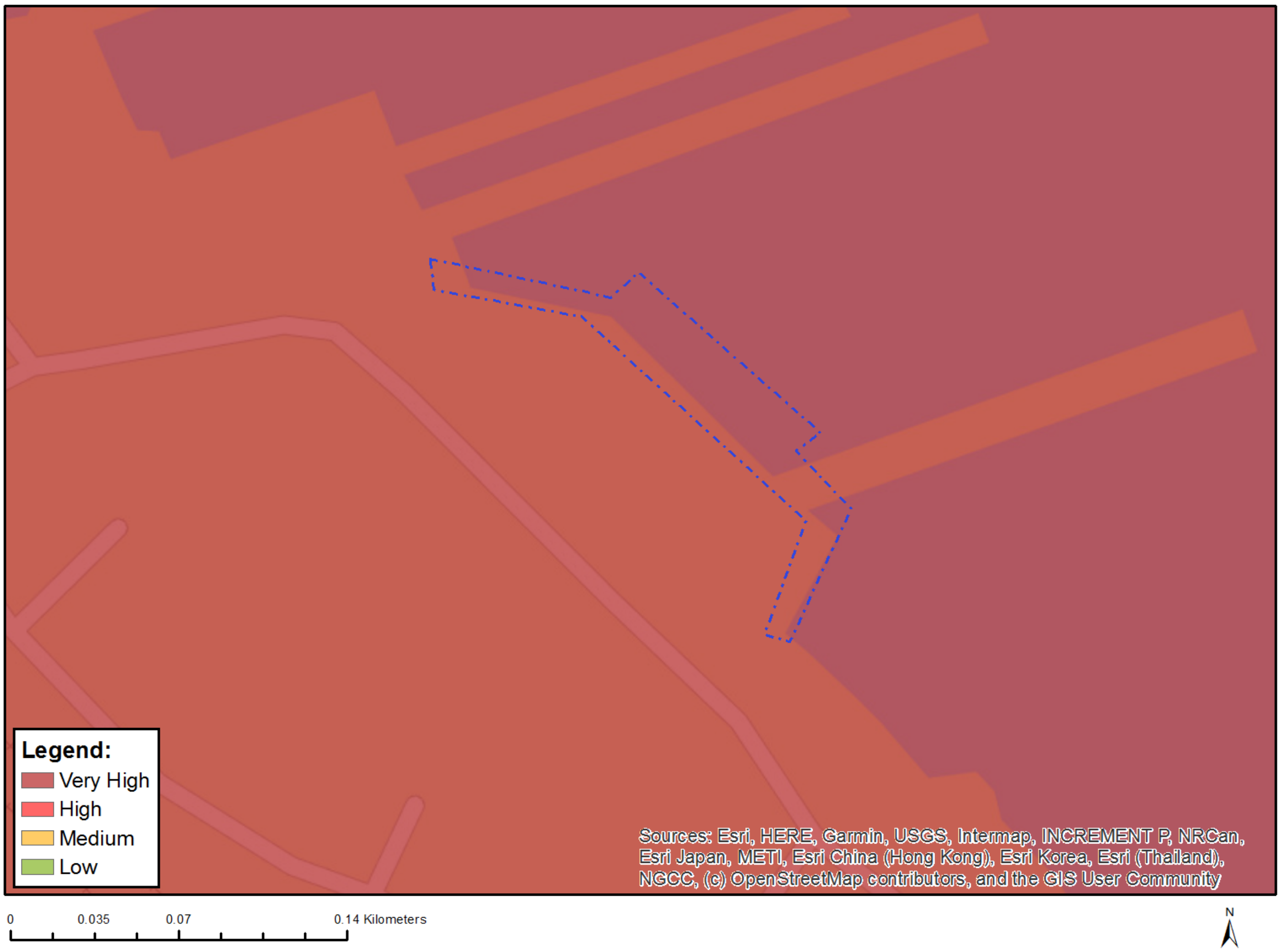

Figure 51: Archaeological Heritage

10.3 SOCIAL ENVIRONMENT

10.3.1 Demographic Profile

The proposed project is located in Port Elizabeth Harbour. Gqeberha (formerly known as Port Elizabeth) is located in Nelson Mandela Bay Municipality, in the Eastern Cape Province of South Africa and is one of eight Metropolitan Municipalities. In 2001, the Nelson Mandela Bay Metropolitan Municipality was formed as a single administrative area covering inter alia Gqeberha, Kariega (formerly Uitenhage), Despatch and a number of surrounding areas.

The City has a unique advantage in that it possesses two ports, namely Port Elizabeth Harbour and Ngqura. This creates a number of opportunities linked to the diversification of port activities, the maritime sector and the separation of ‘dirty’ and ‘clean’ port uses.

The NMBM Municipality has a size of 195 890,76 ha and covers the smallest area of land (1952 km²) in the Eastern Cape, which is the second largest province in South Africa (Almond et al., 2008). The current population of Nelson Mandela Bay is estimated at 1 263 051 (Community Survey, 2016), with a growth rate of 1.54% (IHS, 2017), which is lower than that of other metropolitan areas in South Africa, such as Ekurhuleni (2.1%) and Tshwane (2.6%). The Municipality has 368 518 households, with an average size of 3.6 persons per household (CS 2016). Female-headed households constitute 41.6% of the total number of households in the Municipality (Community Survey, 2016).

Altogether 640 000 people (representing about 49.6% of the total population) live in poverty in the Nelson Mandela Bay Metropolitan area (ECSECC, 2017). During the 2017/18 financial year, 100% of qualifying households earning less than R3 200 per month (two state pensions) had access to free basic services offered by the Municipality through its Assistance To The Poor Programme (ATTP).

10.3.2 Education Health

A comparison with other metros shows that 75,8% of learners aged 7 to 24 years in Nelson Mandela Bay attended an educational institution as compared to 80,2% in Buffalo City and 79,2% in Mangaung (79,2%). The lowest learner attendance was observed in Cape Town (69,8%) and eThekwini (71,1%). Persons 20 years and older with less than Grade 7 as highest level of education are 4,1%. Buffalo City is 11,4% and Cape Town is 6,1%. 0,8% of people 20 years and older in Nelson Mandela Bay have no schooling compared to a Metro average of 1,4% (STATS SA GHS, 2019).

10.3.3 Economic Profile

Whilst the NMBM is undoubtedly an important node of activity within the economy of the Eastern Cape, it is 150haracterized by several challenges in terms of economic development. These include:

- A high unemployment rate (36,6%), compounded by the low education levels of the labour force, including large numbers of illiterate adults with limited employment prospects.
- Ageing and inadequate investment in the maintenance and upgrading of infrastructure.

- The dependence on the automotive sector and insufficient diversification within the manufacturing and others sectors.
- A lack of up-to-date local economic statistics and monitoring and evaluation systems.

STATS SA states that: "according to ECSECC (Eastern Cape Socio Economic Consultative Council), the GDP growth rate for the Nelson Mandela Bay Municipality was 2.1% in 2010 and the GDP per capita R52147. The largest economic sectors in the Nelson Mandela Metro are manufacturing, finance, community services and transport. Community services, trade and manufacturing sectors are the sectors that create the most employment in the Metro".

Good quality infrastructure is key to sustainable social, economic and industrial development. Poor infrastructure hampers development, growth and ability to trade in the domestic and global economy.

Economic infrastructure, which includes transport, energy, telecommunications, water and sanitation provides services which are of fundamental importance for development. In NMBM it is deficient and this is exacerbated by inadequate maintenance and thus prematurely deteriorating installations and services.

Infrastructural services are often overlooked as a means to alleviate poverty and improve environmental conditions. In order for Nelson Mandela Bay to grow and develop a sustainable economy, it is important to build new economic drivers to replace or augment the ones that have served the region in the past.

According to STATS SA General Households Survey (2019), 21,6% of households in Nelson Mandela Bay listed grants as their main source of income.

In view of the site and nature of the proposed Rehabilitation of the Old Tug Jetty, the affected socio-economic environment firstly involves the Port of Port Elizabeth, particularly the physical extent of the relevant quay area (Figure 1) and associated economic activities. The site of the proposed development is particularly relevant in the context of its use and utility, i.e., as noted in Section 4, the berthing of fishing vessels and trawlers, as well as associated processing activities.

Commercial fishing along the South African coast takes place within and beyond the entire exclusive economic zone. This happens out of three major centres in South Africa, i.e. Richards Bay, Cape Town and Port Elizabeth. The fishing industry therefore makes extensive use of the Port of Port Elizabeth as the second most important centre in this industry outside Cape Town (DEFF, 2020).

The other context within which the proposed development is likely to play a role, concerns the economy of the NMB Metro. The Metro experienced its economic heyday about four-and-a-half decades ago, but it has been in steady decline ever since, a trend that has shown little change in the first two decades of the new millennium. The economic decline of the NMB Metro currently shows some signs of abating (NMBM, 2022b), but without much impact on unemployment which continues to manifest at record levels in a post-Covid time (ECSECC, 2018; StatsSA, n.d.).

10.3.4 Land Use and Visual

Between 2003 and 2007 the primary change in land use in the NMBM was caused by urban expansion (+14.1%) and a reduction in near-natural areas (-10.9%). The latter outcome has had negative repercussions for the biodiversity protection and maintenance of important ecological services in the municipal area. More than one third of the 58 vegetation types occurring on NMBM cannot sustain further loss from developmental activities. Between 1997 and 2007 the coastal zone within 1 km of the high-water mark lost 8.5% of land in near-natural condition through commercial and industrial development projects (NMBM SOER, 2011).

A large proportion (62 %) of Nelson Mandela Bay is in a natural state (SRK Consulting, 2010), making it the metropolitan municipality with the highest proportion of natural habitat in the country. The application area however, is transformed land which consists of existing Port infrastructure. The project site is located within 8 km of a major civil aviation aerodrome and near a Military Defense Site.

The sea which is adjacent to the land or property within which the application area falls presents the largest natural feature of the site. Thus, in line with normal Port activities, infrastructure that is visible on site include:

- Buildings
- Roads
- Old Tug Jetty Sheet Pile Wall
- Slipway
- Vessels for commercial fishing

11. ENVIRONMENTAL IMPACTS ASSESSMENT

11.1 IMPACT ASSESSMENT METHODOLOGY

This section provides the methodology for assessing the significance of impacts associated with the activity. The criterion for determining impact significance has been defined in accordance with the criteria drawn from Appendix 3 of the Environmental Impact Assessment Regulations, 2014. The levels of detail described in the EIA regulations were fine-tuned by assigning specific values to each impact identified. The impact ratings will be informed by the findings of specialist assessments conducted, fieldwork, and desk-top analysis. The significance of potential impacts that may result from the proposed development will be determined in order to assist the competent authority in making a decision.

In order to establish a coherent framework within which all impacts could be objectively assessed, it is necessary to establish a rating system, to be applied consistently to all the criteria. For such purposes each aspect is assigned a value ranging from one (1) to five (5) depending on its definition. The methodology to identify, determine and assess the potential impacts is set out below. It aims to minimise subjectivity as far as possible by using standard rating scales for the assessment and quantification of identified impacts.

The impact assessment methodology utilised for the project consists of two phases namely impact identification and impact significance rating. Impacts and risks have been identified based on a description of the activities to be undertaken. Once impacts have been identified, a numerical environmental significance rating process is undertaken that utilises the probability of an event occurring and the severity of the impact as factors to determine the significance of a particular environmental impact.

The severity of an impact is determined by taking the spatial extent, the duration and the magnitude of the impacts into consideration. The probability of an impact is then determined by the frequency at which the activity takes place or is likely to take place and by how often the type of impact in question has taken place in similar circumstances. The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability

where

Consequence= Nature (Magnitude + Spatial Scale + Duration)

and

Probability = Likelihood of an impact occurring

The nature of an impact is either negative or positive (+1 or -1) based on whether it is likely to result in a beneficial or detrimental impact. Table 6-1 provides a summary of the criteria and the rating scales, which will be used in the assessment the impacts.

Table 6-1: Impact rating method

Nature: classification of whether the impact is positive or negative, direct or indirect.
Scale: spatial scale of impact and classified as: • Site: the impacted area is the whole or significant portion of the site; • Local: Within a radius of 2 km of the construction site; • Regional: the impacted area extends to the immediate, surrounding and neighbouring properties; and • National: the impact can be considered to be of national significance.
Duration: Indicates what the lifetime of the impact will be and is classified as: • Short term: The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase; • Medium term: The impact will last for the period of the construction phase, where after it will be entirely negated;

• Long term: The impact will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory; and • Permanent: Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.
Magnitude: Describes whether an impact is destructive or benign. • Low: Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected; • Moderate: Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way; • High: Natural, cultural and social functions and processes are altered to extent that they temporarily cease; and • Very High: Natural, cultural and social functions and processes are altered to extent that they permanently cease.
Probability: Describes the likelihood of an impact actually occurring: • Improbable: Likelihood of the impact materialising is very low; • Possible: The impact may occur; • Highly Probable: Most likely that the impact will occur; and • Definite: Impact will certainly occur.
Significance: Based on the above criteria the significance of issues was determined. The total number of points scored for each impact indicates the level of significance of the impact, and is rated as: • Low: the impacts are less important. • Medium: the impacts are important and require attention; mitigation is required to reduce the negative impacts. • High: the impacts are of great importance. Mitigation is therefore crucial.
Mitigation: Where negative impacts are identified, mitigation measures (ways of reducing impacts) are required. An indication of the degree of success of the potential mitigation measures is given per impact.

11.1.1 Criteria for rating impacts

Table 16 describes the criteria to be used and the significance rating of the impacts.

Table 16: Impact rating criteria

DURATION (D)	MAGNITUDE (M)
5 - Permanent 4 - Long term (ceases with operational life) 3 - Medium term (5-15 years) 2 - Short term (0-5 years) 1 – Immediate	5 - Very high/do not know 4 - High 3 - Moderate 2 - Low 1 - Minor
SCALE (S)	**PROBABILITY (P)**
5 - International 4 - National 3 - Regional 2 - Local 1 - Site 0 – None	5 - Definite/do not know 4 - Highly probable 3 - Medium probability 2 - low probability 1- Unlikely/I,prabable 0 - None
SIGNIFICANCE POINTS (SP) = N(D+M+S) X P	
HIGH (H) = >60 POINTS	
MEDIUM / MODERATE (M) = 30-60 POINTS	
LOW (L) = <30 POINTS	
Very Low = <10 POINTS	
NO SIGNIFICANCE = 0	
POSITIVE IMPACT	

The maximum value of significance points is 100. Environmental effects could therefore be rated as either high (H), moderate (M), or low (L) significance, as seen above.

Practicable mitigation measures will be recommended, and impacts will be rated in the prescribed way both with and without the assumed effective implementation of mitigation measures.

11.1.2 IMPACT PRIORITIZATION

Further to the assessment criteria presented above, it is necessary to assess each potentially significant impact in terms of:

- Reversibility;
- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

REVERSIBILITY (R)	CUMULATIVE IMPACTS (CI)
3 - High 2 - Medium 1 – Low	3 - High 2 - Medium 1 – Low
LOSS OF RESOURCES (LR)	
3 - High 2 - Medium 1 – Low	

In an effort to ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact significance score (post-mitigation). The aim of the prioritisation factor is not to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the significance score based on the assumption that relevant suggested management/mitigation impacts are implemented. PF=(R+CI+LR)/3

The degree of confidence in predictions based on available information, the EAP's judgment and/or specialist knowledge.

Table 17: Description Significance Ratings

SIGNIFICANCE RATING	DESCRIPTION
Very Low (Negligible)	The impacts on this issue are acceptable and mitigation, whilst desirable, is not essential. The impacts on the issue by themselves are insufficient, even in combination with other low impacts, to prevent the development being approved. Impacts on this particular issue will result in either positive or negative medium to short term effects on the social and/or natural environment.
Low (Minor)	The impacts on this issue are important and require mitigation. The impacts on this issue are, by themselves, insufficient to prevent the implementation of the project, but could in conjunction with other issues with moderate impacts, cause restrictive approval of the proposed project. Impacts on this issue will usually result in either a positive or negative medium to long-term effect on the social and/or natural environment.
Medium (Moderate)	The impacts on this issue are important and require mitigation. The impacts on this issue are, by themselves, insufficient to prevent the implementation of the project, but could in conjunction with other issues with moderate impacts, prevent its implementation. Impacts on this particular issue will usually result in either a positive or negative medium to long-term effect on the social and/or natural environment.
High (Major)	The impacts on this issue are serious, and if not mitigated, they may prevent the implementation of the project (if it is a negative impact). Impacts on this particular issue would be considered by society as constituting a major and usually a long-term change to the (natural and/or social) environment, and will result in severe effects or if positive, substantial beneficial effects.

11.2 IMPACT IDENTIFICATION

The impact assessment methodology utilised for the project consists of two phases namely impact identification and impact significance rating. Impacts and risks have been identified based on a description of the activities to be undertaken and consideration of each phase of the development. The identified impacts are applicable to Alternative 1 and 2. The no-go alternative (Alternative 3) maintains the status quo and is considered as the baseline for current impacts.

It is expected that proposed rehabilitation of the Old Tug Jetty sheet pile wall will have environmental and social impacts during the planning, construction, rehabilitation and operational phases. There is no intended decommissioning phase for the project as the rehabilitated quay will be designed for a 50-year service life subject to regular and effective maintenance (PRDW, 2017). It is impossible to anticipate what the port and its surroundings may resemble at that time, making it difficult to assess the significance of decommissioning impacts. The following list of impacts have been identified through EIA process:

Table 18: Impact Identification

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	**Phase**	**Nature**	**Magnitude**	**Spatial Extent**	**Duration**	**Probability**	**Reversibility**	**Loss of Resources**	**Avoidance, management or mitigation**	**Significance**	**Confidence Level**
1.Impacts due to the ingress of non-hazardous solid waste into the port	Construction	-ve	5	5	5	4	low	low	medium	high	high
2.Environmental deterioration due to spillages from portable toilets	Construction	-ve	3	1	2	2	medium	low	medium	very low	high
3.Impacts to soil, sediment, and geology	Construction	-ve	1	1	5	1	low	low	high	very low	high
4.Deterioration in water and sediment quality due to hazardous material spills and leaks	Construction	-ve	4	2	4	4	medium	low	high	high	high
5.Ecological impacts due to the spillage of construction material and	Construction	-ve	1	1	1	4	high	low	medium	low	high

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	Phase	Nature	Magnitude	Spatial Extent	Duration	Probability	Reversibility	Loss of Resources	Avoidance, management or mitigation	Significance	Confidence Level
demolition debris into the port											
6.Deterioration in water quality due to increased suspended sediment concentrations and turbidity caused of construction activities	Construction	-ve	1	1	1	2	medium	low	high	very low	high
7.Ecological impacts due to the deposition of sediment mobilised and introduced into the water column by construction activities	Construction	-ve	2	1	1	2	medium	low	high	very low	high
8.Deterioration in water quality due to the release of oxygen depleting	Construction	-ve	1	1	1	1	high	low	high	very low	high

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	**Phase**	**Nature**	**Magnitude**	**Spatial Extent**	**Duration**	**Probability**	**Reversibility**	**Loss of Resources**	**Avoidance, management or mitigation**	**Significance**	**Confidence Level**
substances from sediment by construction activities											
9.Deterioration in water quality due to the release of nutrients from sediment by construction activities	Construction	-ve	1	1	1	1	medium	low	high	very low	high
10.Deterioration in water and sediment quality due to the mobilisation of toxic chemicals from sediment by construction activities	Construction	-ve	2	1	1	2	medium	low	high	very low	high
11.Deterioration in water quality due to dredging related increases in	Construction	-ve	3	2	1	5	medium	low	high	medium	high

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	Phase	Nature	Magnitude	Spatial Extent	Duration	Probability	Reversibility	Loss of Resources	Avoidance, management or mitigation	Significance	Confidence Level
suspended sediment concentrations and turbidity											
12.Ecological impacts due to the deposition of sediment outside the dredging footprint	Construction	-ve	2	1	2	2	medium	low	medium	low	high
13.Deterioration in water quality due to the release of oxygen depleting substances from sediment by dredging	Construction	-ve	2	1	2	2	medium	low	medium	low	high
14.Deterioration in water quality due to the release of nutrients from sediment by dredging	Construction	-ve	1	1	2	2	high	low	high	Very low	high

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	**Phase**	**Nature**	**Magnitude**	**Spatial Extent**	**Duration**	**Probability**	**Reversibility**	**Loss of Resources**	**Avoidance, management or mitigation**	**Significance**	**Confidence Level**
15.Deterioration in water quality due to the release of toxic chemicals from sediment by dredging	Construction	-ve	2	1	2	4	medium	low	high	low	high
16.Ecological impacts due to the removal, injury, and disturbance of biological communities in dredging footprints	Construction	-ve	2	1	3	5	medium	low	high	medium	high
17.Deterioration in water quality due to an increase in suspended sediment concentrations during dredged sediment disposal	Construction	-ve	1	1	1	5	medium	low	medium	Very low	high
18.Deterioration in water quality due to	Construction	-ve	1	1	1	4	high	low	medium	Very low	high

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	**Phase**	**Nature**	**Magnitude**	**Spatial Extent**	**Duration**	**Probability**	**Reversibility**	**Loss of Resources**	**Avoidance, management or mitigation**	**Significance**	**Confidence Level**
the release of oxygen depleting substances from sediment during disposal											
19.Deterioration in water quality due to the release of nutrients from sediment during disposal	Construction	-ve	1	1	1	1	high	low	high	Very low	high
20.Ecological impacts due to the transfer of toxic chemicals in dredged sediment to the dredged spoil disposal site	Construction	-ve	2	1	2	3	medium	low	medium	low	high
21.Ecological impacts due to physical effects of sediment disposal at	Construction	-ve	2	1	2	5	medium	low	high	low	high

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	**Phase**	**Nature**	**Magnitude**	**Spatial Extent**	**Duration**	**Probability**	**Reversibility**	**Loss of Resources**	**Avoidance, management or mitigation**	**Significance**	**Confidence Level**
the dredged spoil disposal site											
22.Impacts associated with the disposal of sediment leading to an elevated seabed at the dredged spoil disposal site	Construction	-ve	2	2	3	2	high	low	medium	low	high
23. Ecological impacts due to the temporary loss of sheet pile wall biological communities	Construction	-ve	2	2	3	2	high	low	medium	low	high
24. Ecological impacts due to underwater noise	Construction	-ve	4	3	2	4	medium	low	medium	medium	high
25. Ecological impacts due to above water noise disturbance	Construction	-ve	2	1	2	4	medium	low	medium	low	high

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	**Phase**	**Nature**	**Magnitude**	**Spatial Extent**	**Duration**	**Probability**	**Reversibility**	**Loss of Resources**	**Avoidance, management or mitigation**	**Significance**	**Confidence Level**
26. Impact of altered quay wall geometry on hydrodynamics	Operation	-ve	1	1	5	1	low	low	low	Very low	high
27. Ecological impact due to permanent habitat loss	Operation	-ve	3	2	5	2	low	medium	low	low	high
28. Ecological impact due to habitat modification by the deck-on-pile structure	Operation	-ve	2	2	5	2	low	medium	low	low	high
29.The damage and disruption of paleontological resources as preserved in its host rocks within the development footprints.	Construction	-ve	3	2	4	3	low	medium	low	low	high
30.Employment creation	Construction	+ve	4	2	2	5	medium	low	high	medium	high

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	Phase	Nature	Magnitude	Spatial Extent	Duration	Probability	Reversibility	Loss of Resources	Avoidance, management or mitigation	Significance	Confidence Level
31.Skills development and transfer	Construction	+ve	4	2	2	5	medium	low	high	medium	high
32.Scheduling of Construction	Planning	-ve	1	2	3	4	high	low	high	low	high
33.Employment creation	Planning	+ve	1	2	2	3	high	low	high	low	high
34.Policy and Legislative Context	Planning	-ve	5	2	3	3	medium	low	high	low	high
35.Air Quality	Construction	-ve	2	2	2	3	medium	low	high	low	high
36.Disturbance of existing land uses and visual impact	Construction	-ve	2	2	2	4	high	low	medium	low	high
37.Climate Change	Operation	-ve	3	2	5	3	medium	low	medium	medium	medium
38.Safety-Injuries and fatalities during construction	Construction	-ve	5	3	2	3	medium	low	medium	medium	
39.Improved Jetty stability and safety	Operation	+ve	4	3	5	5	medium	low	medium	medium	medium
40.Economic stimulation of NMBM	Operation	+ve	2	2	3	3	medium	low	medium	low	medium

11.3 THE POSITIVE AND NEGATIVE IMPACTS THAT THE PROPOSED ACTIVITY AND ALTERNATIVES WILL HAVE ON THE ENVIRONMENT AND THE COMMUNITY THAT MAY BE AFFECTED

A description of the positive and negative impacts of the proposed activity are described below. These impacts are applicable to both alternatives considered, however the significance of the impact may vary per alternative.

11.3.1 Impacts due to the ingress of non-hazardous solid waste into the port

Construction for the proposed project will generate non-hazardous solid waste that, if not properly managed, will enter the aquatic environment in the Port of Port Elizabeth and pose an environmental risk. Plastic and other solid waste that washes up on estuary and marine shorelines and floats in water is also unsightly and affects tourism and recreation. Especially problematic from an environmental perspective is the ingress of non-biodegradable waste into aquatic ecosystems, such as plastic bottles, plastic bags, plastic food wrappers, polystyrene food containers, plastic strapping tape, and synthetic rope and cord. Plastic and small items of solid waste are often light enough to be blown by wind or washed by surface (rain) runoff into aquatic ecosystems. Plastic and other low-density solid waste does not immediately sink to the bottom and can be transported over extremely large distances by ocean currents. The spatial extent of the impacts caused by solid waste are thus potentially international. Floating plastic waste, including small plastic particles, can be mistaken for food and be ingested by marine mammals, seabirds, sea turtles, fish, and invertebrates. The ingestion of solid waste can have a variety of adverse effects on fauna, including but not limited to ulceration or laceration in the digestive tract leading to infection or internal bleeding, blockage of the digestive tract resulting in reduced nutrient uptake, and retention of ingested waste and reduction of the urge to feed (NOAA Marine Debris Program, 2014a; 2016). Marine fauna can also become entangled in solid waste, which can reduce the swimming and feeding abilities of the fauna and may result in injury or mortality (NOAA Marine Debris Program, 2014b). Solid waste also provides a site for the attachment of encrusting (fouling) fauna (e.g. barnacles) that can potentially be transported in this way to and colonise areas well outside their natural range, where they may become invasive (Lewis et al., 2005; Allsopp et al., 2006; Gregory, 2009; NOAA Marine Debris Program, 2017). Plastic also leaches constituent chemicals as it breaks down, such as plasticisers, which can present a toxic risk to fauna and flora (Thompson et al., 2009). Plastic waste that sinks to the bottom can smother benthic habitat, causing the death of or displacing invertebrate fauna and flora.

Responsible construction companies generally implement measures to limit the release of solid waste from their construction sites into the surrounding environment. It is nevertheless probable that non-hazardous solid waste will enter the Port of Port Elizabeth without effective waste management at the proposed construction site. The amount would probably be quite small, but the implications (intensity) of non-hazardous waste in the marine environment is potentially high because it can pose a risk to threatened, vulnerable and endangered species. The potential for non-hazardous solid waste to enter the port will persist for the duration of construction (i.e. medium term), but many forms of non-hazardous solid waste (such as plastic items) are essentially non-biodegradable (or at least take a very long time to degrade) and may be transported over very large distances by ocean currents. The extent of this impact is thus potentially international and the duration permanent (or at least long-term). This impact is thus largely irreversible. The significance rating for this impact without mitigation is thus HIGH.

11.3.2 Environmental deterioration due to spillages from portable toilets

Sanitation facilities will obviously be required for use by construction personnel. It is assumed the contractor will provide portable sanitation facilities, but if reasonable access to existing facilities in the area is possible this would be preferred. If portable sanitation facilities are provided onsite there is the possibility these might leak or overflow and faecal material and chemicals used in the toilets might find their way into the estuary, either directly or via surface (stormwater) runoff. The chemicals used in these toilets are toxic to aquatic biological communities.

It is possible waste from portable toilets could reach the port with no mitigation. The possibility will persist for the duration of construction, but a spill or leak from a toilet at any time would have a temporary impact as the toxic chemicals and other waste would be diluted and dispersed quite rapidly and adverse impacts would thus be limited to a small area. The spatial extent is thus site-specific and the intensity low. This impact is fully reversible as any waste that might reach the estuary would degrade over time. The significance rating for this impact without mitigation is thus VERY LOW.

11.3.3 Impacts to soil, sediment, and geology

The Port of Port Elizabeth is underlain by Quaternary alluvial sand, gravel, cobbles, and boulders. This material is underlain, at depth, by the Peninsula Formation of the Table Mountain Group. According to Le Roux (2000), the Ordovician-aged Peninsula Formation consists of light grey, medium- to course-grained quartzite with minor lenticular shale layers. The quartzite is typically well bedded. Deposition of the Peninsula Formation is believed to have occurred on a shallow marine shelf. No large faulting is known to occur in the area.

The sub-surface geology in the construction footprint is unknown, but geotechnical surveys for the recently completed leading jetties rehabilitation project near the Old Tug Jetty quay area provides an understanding of the possible geology in the construction footprint. Jeffares and Green (2015) drilled six boreholes to depths of -23.00 to -35.30 m relative to mean sea level in the leading jetties area. Alluvium/fill dominated all boreholes and was mainly comprised of sub-angular to rounded gravel, cobbles, and minor boulders of quartzitic sandstone and gravelly sand. Alluvial, silty clay was encountered in part of one borehole. None of the boreholes terminated in rock, which can be attributed to the Port of Port Elizabeth being underlain by an alluvial/fill deposit of considerable thickness.

The proposed project will lead to the permanent loss or disturbance of sediment and rock in the construction footprints. The disturbance and loss will occur through piling and projection of the new quay area ±6 m further into the port than the current sheet pile wall. Other geological resources may be disturbed and removed from site during the rehabilitation of the sheet pile wall or for piling for the deck-on-pile structure. Geological material will be brought onsite for the Old Tug Jetty sheet pile wall rehabilitation and deck-on-pile structure construction and will alter the existing soil and sediment composition. Sediment will be removed by dredging.

The surface sediment on the port bottom in the construction footprints is not of a high ecological value because on its rarity as similar material is present elsewhere in the port, and it has no apparent commercial value. The area of geological material that will be lost is small in the context of similar material in the wider port area. The proposed dredging will not substantially or adversely modify unique geological or physical features within the port, not will the disposal of dredged sediment nor at the dredged spoil disposal site in Algoa Bay. The proposed construction works are unlikely to lead to geological instability in the area, nor to seismic activity, based on similar works during the rehabilitation of the leading jetties to the north of the proposed project site not causing such effects. It must, however, be reiterated that nothing is known about the sub-surface geology in the construction footprint and this impact might need to be re-assessed when the findings of geotechnical surveys are available.

Geological material in the construction footprints will thus be impacted by dredging and construction. However, the intensity will be minor as little material will be disturbed or lost and the material has no commercial value. The impact will be site-specific. Although the impact to some geological resources will be permanent as they will be covered the significance rating for this impact without mitigation is VERY LOW.

11.3.4 Deterioration in water and sediment quality due to hazardous material spills and leaks

The proposed rehabilitation of the Old Tug Jetty quay area in Phase 1 and the construction of a deck-on-pile extension of the quay area in Phase 2 will require the operation and use of construction machinery, equipment, and vehicles, and the delivery of construction materials to the site by vehicle (road). Some of the construction machinery and equipment will be operated in and over water in the Port of Port Elizabeth. There is a risk the machinery, equipment, and vehicles may leak oil, hydraulic fluids, and fuel amongst other potential hazardous materials, for the accidental spillage of these same materials during the refuelling or emergency repairs to machinery, equipment, and vehicles, and for a spill through a loss of onsite containment. The hazardous materials could enter the estuary directly if there is a leak on machinery and equipment that is operated in or over water or near the water's edge, or indirectly if hazardous materials are spilled or leaked onto hard surfaces such as the quay apron and then drain directly into the estuary or are washed from hard surfaces by surface (rainfall) runoff. Leaks and spills of hazardous materials could also occur during the operation of dredgers and construction support vessels. If there is a fire onsite and the fire is doused using firefighting equipment the resultant waste will represent hazardous material that could enter the port if not properly contained and cleaned up.

Hazardous materials are so denoted because they are toxic to aquatic biological communities and thus pose an environmental risk if they enter aquatic ecosystems (in addition to presenting human health risks). The magnitude of impacts arising from hazardous material spills and leaks will depend on the nature and amount of the material released. These impacts can be acute if a 'large' amount of a hazardous material, or a particularly hazardous material enters a waterbody, resulting in the mortality of organisms and in so doing disrupting ecological processes (Hutchinson et al., 2013; Wenger et al., 2017). Alternately, or in addition, the impact may be chronic, wherein a hazardous material affects the physiology of organisms over an extended period while accumulating in their tissue, in this way allowing contaminants to also pass through the wider ecosystem (Oleksiak, 2008; Hamilton et al., 2017). The larval and juvenile stages of aquatic fauna and reproductive propagules of aquatic flora are especially sensitive to contaminants and usually require a lower dosage for adverse effects to occur than adults (Costa et al., 2011; Limburg and Waldman, 2009; Wenger et al., 2017). Contamination can also affect primary production by aquatic flora, the availability of oxygen since the breakdown of chemicals is usually an oxygen demanding process, and the health of microbial communities (Lee and Lin, 2013).

It is thus probable hazardous materials will be spilled or leaked at the construction site for the proposed project since hydraulic lines on machinery fails from time to time and multiple refuelling events or other maintenance of vehicles and equipment, for example, increases the probability of human error. However, these are in the main likely to be small volume leaks and spills that can be adequately contained and cleaned up if they occur on land and are unlikely to have a major impact on water and sediment quality and associated biological communities in the Port of Port Elizabeth. Oil and fuel leaks during the normal operation dredging and construction support vessels are also probable, but these too are likely to release a small volume of hazardous materials into the port. Here, however, it will be impossible, or at least very difficult to retrieve and clean-up the leaked material, although these spills are also unlikely to have a major impact on water and sediment quality and associated biological communities in the port. A major spill of hazardous material is possible and would have a more significant and widespread impact on water and sediment quality in the port and potentially beyond without adequate management, and hence to affect biological communities at a local scale with a high intensity. The impact on the water column will occur over the short-term as the spilled or leaked hazardous material will dissipate due to dispersion, dilution, and degradation. However, if the hazardous material accumulates in sediment the effect may be longer lasting (years) since various biogeochemical processes can delay the degradation of hazardous chemical compounds in sediment, with the result the duration could be long-term. Indeed, it is because of these differences in degradation that certain contaminants may be found in sediment but not in the overlying water. The impact is fully reversible as the hazardous materials will degrade with time, even if this may occur for a considerable period. The significance rating for this impact without mitigation is thus HIGH.

11.3.5 Ecological impacts due to the spillage of construction material and demolition debris into the port

There is the potential for various types of solid construction material and debris to be spilled into the port during construction of the counterfort wall in Phase 1 and deck-on-pile structure in Phase 2. This could include concrete debris generated during the removal of quay furniture and the breaking of the quay apron, and solid granular material used for backfilling the area between the new counterfort wall and existing sheet pile wall. Pre-cast concrete beams will be used for the various parts of the quay rehabilitation and construction of the deck-on-pile structure. However, liquid concrete will be poured over the top to bind the concrete elements together before grouting. Debris will also be removed from the tubular piles for concrete to be poured into the pile casings. There is thus the potential for wet cement and grout to be spilled into the port.

The spilled solid material will alter the physical properties of the benthic habitat, changing it from a sediment dominated one to a mixed sediment and gravel/stone type habitat. The change may impact on fauna that preferentially live in and on sediment, to the extent they may be excluded. For example, if the benthic habitat is transformed from a sediment to a gravel type habitat, burrowing animals will not be able to burrow through the material. Stones, gravel, and other hard objects spilled into the port could also crush or injure delicate benthic invertebrate epifauna when they impact the bottom. Small stones, gravel, and other solid objects will also be buffeted along the bottom by vessel propeller wash and in this way may physically damage invertebrate epifauna, although this is more likely to occur only after construction ceases since no vessels will be allowed to use Old Tug Jetty quay area during the construction period. Small stones, gravel, and other solid objects that can be buffeted in this way will probably be gradually removed over time by maintenance dredging.

Fresh concrete, cement, and grout are highly alkaline and corrosive. The excessive spillage of cementitious material and grout into the port could adversely affect biological communities by impairing water quality, most notably by altering (increasing) the pH well above that of the baseline (Fitch, 2003). The cement will harden over time and will alter the physical properties of sediment in the same way as spilled stones and solid construction debris.

Construction activities will thus probably introduce construction material, demolition waste, and cementitious material into the port without mitigation. The material will affect the immediate area of construction activities and is thus site specific. It is unlikely the spilled material will be retrieved and the impact is thus irreversible, noting that some of the material will be removed by future maintenance dredging depending on its size. In Phase 1, benthic biological communities will be significantly impacted by dredging, counterfort wall unit placement, and scour protection rock placement in the area immediately alongside the Old Tug Jetty sheet pile wall where such losses of material would occur. Similarly for Phase 2, benthic biological communities will already have been significantly impacted by dredging and scour protection rock placement in the area immediately alongside the deck-on-pile structure where such losses of material would occur. This impact will thus be temporary in duration and of a minor intensity, resulting in a VERY LOW significance rating without mitigation.

11.3.6 Deterioration in water quality due to increased suspended sediment concentrations and turbidity caused of construction activities

Several (non-dredging) construction activities required for the rehabilitation of the Old Tug Jetty have the potential to or will impact on water quality, and in this way biological communities, by disturbing sediment and causing an increase in the suspended sediment concentration and associated turbidity in the water column in the Port of Port Elizabeth. These activities include, but are not limited to:

Phase 1: Counterfort wall

- Site establishment.

- Removal of scour rock protection.
- Removal of existing concrete superstructure in the quay area.
- Placing a filter fabric on top of rock fill and along vertical extents of the existing sheet pile wall.
- Placing of a stone bed layer.
- Removal of the existing quay furniture and demolish existing structures that obstruct the new works.
- Placing of counterfort units.
- Installing scour rock protection on top of the counterfort wall toe.
- Backfilling the counterfort wall with quarry run.
- Placing of filter fabric on top of the quarry run backfill.
- Undertake pavement layer works.
- Install civil services and quay furniture.

Phase 2: Deck on pile structure

- Partial decommissioning of Old Tug Jetty counterfort wall.
- Site establishment.
- Removal of quay furniture.
- Piling.
- Deck installation

Some of the existing scour rock protection for the sheet pile wall will need to be removed before quay wall construction and this will mobilise sediment into the water column. After dredging (dealt with as a separate impact) a stone bed layer will be placed on the bottom to act as a foundation for the counterfort wall. This will mobilise sediment into the water column if the stones are dropped rather than placed onto the bottom, although even in the latter case sediment can be expected to be mobilised. The stones may also have soil and dust particles adhering to them that will be 'washed' from the surface when dropped or placed in water. A filter fabric will be placed onto the stone layer, and this will inevitably mobilise sediment into the water column when it is moved into place along the bottom. The placing of counterfort units will displace and mobilise sediment into the water column. After the counterfort wall is in place scour rock protection will be placed at its toe. This will mobilise sediment into the water column in the same way as the placing of the stone bed layer.

The counterfort wall will be constructed in front of, but not directly connected to the existing sheet pile wall. The area between the counterfort wall and existing sheet pile wall will be backfilled with a granular material. It is inevitable that during backfilling dust and soil particles adhering to the fill material will be released by as it is dropped into the area between the counterfort and sheet pile wall. This material will enter the port and contribute to the suspended solids concentration.

The existing quay apron concrete superstructure needs to be removed. This will require the breaking, cutting, and crushing of concrete and will lead to the generation of highly alkaline fine-grained cementitious dust and that will enter the port and contribute to the suspended solids concentration. It will also expose fill material that might be blown by wind or carried by surface (rain) runoff into the port. Similarly, quay furniture, including bollards, fenders, and ladders, will need to be removed from the quays to allow construction to proceed. This will also require the breaking, cutting, and crushing of concrete and will also lead to the generation of highly alkaline fine-grained cementitious dust and that will enter the port and contribute to the suspended solids concentration.

In Phase 2 piling will be required for the deck-on-pile structure. Piling creates shockwaves that mobilise fine-grained sediment into the water column.

Construction materials that might be blown by wind or eroded by rain/surface runoff will be stored temporarily onsite, such as backfill material, soil, cementitious material, and so on. The surface of the quay area is impermeable, which will heighten the potential for the wash off of these materials by rainfall/surface runoff. There is a high probability some of this material will be blown by wind into the estuary from storage areas and during handling near the water's edge.

An increase in the suspended sediment concentration and turbidity in the water column in an aquatic ecosystem above the baseline can have numerous adverse effects on biological communities. In general, the higher the concentration of suspended sediment and the longer the period of exposure above the baseline the greater the risk of adverse effects (Berry et al., 2003; Wenger et al., 2018). Many aquatic biological communities, including those in ports, can tolerate relatively short intense increases in the suspended solids concentration such as might occur during a high river discharge event associated with rainfall, but will be adversely affected if the increase is prolonged. Fish and invertebrates that live in, on, or near sediment are generally more tolerant of suspended sediment exposure than their pelagic counterparts given their natural association with sediment and the sediment-water interface, where the suspended concentration is naturally higher on average than in the water column (Sherk et al., 1974; Noggle, 1978; Wilber and Clarke, 2001; Berry et al., 2003). Fish and other mobile fauna can escape areas of high suspended sediment concentrations, but slow moving or sessile invertebrates cannot. An increase in the suspended sediment concentration and turbidity in the water column can affect the ability of fish that hunt by sight to capture their prey, affecting their foraging success or leading to a shift in their foraging strategy (Breitburg, 1988; Hecht and van der Lingen, 1992; de Jonge et al., 1993; Wilber and Clarke, 2001; Utne-Palm, 2002; De Robertis et al., 2003; Hedrick et al., 2006; Johansen and Jones, 2013; Wenger et al., 2017). The avoidance of areas of high suspended sediment concentration restricts access to normal foraging areas (Collin and Hart, 2015; Wenger et al., 2017). Excessive suspended sediment concentrations can clog or physically damage the feeding and respiratory organs (e.g. gills) of invertebrates and fish (Servizi and Martens, 1987; Kerr, 1995; Bash et al., 2001; Wilber and Clarke, 2001; Hess et al., 2015) with implications for respiratory ability, nitrogenous excretion, and ion exchange (Appleby and Scarratt, 1989; Wong, et al., 2013). The size of fish gills is proportional to their size, meaning the spaces between gill lamellae are smaller in larvae and juveniles. It is, therefore, likely that suspended sediment will more easily clog the gills and reduce their efficiency in smaller fish and larvae than in adult fish (Appleby and Scarratt, 1989). The eggs and larvae, and juvenile stages of fish are indeed generally more susceptible to suspended sediment than adult stages (Engell-Sørensen and Skyt, 2001; Wenger et al., 2017). Excessive suspended sediment concentrations can reduce the fitness and in extreme cases the survival of filter feeding invertebrates (e.g. mussels) that must process large amounts of sediment that is poor in organic material, causing them to use more energy than can be replaced by food intake (Widdows et al., 1979; Essink and Bos, 1985). Suspended sediment can also cause 'shading' that affects photosynthesis in micro- and macroalgae (Fredette and French, 2004; Wenger et al., 2017).

Certain construction activities for the proposed project, as discussed above, will disturb sediment, or will introduce soil and dust into the port and in this way will increase the suspended solids concentration and turbidity in the water column above the baseline. The sediment alongside the Old Tug Jetty quay area is comprised of a large amount of fine-grained material (mud) that is easily mobilised into the water column. Coarse heavy particles of sand will fall (back) to the bottom quickly (within seconds) near the point of disturbance or introduction. Fine-grained particles, such as silt and clay, have a low fall velocity and will in contrast remain in suspension for longer (hours to possibly days for very fine-grained material) and will be dispersed over a wider area depending on prevailing currents. The fine-grained sediment will eventually deposit in areas where and when the current is weakest (e.g. slack tide). Some of the fine-grained material could be re-mobilised by currents and be dispersed further on subsequent tides or when the current increases in strength for some other reason. Nevertheless, it is unlikely a significant amount of suspended sediment will be dispersed over a wide area and the increase in suspended sediment concentrations and turbidity is anticipated to be site specific. The biological communities in the Old Tug Jetty quay area, including those that have colonised quay walls and piles on deck-on-pile structures nearby, are undoubtedly habituated to periodically elevated suspended sediment concentrations and turbidity caused by vessel propeller wash and dredging. There are no known fauna and flora in the project area that are of special ecological, commercial, or social significance. Pelagic species and life stages will continue to use unaffected parts of the water column during construction. Construction will only occur during daylight hours. The increase in suspended sediment concentrations and turbidity will thus be intermittent, providing a measure of relief as the suspended sediment will disperse and settle from the water column between construction days. It is also important to consider that dredging and the removal of scour rock protection for Phase 1 will already have caused high suspended sediment concentrations and turbidity in the water column prior to other construction activities for this phase. The intensity of this impact is thus assessed as minor and the duration temporary. The impact is fully reversible as the mobilisation of sediment will cease when construction ceases. The significance rating for this impact is thus VERY LOW.

11.3.7 Ecological impacts due to the deposition of sediment mobilised and introduced into the water column by construction activities

The same construction activities that have the potential to directly impact on water quality and indirectly on biological communities by causing an increase in the suspended sediment concentration and turbidity in the water column (see Impact 6) will result in the deposition of suspended sediment beyond the area of disturbance or introduction. Areas of the port bottom that are directly and indirectly affected by construction activities will thus be impacted by the deposition of suspended sediment. Coarse heavy particles of sand will fall (back) to the bottom quickly (within seconds) near the point of disturbance or introduction. Fine-grained particles, such as silt and clay, have a low fall velocity and will remain in suspension for longer (hours to possibly days for very fine-grained material) and will be dispersed over a wider area depending on prevailing currents. The fine-grained sediment will eventually deposit in areas where and when the current is weakest (e.g. slack tide). Some of the fine-grained material could be re-mobilised by currents and be dispersed further on subsequent tides or when the current increases in strength for some other reason.

The excessive deposition of sediment can bury, smother, and crush biological communities, including benthic invertebrate infauna and poorly mobile, sessile, or sedentary epifauna, the eggs of invertebrates and fish that develop on the bottom, and in extreme cases can lead to the complete loss of benthic ecology (Miller et al., 2002). Most benthic invertebrate infauna live in the top 10 cm of sediment and rely on a connection (e.g. burrows) to the sediment-water interface for ventilation (respiration) and feeding. The 'excessive' deposition of fine-grained sediment (mud) on sandy sediment can lead to the clogging of the spaces between sand grains, displacing the fauna that live between the sand grains or retarding the exchange of oxygen with the overlying water, leading to the suffocation of benthic invertebrate fauna. Frequent repositioning to maintain a relative distance to the sediment-water interface, or the need by burrowing organisms to increase maintenance to prevent the infilling of burrows, requires that organisms shift their energy allotment from other functions, such as growth or reproduction. If the deposited sediment has a different grain size to the sediment existing before deposition it may alter the physical properties of the sediment, which can impact on bottom-dwelling fauna that prefer to live in or on sediment of a fairly specific grain size because of their need to maintain an open burrow or because of their mode of feeding, for example (Holland et al., 2005; Smit et al., 2006; Smit et al., 2008; Boon and Dalfsen, 2022). The deposition of muddy sediment on sandy sediment is generally more problematic than the reverse (Diaz and Boesch, 1977; Boon and Dalfsen, 2022). Many benthic invertebrate infauna and epifauna can migrate upwards through deposited sediment and may be relatively unimpacted by sediment deposition within reasonable limits (Maurer et al. 1979, 1981a, 1981b, 1982, 1986; Fredette and French, 2004; Wilber et al., 2007). Maurer et al. (1979) found that some benthic invertebrates can migrate through as much as 30 cm of deposited sediment, but other invertebrates are less tolerant of burial and smothering and may be significantly affected by even a thin layer of deposited sediment (Schaffner, 1993; Wilber and Clarke, 2007; Hendrick et al., 2016). The consequence of these impacts is usually an altered species diversity, abundance, and biomass of benthic invertebrate infauna and epifauna (Bolam and Rees, 2003; Bolam et al., 2011; Bolam et al., 2021), with attendant impacts to other ecosystem processes (e.g. fish that rely on invertebrates in the affected area as a food resource will be deprived of this resource). Biota will colonise areas where sediment has been deposited, and will recover to a species composition, abundance, and biomass comparable to that which existed before deposition provided the physical properties of the sediment are not immeasurably different as a consequence of the deposition. Depending on the intensity of sediment deposition, recolonisation may start immediately, but the recovery of benthic invertebrate communities to a comparable species composition, abundance, and biomass to that which existed before sediment deposition will take longer.

Benthic biological communities in the port area of the Port of Port Elizabeth are undoubtedly habituated to, and thus tolerant of a certain amount of sediment deposition since sediment (particularly the fine-grained fraction) in this area is regularly mobilised into suspension by vessel propeller wash and periodically by maintenance dredging (see Figures 22 and 23). Most of the sediment mobilised by these activities can reasonably be expected to settle on the port bottom, although an insignificant amount might be exported to the adjacent marine environment depending on the tidal state. Ports are known sediment depositional environments due to the usually weak currents that characterise these waters. Indeed, it is the introduced sediment and calm conditions that accounts for the need to periodically maintenance dredge the port. As discussed above, many benthic invertebrate infauna and epifauna are able to migrate through an appreciable depth of deposited sediment, although the smothering of less mobile forms and newly settled juveniles may be too much for them to tolerate and will lead their mortality. The volume of sediment that is mobilised into the water column by vessel propeller wash and maintenance dredging will undoubtedly far exceed the volume that will be mobilised into the water column in any day by construction activities. This is because construction of the new quay wall and deck-on-pile structure is likely to proceed sequentially from one end of the quay to the other. This will allow benthic invertebrate infauna and epifauna time to migrate through or otherwise deal with sediment deposited on the bottom between deposition events (which may only last a few days as construction progresses). The sediment mobilised into the water column and then dispersed to settle elsewhere is unlikely to differ substantially in terms of its grain size from bottom sediment in the greater area near the project area. As discussed elsewhere, the sediment in the Port of Port Elizabeth is dominated by mud.

Construction activities will thus mobilise or introduce sediment and dust into the water column. The sediment and dust will settle on the bottom and bury or smother benthic biological communities, with the possible attendant impacts as outlined above. Although fine-grained sediment and dust will probably be dispersed by currents over a fairly wide area, most of the sediment and dust will probably settle on the bottom near the point of disturbance or introduction. The impact is thus site-specific. Sediment and dust may be mobilised or introduced into the water column throughout the construction period if not properly controlled, but this will be intermittent and the effects of the deposition on biological communities are for the most part likely to be temporary in duration. There appear to be no benthic invertebrate infauna or epifauna in that part of the port most likely to be impacted that are of special ecological, commercial, or social significance, and impacts on other components of the biological community in the estuary that may be indirectly affected, such as through a loss of food resources due to the direct impact, are likely to be insignificant. Benthic biological communities in the area where this impact is most likely are also already disturbed by vessel propeller wash and maintenance dredging and are thus probably habituated to the impact of sediment deposition. Indeed, these communities will be substantially impacted by dredging that will precede the most intense period of construction. It is thus unlikely the burial and smothering of benthic biological communities will lead to a substantial loss in ecological productivity. The intensity is thus considered low. The impact is fully reversible as its potential to occur will cease when construction ceases, and fauna will colonise and migrate through, or otherwise deal with the deposited sediment over time. The significance rating for this impact is thus VERY LOW.

11.3.8 Deterioration in water quality due to the release of oxygen depleting substances from sediment by construction activities

The proposed rehabilitation of the Old Tug Jetty quay area in Phase 1 and the construction of a deck-on-pile extension of the quay area in Phase 2 will disturb the port bottom and mobilise sediment into the water column. These activities include the placing of filter fabric, placing of stone bed layer, placing of counterfort units, piling, and placing of scour protection rock. The mobilisation of sediment can lead to the release of oxygen depleting substances into the water column. Oxygen depletion can occur when reduced iron, manganese, ammonia, nitrite, and hydrogen sulphide in the mobilised sediment is oxidised and by the mineralisation of exposed organic matter. The oxygen depleting substances will disperse in the water column depending on prevailing currents and the amount of sediment mobilised. A depletion in the dissolved oxygen concentration in the water column directly impacts on water quality and may indirectly affect components of biological communities that rely on an adequate supply of dissolved oxygen for their survival, depending on the magnitude of oxygen depletion and individual organism requirements and tolerances. Sessile and poorly mobile fauna that live in and on sediment in deeper water are often at the most risk because the oxygen concentration in the water column usually naturally decreases from the surface to the bottom. Mobile fauna can in contrast avoid areas of low oxygen concentration provided this does not occur through the water column over a large area.

The amount of particulate organic matter in sediment sampled alongside and near the Old Tug Jetty quay area in August 2022 was moderate to high at Stations PE1 and PE3, but within the baseline range at Stations PE2 and PE4. The sediment at Stations PE1 and PE3 was slightly anoxic but the degree of anoxia was not pronounced, as is evident in the colour of the sediment (Figure 14) and an only feint aroma of hydrogen sulphide. In previous surveys, however, the sediment at Station PE1 was noted to highly anoxic. It is thus apparent that the amount of particulate organic matter in sediment near the Old Tug Jetty quay area is patchy and that the accumulation of this matter may, at times, lead to the sediment becoming anoxic. There is no information on nutrient concentrations in sediment porewater in the port, but this might well be elevated in parts of the area (see Impact 9).

A potential additional source of oxygen depletion associated with the proposed project is the decomposing remains of fauna that currently colonise the Old Tug Jetty sheet pile wall, which will die when construction proceeds. The most substantial risk will occur if the remains of these fauna sink to the bottom in relatively large amounts, which could lead to oxygen depletion and the development of anoxia in the sediment when they are degraded by oxygen consuming microorganisms. It is difficult to estimate the possible consumption of oxygen that might occur in this way since this will depend on the amount of organism remains that reach the bottom and whether these might be scavenged by other organisms (e.g. crabs). It is, however, unlikely the sheet pile fauna remains will sink to the bottom in a single pulse, but rather gradually since construction of the counterfort wall will proceed progressively. This will minimise the risk of significant oxygen depression.

Construction activities will thus mobilise sediment into the water column, and this will in turn probably release oxygen depleting substances into the water column. However, the area of sediment and associated porewater that will be disturbed by construction activities at any time will be so small in the context of the port water volume that that it is highly unlikely the oxygen depleting substances that might be released will reduce the oxygen concentration in the water column to any significant degree. Any reduction in the dissolved oxygen concentration that does occur will be temporary as the concentration will return to the baseline when construction activities cease disturbing the sediment at the end of each day, or even within a day. The dissolved oxygen concentration in the water column in the Port of Port Elizabeth is usually high. Biological communities in the port are nevertheless probably habituated to and tolerant of fluctuations in the dissolved oxygen concentration in the water column and motile fauna will be able to avoid areas where the dissolved oxygen concentration is temporarily depressed. However, as stated above it is highly unlikely the oxygen concentration will be depressed to any significant degree below the baseline. The intensity is thus anticipated to be minor, and the spatial extent of oxygen depletion to be site specific. This impact is fully reversible as the dissolved oxygen will quickly return to the baseline once the mobilisation of sediment ceases. The significance rating for this impact without mitigation is thus VERY LOW.

11.3.9 Deterioration in water quality due to the release of nutrients from sediment by construction activities

The proposed rehabilitation of the Old Tug Jetty quay area in Phase 1 and the construction of a deck-on-pile extension of the quay area in Phase 2 will disturb the port bottom and mobilise sediment into the water column. These activities include the placing of filter fabric, placing of stone bed layer, placing of counterfort units, piling, and placing of scour protection rock. The mobilisation of sediment can lead to the release of nutrients dissolved in sediment porewater into the water column (Wainright and Hopkinson, 1997; Gibson et al., 2015). The mobilisation of particulate organic matter from the sediment may also result in an increase in nutrient concentrations when the matter is remineralised. A possible additional source of oxygen depletion is the decomposing remains of biological communities that currently colonise the sheet pile wall at the Old Tug Jetty, which will die as construction proceeds. A potential additional source of nutrient release with the proposed project is the decomposing remains of fauna that currently colonise the Old Tug Jetty sheet pile wall, which will die when construction proceeds. The most substantial risk will occur when the remains of these fauna sink to the bottom in relatively large amounts, which could lead to a nutrient pulse when they are degraded by oxygen consuming microorganisms or are scavenged by other fauna. It is difficult to estimate the possible nutrient release that might occur in this way since this will depend on the amount of organisms affected at any time. It is, however, unlikely fauna on the entire sheet pile wall will die in a single pulse but rather gradually as construction of the counterfort wall will proceed progressively. This will minimise the risk of nutrient release in a pulse.

An increase in nutrient concentrations can have a direct impact on water quality and in that way an indirect impact on biological communities. The release of small amounts of nutrients can positively impact on primary productivity by increasing nutrient availability to micro- and macroalgae (Lohrenz et al., 2004). A marked increase in nutrient concentrations, in contrast, can stimulate the excessive growth of micro- and macroalgae, leading to eutrophication that in turn can lead to a host of ecological problems (including depleting the dissolved oxygen concentration in the water column and sediment). There is no information on the concentrations of nutrients in sediment porewater in the Port of Port Elizabeth, but nutrient concentrations in the water column are usually low. The microalgal biomass in the port is also usually low (see Section 5.1.5). Nevertheless, microalgal blooms have been recorded periodically in the port, indicating that under certain circumstances the port environment is susceptible to eutrophication. The recent construction of the leading jetties for the vessel maintenance slipway, which involved the installation of a large number of piles, had no apparent marked effect on nutrient concentrations in the water column in the port as deduced from measurements made for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth.

Construction activities for the proposed project will thus disturb sediment, and this will release nutrients into the water column. Any increase in nutrient concentrations that does occur will be temporary since the concentration will return to the baseline when construction activities cease at the end of each day but may occur intermittently throughout the construction period. Any nutrients that are released will probably be rapidly diluted in the surrounding water column and any increase is thus likely to be site specific. Although the nutrients will add to the nutrient concentrations in the water column in the port, the area of sediment and associated porewater that will be disturbed by construction activities at any time will be so small in the context of the port water volume that it is highly unlikely the released nutrients will excessively stimulate the growth of microalgae over and above the growth attributed to existing nutrient concentrations. The intensity will thus be minor. This impact is fully reversible since nutrient concentrations will return to the baseline when the disturbance of sediment ceases. The significance rating for this impact without mitigation is thus VERY LOW.

11.3.10 Deterioration in water and sediment quality due to the mobilisation of toxic chemicals from sediment by construction activities

The proposed rehabilitation of the Old Tug Jetty quay area in Phase 1 and the construction of a deck-on-pile extension of the quay area in Phase 2 will disturb the port bottom and mobilise sediment into the water column. These activities include the placing of filter fabric, placing of stone bed layer, placing of counterfort units, piling, and placing of scour protection rock. The mobilisation of sediment can lead to the release of toxic chemicals in the sediment into the water column. Toxic chemicals dissolved in porewater in sediment can be released directly into the water column. However, most toxic chemicals in sediment are immobilised by their complexation with sulphides, hydrous metal oxides of iron and manganese, and/or or adsorption onto sediment grains and particulate organic matter. The complexes are generally stable and largely insoluble in the usually low oxygen or anoxic conditions commonly found a few centimetres beneath the sediment surface, limiting their potential to pose a toxic risk to biological communities (Goossens and Zwolsman, 1996; Eggleton and Thomas, 2004). The main mechanism by which toxic chemicals are released from sediment during mobilisation is by the oxidation of these complexes. When sediment is mobilised or otherwise disturbed, oxygen permeates the sediment and destabilises the complexes, and may result in the partitioning of the bound chemicals into the dissolved phase (Eggleton and Thomas, 2004). The rate of metal desorption from complexes during sediment mobilisation is strongly influenced by properties of the sediment, including its grain size and the presence of sulphides, particulate organic matter, and hydrous metal oxides of iron and manganese (Goossens and Zwolsman, 1996; Eggleton and Thomas, 2004; Atkinson et al., 2007; Cantwell et al., 2008). Some chemical-particle complexes (e.g. between high molecular weight polycyclic aromatic hydrocarbons and particulate organic matter) are quite stable even in oxygenated conditions and these chemicals may not desorb from the suspended particulate matter, or the desorption process may be slower than the time it takes for the remobilised particulate organic matter to again settle from the water column onto the bottom.

The behaviour of toxic chemicals after repartitioning or suspension with sediment is complex, governed by the properties of the chemicals and various biogeochemical modifying factors such as the salinity, pH, and dissolved oxygen concentration of the water column (Eggleton and Thomas, 2004). The toxic chemicals may be dispersed in the water column by currents in the dissolved form or bound to suspended particulate matter by currents, but most chemicals are usually rapidly scavenged from the water column and deposited on sediment by flocculation, coagulation, and settlement. Reduced iron and manganese, for example, when oxidised during suspension rapidly scavenge metals and other compounds from the water column. As the compounds settle on the bottom, they are again reduced under anoxic conditions. Thus, while mobilisation may repartition chemicals into the dissolved phase, the increase in concentration usually persists for only a short period. The scavenged chemicals, or chemical-particle complexes mobilised into the water column may settle in a different area to that where the sediment was mobilised, causing the contamination of previously uncontaminated sediment, or adding to the contaminant load in already contaminated sediment. However, as stated above chemicals repartitioned into the dissolved phase are usually rapidly scavenged from the water column, which usually limits the extent of their dispersion.

The repartitioning of chemicals into the dissolved phase makes them more bioavailable than when adsorbed onto or buried in sediment. This is important because toxic chemicals can only exert a toxic effect if they are in a bioavailable form and organisms are actually exposed to the chemicals. An increase in toxic chemical concentrations impacts on water and sediment quality and may impact in turn indirectly impact on biological communities depending on each chemicals concentration and the tolerances of organisms to the chemical. Adverse impacts might occur by fauna and flora accumulating toxic chemicals in their tissue, leading to sub-lethal impacts such as reduced growth rates or an increase in their susceptibility to other stressors, and in extreme cases mortality (e.g. Sved and Roberts, 1995; Gregg et al., 1997; Cruz-Rodríguez and Chu, 2002; Geffard et al., 2007; Tolhurst et al., 2007; Lotufo et al., 2010). The loss of biological communities through mortality may affect other biota by depleting food resources. Toxic chemicals can enter food webs through their bioaccumulation by fauna and flora, with sub-lethal impacts (Lotufo et al., 2010). Some toxic chemicals increase in concentration through successive trophic levels of food webs in a process known as biomagnification and in this way can pose a toxic risk to higher level consumers (e.g. sharks, dolphins) and humans that consume contaminated fish and shellfish.

The sediment alongside and near the Old Tug Jetty quay area is metal contaminated, but not to an especially high magnitude. There is no information on the concentrations of other chemicals in sediment in this area, but there is information on polycyclic aromatic hydrocarbons, organochlorine pesticides, polychlorinated biphenyls, and butyltins in sediment near the quay area. It is impossible to determine if these chemicals are present in sediment alongside the Old Tug Jetty quay area without actually analysing the sediment, but this is probably the case considering the trend for the sediment nearby and elsewhere in the port. It is difficult to quantify the amount of toxic chemicals that might be released into the water column when the sediment is mobilised by construction activities based on chemical concentrations in the sediment alone because chemicals differ in their mobility and bioavailability depending on their chemical and mineralogical form and conditions in the water column (Baeyens et al., 2003; Nicolau et al., 2006; Nouri et al., 2011). Chemical concentrations measured in sediment are thus a poor predictor of their potential release from sediment – the fraction that is released by the mobilisation of sediment is usually far lower than concentration measured in sediment. One approach to estimating the release of chemicals is the testing of sediment elutriates, which involves mixing known volumes of water and sediment, agitating the mixture to mimic the sediment mobilisation by dredging, and then analysing chemical concentrations in the water (elutriate). However, even this information will not provide an indication if the chemicals will exert a toxic effect unless the elutriate is tested for toxicity. Elutriate testing was not performed for this study (it is rarely performed in South Africa). However, the sediment sampled at four stations alongside and near the Old Tug Jetty quay area in July 2022 was tested for toxicity to sea urchin embryo-larvae under a sediment-water interface testing regime. A sediment-water interface toxicity test simulates the release of toxic chemicals from bedded sediment into the water column. The sediment sampled at three stations was not toxic to sea urchin embryo-larvae, while sediment sampled at the fourth station it was slightly toxic. It is probable, therefore, that the disturbance of sediment by construction activities will release toxic chemicals from sediment in some parts of the construction footprint into the water column. Following a precautionary principle, the sediment across the construction footprint is assumed to be slightly toxic.

Toxic chemicals will thus probably be released by construction activities into the water column at concentrations that may possibly cause slight toxic effects to biological communities. However, construction activities are likely to disturb such low volumes of sediment at any time and the toxic chemicals released into the water column will probably be rapidly scavenged from the water column or diluted and dispersed soon after release. The intensity for this impact is thus low and the spatial extent is site specific. This impact is possible throughout the construction period but any increase in toxic chemical concentrations will be temporary. The impact is fully reversible as the release of toxic chemicals will cease when construction ceases, and the chemicals will be dispersed and diluted over time. The significance rating for this impact without mitigation is thus VERY LOW.

11.3.11 Deterioration in water quality due to dredging related increases in suspended sediment concentrations and turbidity

Sediment alongside and near the Old Tug Jetty quay area will need to be dredged for Phase 1 of the proposed project to allow the removal of existing scour protection rock near the sheet pile wall, to allow the placement of a stone bed and filter fabric layer, and to allow the positioning of the counterfort wall units. Sediment will also need to be dredged for Phase 2 of the proposed project to provide the necessary water depth for larger vessels and to allow the placing of scour protection rock beneath and near the deck-on-pile structure. There is no information yet on the volume of sediment that will need to be dredged during Phase 1 and Phase 2, nor on the dredging method. This information will be finalised after a geotechnical survey has been completed and the engineering design for each phase has been finalised.

Dredging presents numerous predictable and unavoidable environmental impacts. One impact is the mobilisation and release of sediment into the water column, resulting in an increase in the suspended sediment concentration and turbidity in the water column at and near the dredging operations. Depending on the method of dredging the mobilisation of sediment occurs at the dredging head for hydraulic dredging or by the bucket or grab impacting on the bottom during mechanical dredging. Sediment can also be mobilised by dredger propeller wash and the deployment of anchoring systems. The release of sediment occurs through overspill from the bucket or grab during mechanical dredging and overspill from hoppers or barges. The volume of sediment mobilised and released into the water column depends on the nature of the sediment that is dredged (i.e. its particle size, mineralogy, bulk density), the depth of the water column at the dredging site, prevailing currents and other forms of turbulence, the type of equipment used for dredging (e.g. mechanical versus hydraulic), and skill of dredge operator (e.g. speed of dredging, rate at which dredge bucket is lifted).

The highest suspended sediment concentrations can be expected very near the dredging operation (these can be up to several hundred to several thousand milligrams per litre depending on the dredging method), with the highest concentrations usually found in the middle and bottom parts of the water column. Fine-grained sediment (mud) is mobilised and released more easily by dredging and remains in suspension longer than coarse grained sand and is dispersed from the dredging site by currents. The extent of the dispersion depends on the particle size of the sediment, which affects its fall rate, and the strength of currents. Very coarse particles of sand have a high fall velocity in seawater at a temperature of 35oC (in the order of 0.12 m.s-1 for coarse-grained sand; Soulsby, 1997) and will settle rapidly on the bottom. Fine-grained particles have a far lower fall velocity (in the order of 0.0003 - 0.0004 m.s-1 for silts and clays; Soulsby, 1997) and will disperse over a wider area depending on prevailing currents, but could remain in the water column for hours to possibly days and can thus be dispersed over a wide area depending on prevailing currents. The fine-grained sediment will eventually deposit in areas where and when the current is weakest (e.g. slack tide). Some of the fine-grained material could be re-mobilised by currents and be dispersed further on subsequent tides or when the current increases in strength for some other reason. It is important to note that while a turbid plume may be visible a considerable distance down current of dredging operations the actual amount of fine-grained material in suspension that causes the plume to be visible is usually very low (Hitchcock and Drucker, 1996).

An increase in the suspended sediment concentration and turbidity in the water column due to dredging can have the same potential environmental consequences as those that might occur when sediment is mobilised by construction activities (see Impact 6), although the impacts is usually more intense.

The sediment in the dredging footprints for the proposed project is comprised largely of mud. The dredging of sediment will thus increase the suspended sediment concentration and turbidity above the baseline in the water column at and near the dredging site. This is an unavoidable impact of dredging. The water column in the dredging footprint is shallow. The increased suspended sediment concentration and turbidity is anticipated to be highly localised near the dredging operation as currents in the area are anticipated to be weak on average and are thus unlikely to disperse large volumes of suspended sediment over large areas. The suspended sediment is unlikely to be dispersed from the port entrance to any significant degree. The finer-grained material will be dispersed over a wider area depending on prevailing currents but this is likely to increase the suspended sediment concentration only slightly above the baseline. The impact on water quality is thus considered local. The increase will be temporary since dredging will not proceed 24 hrs a day and dredging will be completed cumulatively within a relatively short period. The suspended sediment concentrations near the dredging operation will probably be high. Biological communities at and near the dredging footprints, including benthic communities and communities that have colonised hard structures such as jetty piles, are probably habituated to the impact of suspended sediment but will be impacted as the suspended sediment concentration near the dredging operation will probably considerably exceed the baseline. The intensity is thus considered moderate. The impact is fully reversible since biological communities and ecological processes impacted by the elevated suspended sediment concentrations and associated turbidity will recover and re-establish after dredging ceases. The significance rating for this impact without mitigation is thus MEDIUM.

11.3.12 Ecological impacts due to the deposition of sediment outside the dredging footprint

Sediment alongside and near the Old Tug Jetty quay area will need to be dredged for Phase 1 of the proposed project to allow the removal of existing scour protection rock near the sheet pile wall, to allow the placement of a stone bed and filter fabric layer, and to allow the positioning of the counterfort wall units. Sediment will also need to be dredged for Phase 2 of the proposed project to provide the necessary water depth for larger vessels and to allow the placing of scour protection rock beneath and near the deck-on-pile structure. There is no information yet on the volume of sediment that will need to be dredged during Phase 1 and Phase 2, nor on the dredging method. This information will be finalised after a geotechnical survey has been completed and the engineering design for each phase has been finalised.

Dredging presents numerous predictable environmental impacts. One impact is the mobilisation and release of sediment into the water column. The volume of sediment that is mobilised and released into the water column depends on the nature of the sediment that is dredged (i.e. its grain size), the depth of the water column at the dredging site, prevailing currents and other forms of turbulence, the method of dredging (e.g. mechanical versus hydraulic), and the skill of dredge operator (e.g. speed of dredging, rate at which dredge bucket is lifted). The highest suspended sediment concentrations are near the dredger (these can be up to several hundred milligrams per litre or more), in the middle and lower parts of the water column. Coarse heavy particles of sand will fall (back) to the bottom quickly (within seconds) near the point of disturbance or introduction. Fine-grained particles, such as silt and clay, have a low fall velocity and will remain in suspension for longer (hours to possibly days for very fine-grained material) and will be dispersed over a wider area depending on prevailing currents. The fine-grained sediment will eventually deposit in areas where and when the current is weakest (e.g. slack tide). Some of the fine-grained material could be re-mobilised by currents and be dispersed further on subsequent tides or when the current increases in strength for some other reason.

Sediment that is mobilised and released into the water column by dredging will thus settle on the seabed outside the dredging footprint. The area over which sediment mobilised and released by dredging for the Old Tug Jetty rehabilitation will settle in the Port of Port Elizabeth has not been modelled. The sediment in the dredging footprint is a mix of sand and mud, but the mud content is considerably higher than the sand content. It is unlikely a significant volume of the sediment will be dispersed over a large area beyond the dredging footprint since currents in the project area are anticipated to be weak on average. It is thus anticipated that most of the sediment mobilised and released into the water column by dredging will settle on the bottom near the dredging footprint and this impact will thus be most intense near the dredging footprint. Although plumes of sediment mobilised or released into the water column by vessel propeller wash, dredging, and construction can be seen extending over quite a large area in satellite images of the Port of Port Elizabeth (see Figures 22 and 23), the visible plume some distance from these operations is probably represented by very fine-grained material that comprises only a small volume of the sediment that was mobilised and released by these disturbances. A small amount of sediment will thus be deposited further from the dredging footprint.

Sediment that is mobilised and released into the water and subsequently deposited on the bottom will have the same potential environmental consequences as those that might occur when sediment that is mobilised by construction activities is deposited on the bottom (see Impact 7).

Dredging for the Old Tug Jetty sheet pile wall rehabilitation in Phase 1 and for the construction of the deck-on-pile structure in Phase 2 of the proposed project will thus mobilise and release sediment into the water column and the sediment will settle on the bottom outside the dredging footprints, where it will probably bury or smother benthic biological communities. Although very fine-grained sediment mobilised or released into the water column may be dispersed by currents over a fairly wide area, currents in the affected area are probably weak on average and most of the sediment is expected to settle on the bottom relatively near the dredging footprints. The most significant impact is thus expected near the dredging footprints the extent of this impact is thus considered site-specific. Depending on the dredging method, sediment deposition could be fairly significant near the dredging footprints. However, the deposition will be intermittent as dredging will not proceed throughout the day and the more mobile benthic invertebrate infauna and epifauna will be able to migrate through the sediment. However, some components of the biological communities near the dredging footprints may suffer mortality and it will take some time for the affected benthic biological communities to recover to the same species diversity, abundance, and biomass as that which existed before dredging. This is expected to occur within a short period after the disturbance and the duration is thus considered short-term. There appear to be no benthic invertebrate infauna or epifauna in that part of the port most likely to be impacted that are of special ecological, commercial, or social significance, and impacts on other components of the biological community in the port that may be indirectly affected, such as through a loss of food resources, are likely to be insignificant. Benthic biological communities near the dredging footprints are most likely already disturbed by vessel propeller wash and maintenance dredging and are thus probably habituated to the impacts of sediment deposition, although probably not to the same degree that can be expected from a dredging operation nearby. Benthic biological communities near the dredging footprints will thus experience some degree of impoverishment due to sediment deposition, but it is unlikely this will lead to a substantial loss in ecological productivity. The intensity is thus considered low. The impact is fully reversible as its potential to occur will cease when dredging ceases, and fauna will colonise and migrate through, or otherwise deal with the deposited sediment over time. The significance rating for this impact is thus LOW.

11.3.13 Deterioration in water quality due to the release of oxygen depleting substances from sediment by dredging

Sediment alongside and near the Old Tug Jetty quay area will need to be dredged for Phase 1 of the proposed project to allow the removal of existing scour protection rock near the sheet pile wall, to allow the placement of a stone bed and filter fabric layer, and to allow the positioning of the counterfort wall units. Sediment will also need to be dredged for Phase 2 of the proposed project to provide the necessary water depth for larger vessels and to allow the placing of scour protection rock beneath and near the deck-on-pile structure. There is no information yet on the volume of sediment that will need to be dredged during Phase 1 and Phase 2, nor on the dredging method. This information will be finalised after a geotechnical survey has been completed and the engineering design for each phase has been finalised.

The dredging of sediment will lead to the mobilisation and release of sediment into the water column and in this way will release oxygen depleting substances into the water column, with the same potential environmental consequences as those that might occur when sediment is mobilised by construction activities (see Impact 8). Water quality monitoring has shown that there is usually only a small and an often difficult to detect depletion of the dissolved oxygen concentration in the water column near dredging operations, but when a depletion is evident the oxygen concentration usually returns to the baseline within a short period (in the order of <30 minutes) after dredging ceases (e.g. USACE, 1976; USACE, 1998; Houston et al., 1989; Pledger et al., 2021).

Dredging will thus mobilise and release sediment into the water column and this will release oxygen depleting substances into the water column. Water quality monitoring near dredging operations has shown that dredging usually has a minimal, localised effect on the dissolved oxygen concentration in the water column. The dissolved oxygen concentration in the water column in the port is usually high. Any depression in the dissolved oxygen concentration that does occur during dredging for Phase 1 and Phase 2 will be temporary as the concentration will return to the baseline when dredging ceases at the end of each day, but may occur daily for a fairly long period and is thus considered short-term. Any depression in the dissolved oxygen concentration is likely to be restricted to the area near dredging operations and the spatial extent of this impact is thus site specific. Biological communities in the Port of Port Elizabeth are undoubtedly habituated to and tolerant of small fluctuations in the dissolved oxygen concentration in the water column and mobile fauna will be able to avoid areas where the dissolved oxygen concentration is temporarily depressed. The benthic biological community near the dredging footprints is also not especially diverse. There is thus unlikely to be a significant impact on ecological processes in the port. The intensity is thus considered low. This impact is fully reversible as the dissolved oxygen concentration will return the baseline soon after dredging ceases. The significance rating for this impact without mitigation is thus LOW.

11.3.14 Deterioration in water quality due to the release of nutrients from sediment by dredging

Sediment alongside and near the Old Tug Jetty quay area will need to be dredged for Phase 1 of the proposed project to allow the removal of existing scour protection rock near the sheet pile wall, to allow the placement of a stone bed and filter fabric layer, and to allow the positioning of the counterfort wall units. Sediment will also need to be dredged for Phase 2 of the proposed project to provide the necessary water depth for larger vessels and to allow the placing of scour protection rock beneath and near the deck-on-pile structure. There is no information yet on the volume of sediment that will need to be dredged during Phase 1 and Phase 2, nor on the dredging method. This information will be finalised after a geotechnical survey has been completed and the engineering design for each phase has been finalised.

The dredging of sediment will lead to the mobilisation and release of sediment into the water column and in this way will release nutrients into the water column, with the same potential environmental consequences as those that might occur when sediment is mobilised by construction activities (see Impact 9).

Dredging will thus mobilise and release sediment and this way will release nutrients into the water column. Dredging can mobilise and release a considerable volume of sediment into the water column depending on the dredging method. However, the volume of porewater disturbed in the dredging footprints will be very small in the context of the port water volume. It is thus unlikely a sufficient volume of nutrients will be released to excessively stimulate the growth of microalgae over and above the growth attributed to existing nutrient concentrations. The impact is thus likely to be site specific in extent, short-term in duration, and minor in intensity. This impact is fully reversible since nutrient concentrations will return to the baseline when the disturbance of sediment ceases. The significance rating for this impact without mitigation is thus VERY LOW.

11.3.15 Deterioration in water quality due to the release of toxic chemicals from sediment by dredging

Sediment alongside and near the Old Tug Jetty quay area will need to be dredged for Phase 1 of the proposed project to allow the removal of existing scour protection rock near the sheet pile wall, to allow the placement of a stone bed and filter fabric layer, and to allow the positioning of the counterfort wall units. Sediment will also need to be dredged for Phase 2 of the proposed project to provide the necessary water depth for larger vessels and to allow the placing of scour protection rock beneath and near the deck-on-pile structure. There is no information yet on the volume of sediment that will need to be dredged during Phase 1 and Phase 2, nor on the dredging method. This information will be finalised after a geotechnical survey has been completed and the engineering design for each phase has been finalised.

Dredging can promote the release of toxic chemicals from sediment (Sturve et al., 2005; Bocchetti et al., 2010; Yeager et al., 2010; Layglon et al., 2020), with the same potential environmental consequences as those that might occur when sediment is mobilised by construction activities (see Impact 10).

The contaminant and toxicity status of sediment sampled alongside and near the Old Tug Jetty quay area in August 2022 was discuss under Impact 10 and will thus not be repeated here.

Dredging will probably release toxic chemicals into the water column at concentrations that will cause a minor toxic effect to sensitive components of the local biological communities. The intensity for this impact is thus considered low, and since the released toxic chemicals will be removed from the water column and/or diluted and dispersed by currents the toxic effects are only likely near the dredging footprints the impact is anticipated to be site specific. Toxic chemicals could be released from sediment throughout the dredging period and the duration is thus short-term. The impact is fully reversible as its potential to occur will cease when dredged ceases and any toxic chemicals that are mobilised and released into the water column will be dispersed and diluted and scavenged from the water column. The significance rating for this impact without mitigation is thus LOW.

11.3.16 Ecological impacts due to the removal, injury, and disturbance of biological communities in dredging footprints

Sediment alongside and near the Old Tug Jetty quay area will need to be dredged for Phase 1 of the proposed project to allow the removal of existing scour protection rock near the sheet pile wall, to allow the placement of a stone bed and filter fabric layer, and to allow the positioning of the counterfort wall units. Sediment will also need to be dredged for Phase 2 of the proposed project to provide the necessary water depth for larger vessels and to allow the placing of scour protection rock beneath and near the deck-on-pile structure.

The removal, disturbance, and injury of biological communities in and on sediment in the dredging footprint is an unavoidable impact of the dredging of sediment. Benthic macro- and microflora, invertebrate infauna (e.g. burrowing prawns and annelid worms), slow moving or sessile (immobile) invertebrate epifauna (e.g. gastropods), slow moving fish, and the eggs of fish and invertebrates that develop on sediment are especially susceptible. Dredging usually results in a marked decrease in the species diversity, abundance, and biomass of benthic invertebrate and, if present also macroflora communities in the dredging footprint (e.g. Newell et al., 1998). Zooplankton, phytoplankton, pelagic invertebrates, and fish may also be entrained into the dredger by suction if the dredging method is hydraulic, and they are injured or (usually) killed in the process (Reine and Clarke, 1998; Wyss et al., 1999; Drabble, 2012). The disturbance of sediment by dredging can result in the mobilisation and entrainment of benthic and epibenthic invertebrates into the water column and this may attract fish that feed on the invertebrates to the dredging site. Although this might outwardly appear to be a slight benefit for the fish, the benefit may be short-lived as they run the risk of being entrained into the dredging works. The loss of benthic macro- and microflora and benthic invertebrate infauna and epifauna in the dredging footprint essentially amounts to (temporary) habitat loss or displacement for fish and larger motile invertebrates that feed on the biota, and in this way may affect their abundance and survivorship in addition to other ecosystem processes.

As stated above, the removal, disturbance, and injury of biological communities in dredging footprints is an unavoidable impact of the dredging of sediment. However, benthic invertebrate infauna and epifauna do recolonise newly exposed sediment after dredging. Based on the findings of published studies some benthic invertebrate fauna will probably recolonise or otherwise use the newly exposed sediment within hours to days, but the recovery of benthic biological communities to a comparable species composition, abundance, and biomass to that which existed before dredging will take longer (potentially years in some habitats) (Ellis, 1996; Newell et al., 1998). The recovery of biological communities on muddy substrata after dredging disturbance is generally faster than for communities on sandy substrata, and slowest for for communities on gravelly substrata. Initial recolonisation of benthic invertebrate fauna will occur through invasion (or active immigration) by motile fauna (e.g. amphipods, crabs; Morton, 1977; van Moorsel 1993, 1994; Hall, 1994) from less disturbed or undisturbed areas nearby and by larval settlement (Skilleter, 1998). Short-lived species and/or species with a high reproduction rate (so-called opportunists, like amphipods and various worms) will likely recover more rapidly than slower growing, longer-lived species (e.g. gastropods, large worms).

Dredging will lead to a permanent increase in the water column depth alongside and near the Old Tug Jetty quay area, as the new depth will be maintained by periodic maintenance dredging during the operational phase. The increase in the depth is anticipated to be minimal (in the order of 1-2 m) but might nevertheless reduce the amount of light reaching the bottom. There are no macroalgae on the bottom and the possibly changed light regime will thus have a limited impact on primary productivity in the port. The changed light regime might impact some invertebrates and fish that feed by sight, but this is unlikely to be significant considering the anticipated small change in depth. It is also unlikely the increase in water column depth will lead to a difference in the types of benthic invertebrate infauna and infauna that will colonise the exposed sediment compared to the existing communities.

Dredging will thus definitely remove, injure, and disturb biological communities in the dredging footprints. The removal, injury and disturbance of biological communities will be limited to the dredging footprints and their immediate surroundings and is thus site specific, although their loss may affect ecological processes over a wider area of the port. Biota will recolonise sediment in the dredging footprints and the impact is thus fully reversible. It will, however, take time for the communities to recover to a comparable species composition, abundance, and biomass to that which existed before dredging, including because scour protection rock will be placed on the sediment at some period after dredging is completed for Phase 1 and it will take time for scour protection rock to be inundated by sediment. The duration of this impact is thus considered medium-term. The benthic habitat in the dredging footprints is not particularly unique and the benthic invertebrate community nearby, and thus also presumably in the dredging footprints is not especially species diverse nor abundant when compared to communities elsewhere in the port. There are no apparent benthic or epibenthic invertebrates in sediment near, and hence presumably also in the dredging footprints that are of special ecological, commercial, or social significance. The benthic habitat in the dredging footprints is replicated elsewhere in the port and is thus unlikely to represent critical habitat. Thus, while biological communities in the dredging footprints will be severely impacted by removal, injury, and disturbance, the associated temporary loss of access to this habitat by other fauna and the temporary loss in ecological productivity is unlikely to have a significant impact on ecosystem processes in the port. The intensity is thus considered low. The significance rating for this impact without mitigation is thus MEDIUM.

11.3.17 Deterioration in water quality due to an increase in suspended sediment concentrations during dredged sediment disposal

The sediment dredged during Phases 1 and 2 of the proposed project will be disposed at a registered dredged spoil disposal site in Algoa Bay. Dredged sediment is usually disposed from a dredge vessel or barge through two half doors or valves at the bottom of the hull. The dredged sediment in a hopper or barge represents a dense slurry that, when disposed, behaves as a dense fluid when released into the less dense seawater surrounding it. Surveys have shown that most of the sediment disposed in this way reaches the bottom as a fluid mass. However, some of the sediment is stripped into suspension from the descending mass by friction and entrainment of surrounding water. Dredge vessels often dispose of sediment while moving and at the end of a disposal event will pass water through the hopper to remove sediment trapped at door hinges and so on, which promotes the suspension of sediment. Sediment is also mobilised into suspension when the fluid sediment mass impacts the seabed and surges as a density current laterally under its momentum. The sediment left in suspension by the descent and impact on the seabed will disperse under the impact of currents. Estimates of the volume of sediment stripped from the fluid mass during descent range from about 1-4% (Truitt, 1986). Some portion of this 1-4% mass of suspended sediments stripped from the main mass of material likely deposits in the immediate vicinity of the disposal and thus remains inside most disposal sites, although the size of this portion will vary considerably with site and sediment characteristics. The very fine fraction of sediment on the deposited mass is also eroded and mobilised into suspension by currents at the time of deposition, and then gradually over a longer timeframe after disposal (Palanques et al., 2022).

An increase in suspended sediment concentrations and turbidity generated by the open water disposal of dredged sediment is usually restricted to the lower part (15-20%) of the water column and declines by orders of magnitude toward the surface (Truitt, 1988). The increase in suspended sediment concentrations and turbidity near the bottom may be intense depending on the nature and volume of the sediment disposed and characteristics of the disposal site (Palanques et al., 2022). However, the suspended sediment concentration and turbidity decreases rapidly after a disposal event and usually approaches the background within tens of minutes to a few hours (USACE, 1976; LTMS, 1998; van Parijs et al., 2002; Anchor, 2003; Roman-Sierra et al., 2011; USACE, 2015; Palanques et al., 2022), although in large volume dredging projects the disposal events may be so frequent the suspended sediment concentration does not approach the background until the dredging programme ceases (Palanques et al., 2022).

The mobilisation of deposited sediment by currents following a disposal event may continue for some time, leading to frequent, low intensity increases in the suspended sediment concentration and turbidity (Palanques et al., 2022).

A satellite image in Google Earth that captured a dredger disposing sediment dredged in the Port of Port Elizabeth at the dredged spoil disposal site in Algoa Bay provides an example of the impact of sediment disposal on the suspended sediment concentration in the water column. In this case a suspended sediment plume is evident at the water surface, which probably reflects the fact the dredger was moving while disposing sediment. The dredger in the satellite image might be far larger than the vessel/barge that will be used to dispose dredged sediment for the proposed project. The extent of the impact on suspended sediment concentrations in the water column may thus be smaller for the proposed project.

An increase in the suspended sediment concentration and turbidity in the water column due to dredged sediment disposal can have the same potential environmental consequences as those that might occur when sediment is mobilised by construction activities (see Impact 6).

There is no information on benthic and pelagic biological communities at and very near the dredged spoil disposal site in Algoa Bay. There are no benthic macroalgae in the area but the water column can be expected to provide habitat for a range of microalgal, invertebrate, and fish species. Masikane (2011) investigated the structure and composition of benthic invertebrate communities at a 10 m water column depth at six stations in Algoa Bay, one of which was situated off the Papenkuils River inshore of the dredged spoil disposal site. Masikane (2011) performed two surveys at the stations, one in 2008 and another in 2009. The sediment at the Papenkuils River station was found to comprise a higher fine-grained fraction and to have a higher total organic content than other stations. In both surveys the benthic invertebrate community at the Papenkuils River station was dominated by polychaetes, followed either by amphipods or bivalves. Decapoda were also an important component of the community. In contrast, the benthic invertebrate community at other stations was dominated by amphipods. Masikane (2011) concluded that the primary factor influencing the difference in the benthic invertebrate community structure and composition at the Papenkuils River station compared to other stations was the discharge of effluent from the river. Many species of polychaete worms are known to tolerate and in some cases flourish in areas influenced by effluent discharge and may account for the dominance of the benthic invertebrate community by polychaetes.

It is reasonable to assume that benthic biological communities at and near the dredged spoil disposal site in Algoa Bay have been shaped by the repeated disposal of dredged sediment from the Port of Port Elizabeth, and that the communities are to a large degree probably habituated to and tolerant of dredged sediment disposal. Evidence from satellite imagery provided in Google Earth also provides evidence the communities at and near the dredged spoil disposal site are also periodically exposed to elevated suspended sediment concentrations and turbidity associated with high flow discharge events from the Papenkuils River and Swartkops River estuary.

Schumann et al. (2005) recorded an average current velocity at 12 m depth about 1 km off the Papenkuils River mouth of 0.04 m.s-1 and an apparent maximum velocity of 0.15 m.s-1. Calm conditions (<0.01 m.s-1) occurred about 9.5% of the time. The currents were found to largely flow parallel to the coast, with the dominant flow to the north. It should, however, be noted that current measurements were made for a short period of 46 days and probably do not reflect the trend for currents through the year. However, the weak current speeds are consistent with the higher mud fraction present in sediment in the sheltered western part of Algoa Bay, including at the dredged spoil disposal site.

The disposal of dredged sediment will increase the suspended sediment concentration and turbidity above the baseline in the water column at and near the open water dredged spoil disposal site in Algoa Bay. This is an unavoidable impact of dredged sediment disposal at open water dredged spoil disposal sites. The findings of studies elsewhere in the world show that the increase in the suspended sediment concentrations and turbidity above the baseline after open water dredged sediment disposal is usually restricted to a small area (few hundred meters) and returns to the baseline soon after each disposal event, although some fine-grained material may be dispersed over a wide area depending on prevailing conditions. It is reasonable to assume this will also be the case at the dredged spoil disposal site in Algoa Bay based on the slow current speeds recorded at the site. The impact on water quality though an increase in the suspended sediment concentration and turbidity is thus anticipated to be site specific and the duration temporary. The impact is anticipated to be of a minor intensity since biological communities at and near the dredged spoil disposal site are probably habituated to and thus tolerant of the impacts of elevated suspended sediment concentrations and turbidity through the repeated disposal of dredged sediment at the dredged spoil disposal site. The biological communities are also periodically exposed to elevated suspended sediment concentrations and turbidity associated with discharges from the Papenkuils River and Swartkops River estuary. The impact is fully reversible since increases in the suspended sediment concentration and turbidity will cease after dredged sediment disposal ceases and affected biological communities will recover. The significance rating for this impact is thus VERY LOW.

11.3.18 Deterioration in water quality due to the release of oxygen depleting substances from sediment during disposal

The sediment dredged during Phases 1 and 2 of the proposed project will be disposed at a registered dredged spoil disposal site in Algoa Bay. Dredged sediment is usually disposed from a dredge vessel or barge through two half doors or valves at the bottom of the hull. The dredged sediment in a hopper or barge represents a dense slurry that, when disposed, behaves as a dense fluid when released into the less dense seawater surrounding it. Surveys have shown that most of the sediment disposed in this way reaches the bottom as a fluid mass. However, some of the sediment is stripped into suspension from the descending mass by friction and entrainment of surrounding water. In this way oxygen depleting substances may be released into the water column, with the same potential impacts as those that might occur when sediment is mobilised by construction activities (see Impact 8). Monitoring near open water dredged sediment disposal operations has shown that the dissolved oxygen depletion in the water column near open water dredged sediment disposal operations has shown that the dissolved oxygen concentration in the disposal plume can at times fall to 0 mg.l-1, but in most cases the depletion is usually minimal, localised, and usually difficult to detect from the baseline away from the disposal plume (Slotta et al., 1973; Westley et al., 1973; USACE, 1976; USACE, 1998).

Dredged sediment disposal will thus mobilise and release sediment into the water column and in this way will release oxygen depleting substances into the water column. As stated above, monitoring has shown that the effect of dredged sediment disposal on the dissolved oxygen concentration in the water column is usually minimal, localised, and in most cases it is difficult to detect a difference to the baseline a short distance from a dredged sediment disposal operation. The dissolved oxygen concentration in the water column at the dredged spoil disposal site is unknown. Masikane (2011) provides a mean dissolved oxygen concentration for the (integrated) water column at a site at the 10 m contour off the Papenkuils River mouth (i.e. inshore of the dredged spoil disposal site) of 6.84 mg.l-1 in a survey in 2008 and 6.53 mg.l-1 in a survey in 2009. The bottom water concentration was lower than the integrated concentration for the water column, at 5.28 mg.l-1 in 2008 and 5.62 mg.l-1 in 2009. These concentrations exceed that which is usually considered adequate to sustain most forms of aquatic life (5 mg.l-1). It is thus probable the dissolved oxygen concentration in the water column will be depleted when dredged sediment is disposed. Any reduction in the dissolved oxygen concentration that does occur will, however, be temporary as the concentration will return to the baseline shortly after dredged sediment disposal ceases since currents will replenish the concentration. The depletion is unlikely to have a significant impact on ecological processes as the dissolved oxygen concentration in the water column at and near the dredged spoil disposal site is probably fairly high. The impact is thus considered site specific in spatial extent and minor in intensity. The impact is fully reversible as the dissolved oxygen concentration will return to the baseline shortly after each disposal event. The significance rating for this impact without mitigation is thus VERY LOW.

11.3.19 Deterioration in water quality due to the release of nutrients from sediment during disposal

The sediment dredged in Phases 1 and 2 of the proposed project will be disposed at a registered dredged spoil disposal site in Algoa Bay. Dredged sediment is usually disposed from a dredge vessel or barge through two half doors or valves at the bottom of the hull. The dredged sediment in a hopper or barge represents a dense slurry that, when disposed, behaves as a dense fluid when released into the less dense seawater surrounding it. Surveys have shown that most of the sediment disposed in this way reaches the bottom as a fluid mass. However, some of the sediment is stripped into suspension from the descending mass by friction and entrainment of surrounding water. In this way nutrients in the sediment may be released into the water column (Varkitzi et al., 2022), with the same potential environmental consequences as those that might occur when sediment is mobilised by construction activities (see Impact 9). Nutrient concentrations in Algoa Bay are generally low but are higher at and near wastewater discharges from the Papenkuils River estuary and Fishwater Flats marine outfall (van Zyl, 2017).

Dredged sediment disposal will thus mobilise and release sediment into the water column and in this way will release nutrients into the water column. The nutrients will be diluted and dispersed by currents after release. The increase in nutrient concentrations above the baseline is thus likely to be site specific in spatial extent and temporary in duration. It is highly unlikely the released nutrients will stimulate the growth of macro- and microalgae much above the growth attributed to existing nutrient concentrations in Algoa Bay, which are generally low. The intensity is thus anticipated to be minor. This impact is fully reversible since nutrient concentrations will return to the baseline after each disposal event. The significance rating for this impact without mitigation is thus VERY LOW.

11.3.20 Ecological impacts due to the transfer of toxic chemicals in dredged sediment to the dredged spoil disposal site

The sediment dredged in Phases 1 and 2 of the proposed project will be disposed at a registered dredged spoil disposal site in Algoa Bay. The transfer of toxic chemicals in contaminated sediment to open water dredged spoil disposal sites should such disposal be allowed is an unavoidable impact of dredged sediment disposal (Stronkhorst et al., 2003; De Witte et al., 2016; Donázar-Aramendía et al., 2020; Tao et al., 2021). Components of the biological community that survive or avoid the physical effects of dredged sediment disposal (e.g. burial, smothering) and those that colonise the deposited sediment on the dredged spoil disposal site can be exposed to toxic chemicals in the sediment. The toxic chemicals may pose an acute or chronic toxic risk to biological communities, which might also bioaccumulate the chemicals and in this way the chemicals enter food webs in the relevant area (Donázar-Aramendía et al., 2020). Disposed sediment is gradually eroded by currents from dredged spoil disposal sites and in this way deeper sediment that is contaminated by toxic chemicals is exposed, potentially prolonging the exposure of biological communities to toxic chemicals. Toxic chemicals adsorbed onto sediment eroded and dispersed from a dredged spoil disposal site by currents will be deposited in the surrounding area, transferring the contaminants to these areas and increasing the spatial extent over which biological communities might be exposed to toxic chemicals. However, the concentrations in this deposited sediment will be lower than that disposed due to dilution with the surrounding sediment.

The sediment alongside and near the Old Tug Jetty quay area is metal contaminated. There is no information on the concentrations of other chemicals in sediment alongside the quay area but there is information on polycyclic aromatic hydrocarbon, organochlorine pesticide, polychlorinated biphenyl, and butyltin concentrations in sediment near part of the quay area. It is impossible to determine if these chemicals are present in sediment that will be dredged alongside the Old Tug Jetty quay area, but this is probable considering the trend for the sediment nearby and elsewhere in the port. Following the precautionary principle, therefore, the sediment across the dredging footprints is assumed to be mildly contaminated by a suite of toxic chemicals. The sediment is not severely contaminated by metals. Metal concentrations in the sediment are lower than concentrations specified by the Level I and Level II of the sediment quality guidelines (Action List) that the Department of Forestry, Fisheries and the Environment uses to regulate the open water disposal of sediment dredged in South African ports. The South African Action List does not provide guidelines for organic chemicals. The concentrations of organic chemicals in sediment near the Old Tug Jetty quay area do not exceed the Effects Range Low of the sediment quality guidelines derived by Long et al. (1995) for use in North American coastal waters. The Long et al. (1995) sediment quality are widely used to assess the risks posed by chemicals in sediment and have a similar narrative intent as the South African National Action List. The sediment is thus also considered suitable for open water disposal based on the concentrations of other toxic chemicals. The sediment sampled at four stations alongside and near the Old Tug Jetty quay area in July 2022 was tested for toxicity to sea urchin embryo-larvae under a sediment-water interface testing regime. The sediment at three of the stations was not toxic to sea urchin embryo-larvae, while that at the fourth station was slightly toxic. Following the precautionary principle the sediment across the dredging footprints is assumed to be slightly toxic.

The sediment at the dredged spoil disposal site was not significantly contaminated by metals when surveyed in 2017 (Figures 43 and 44).

Toxic chemicals in sediment dredged alongside and near the Old Tug Jetty quay area will thus be transferred to dredged spoil disposal site in Algoa Bay. During disposal, the contaminants will concentrate initially on the dredged disposal site but over time will be eroded and dispersed along with sediment, and in this way they will be diluted and dispersed over a wider area in Algoa Bay. It is unlikely toxic chemicals in the sediment will pose a significant acute toxic risk to all but the most sensitive components of biological communities at and near the dredged spoil disposal site considering the results of the toxicity testing of sediment sampled in the Port of Port Elizabeth in July 2022, including alongside the Old Tug Jetty quay area, but a chronic impact is possible. The intensity for this impact is thus considered low. The impact is considered site specific in extent since toxic chemicals in sediment eroded and dispersed from the dredged spoil disposal site will be deposited over a wider area and in this way will be diluted and are thus unlikely to present an acute toxic risk. The dredged spoil disposal site is not in a particularly dispersive environment and it might thus take some time for toxic chemicals to be eroded and dispersed from the site. The gradual erosion of contaminated sediment will increase the period over which biological communities might be exposed to toxic chemicals in the sediment. The impact is thus considered short-term in duration. The impact is fully reversible since sediment will be dispersed from the disposal site with time, diluting the concentrations of toxic chemicals. The significance rating for this impact without mitigation is thus LOW.

11.3.21 Ecological impacts due to physical effects of sediment disposal at the dredged spoil disposal site

The sediment dredged in Phases 1 and 2 for the proposed project will be disposed at a registered dredged spoil disposal site in Algoa Bay. Dredged sediment is usually disposed from a dredge vessel or barge through two half doors or valves at the bottom of the hull. The dredged sediment in a hopper or barge represents a dense slurry that, when disposed, behaves as a dense fluid when released into the less dense seawater surrounding it. Surveys have shown that most of the sediment disposed in this way reaches the bottom as a fluid mass. A predictable and unavoidable impact of dredged sediment disposal at open water dredged spoil disposal sites is the burial, smothering, and crushing of biological communities, including benthic invertebrate infauna and poorly mobile epifauna, bottom-dwelling fish, and the eggs of invertebrates and fish that are deposited and develop until hatching on the bottom (Miller et al., 2002). Similar impacts can also occur near a dredged spoil disposal site when sediment is transported off the site by currents (Essink, 1999; Miller et al., 2002; Stronkhorst et al., 2003; Bolam et al., 2011; Boon and Dalfsen, 2022). Most benthic invertebrate infauna live in the top 10 cm of sediment and rely on a connection (e.g. burrows) to the sediment-water interface for ventilation (respiration) and feeding. The 'excessive' deposition of fine-grained sediment (mud) on sandy sediment can lead to the clogging of the spaces between sand grains, displacing the fauna that live between the sand grains or retarding the exchange of oxygen with the overlying water, leading to the suffocation of benthic invertebrate fauna. Frequent repositioning to maintain a relative distance to the sediment-water interface, or the need by burrowing organisms to increase maintenance to prevent the infilling of burrows, requires that organisms shift their energy allotment from other functions, such as growth or reproduction. If the deposited sediment has a different grain size to the sediment existing before deposition it may alter the physical properties of the sediment, which can impact on bottom-dwelling fauna that prefer to live in or on sediment of a fairly specific grain size because of their need to maintain an open burrow or because of their mode of feeding, for example (Holland et al., 2005; Smit et al., 2006; Smit et al., 2008; Boon and Dalfsen, 2022). The deposition of muddy sediment on sandy sediment is generally more problematic than the reverse (Diaz and Boesch, 1977; Boon and Dalfsen, 2022). Many benthic invertebrate infauna and epifauna can migrate upwards through placed sediment and may be relatively unimpacted by sediment deposition within reasonable limits (Maurer et al. 1979, 1981a, 1981b, 1982, 1986; Fredette and French, 2004; Wilber et al., 2007). Maurer et al. (1979), for example, found that some benthic invertebrates can migrate through as much as 30 cm of deposited sediment, although other invertebrates are less tolerant of burial and smothering and may be significantly affected by even a thin layer of placed sediment (Schaffner, 1993; Wilber and Clarke, 2007; Hendrick et al., 2016). The consequence of sediment disposal impacts is an altered species composition, abundance, and biomass of biological communities on and near dredged spoil disposal sites (Miller et al., 2002; Bolam and Rees, 2003; Stronkhorst et al., 2003; Bolam et al., 2011; Donázar-Aramendía et al., 2018; Donázar-Aramendía, 2020; Bolam et al., 2021; Tao et al., 2021; Boon and Dalfsen, 2022), with attendant impacts to other ecosystem processes (e.g. fish that rely on invertebrates in the affected area as a food resource will be deprived of this resource and essentially suffer habitat displacement).It should, however, be noted that it is not always possible to determine if the changes in biological communities at dredged spoil disposal sites is a consequence of the physical effects of sediment disposal or other features of the disposed sediment that might also affect biological communities, such as the presence of toxic chemicals in the sediment.

Benthic biological communities impacted by the disposal of dredged sediment do recover after this disturbance. Some benthic invertebrate infauna and epifauna will recolonise newly deposited sediment within hours to days, but recovery to a comparable species composition, abundance, and biomass to that existing before disposal takes longer (potentially years) (Ellis, 1996; Newell, 1998; Gilkinson et al., 2005; Stronkhorst et al., 2003). Initial recolonisation likely occurs by invasion (or active immigration) by motile fauna (e.g. amphipods, crabs; Morton, 1977; van Moorsel 1993, 1994; Hall, 1994; Ellis, 2000) from less or undisturbed areas nearby and by larval settlement (Skilleter, 1998; Ellis, 1996, 2000). Short-lived species and/or species with a high reproduction rate (so-called opportunists; includes amphipods, various worms) recover more rapidly than slower growing, longer-lived species (e.g. gastropods, large worms). If the deposited sediment is substantially different to that at the site prior to sediment disposal, the benthic invertebrates that colonise the site may differ to the those that were present prior to disposal (Tao et al., 2021).

The dredged spoil disposal site can be classified as being in a moderately dispersive environment as evident from the texture of the sediment sampled at and near the disposal site in 2017. Thus, the sediment sampled at and near the dredged spoil disposal site at that time was comprised predominantly of very fine-grained and medium-grained sand (Figure 43 and Table 3). The mud content of the sediment was low, ranging from 1.11-1.43%. In comparison, the sediment sampled near the Old Tug Jetty quay area consists primarily of mud (61.90-93.48%). The texture of the sediment in the dredging footprints is thus somewhat different to that on the dredged spoil disposal site if the measurements made in 2017 are still relevant, which seems probable.

There is no information on benthic and pelagic biological communities at and near the dredged spoil disposal site in Algoa Bay. There are no benthic macroalgae in the area but the water column can be expected to provide habitat for a range of microalgal, invertebrate, and fish species, while other fauna such as birds and dolphins may use the area for foraging. Masikane (2011) investigated the structure and composition of benthic invertebrate communities at a 10 m water column depth at six stations in Algoa Bay, one of which was situated off the Papenkuils River inshore of the dredged spoil disposal site. Masikane (2011) performed two surveys, in 2008 and 2009. The sediment at the Papenkuils River station was found to comprise a higher fine-grained fraction and to have a higher total organic content than other stations. In both surveys the benthic invertebrate community at the Papenkuils River station was dominated by polychaetes, followed either by amphipods or bivalves. Decapoda were also an important component of the community. In contrast, the benthic invertebrate community at other stations was dominated by amphipods. Masikane (2011) concluded that the primary factor influencing the difference in the benthic invertebrate community structure and composition at the Papenkuils River station compared to other stations was the discharge of effluent from the river. Many species of polychaete worms are known to tolerate and in some cases flourish in areas influenced by effluent discharge and may account for the dominance of the benthic invertebrate community by polychaetes. It is uncertain if the benthic invertebrate community at and near the dredged spoil disposal site when undisturbed by dredged sediment disposal would resemble that at the Papenkuils River station investigated by Masikane (2011), but this seems possible. The key feature is that the communities in the area are dominated by small, fast growing, short-lived species that are likely to rapidly re-colonise disturbed areas (providing there is no significant contamination).

The disposal of dredged sediment will thus lead to the burial, smothering, and crushing of benthic biological communities at and possibly also very near the dredged spoil disposal site in Algoa Bay. This is an unavoidable impact of dredged sediment disposal at open water dredged spoil disposal sites. Most of the sediment disposed from dredgers or barges with hull opening doors reaches the bottom as a fluid mass. Fine-grained sediment will be suspended in the water column during disposal events and will disperse and settle in the area surrounding the dredged spoil disposal site depending on prevailing currents, but the volume of sediment that will be deposited on the seabed outside the disposal site is anticipated to comprise a minor proportion of that disposed. The impact is thus considered site specific. It is reasonable to assume biological communities at and near the dredged spoil disposal site in Algoa Bay have been shaped by the repeated disposal of dredged sediment from the Port of Port Elizabeth and that the communities are to a large degree habituated to and tolerant of dredged sediment disposal to the extent possible. It is nevertheless probable that in areas on the dredged spoil disposal site where the deposition of sediment is heaviest the benthic biological community, or at least a significant proportion thereof, will be buried, smothered, and crushed to a degree this will lead to the injury and mortality of components of the community. However, areas of heavy sediment deposition are likely to comprise a very small part of the dredged spoil disposal site and an even smaller part of available similar habitat in Algoa Bay considering the small volume of sediment that will be dredged for the proposed project. In areas of the dredged spoil disposal site where the deposition is less pronounced, benthic biological communities will be disturbed but it is unlikely there will be a complete loss of benthic ecology. The intensity is thus anticipated to be low. The benthic biological community on the dredged disposal site will recover, probably starting within days of a disposal event. However, it will take time for the communities to return to a species composition, abundance, and biomass like that which existed before disposal provided there is no further disposal in a specific area. The surficial sediment near the Old Tug Jetty quay area has a granulometry that is muddier compared to that on the dredged spoil disposal site. The dredged sediment may thus alter the physical properties of sediment on and near the dredged spoil disposal site and in this way might retard recovery. The impact is thus considered short-term. The impact is fully reversible since the disposal of dredged sediment ceases benthic biological communities will return to a species composition, abundance, and biomass like that which existed before disposal. The significance rating for this impact without mitigation is thus LOW.

11.3.22. Impacts associated with the disposal of sediment leading to an elevated seabed at the dredged spoil disposal site

The sediment dredged in Phases 1 and 2 for the proposed project will be disposed at a registered dredged spoil disposal site in Algoa Bay. The disposal of dredged sediment has the potential to raise the seabed at the dredged spoil disposal site. If the seabed is elevated substantially above the current elevation this may pose a navigation hazard to large vessels that occasionally anchor near the disposal site. An elevated seabed also has the potential to refract and amplify waves to a degree this causes shoreline erosion.

The disposal of dredged sediment will raise the seabed at the dredged spoil disposal site in Algoa Bay. However, the volume of sediment that needs to be disposed is so small the elevation is likely to be insignificant and is highly unlikely to refract and amplify waves or to present a navigational risk, especially when it is considered that the disposal of larger volumes of maintenance dredged sediment at the site have had no such apparent impacts. The elevation will be site specific, but the implications would occur over a wider area and is thus local. Considering the small volume of sediment that needs to be disposed, the intensity is minor. The impact will be short-term and reversible as sediment will be eroded by currents from the dredged spoil disposal site, but this will take time. The significance rating for this impact is thus VERY LOW.

11.3.23. Ecological impacts due to the temporary loss of sheet pile wall biological communities

In Phase 1 of the proposed project a counterfort wall will be constructed in front of the existing sheet pile wall at the Old Tug Jetty. The area between the new counterfort wall and existing sheet pile wall will be backfilled with solid material. The biological communities that have colonised the intertidal and subtidal parts of the existing quay wall, including barnacles, sponges, ascidians, and associated communities of animals that live amongst these larger fauna will be destroyed by construction of the counterfort wall. The subtidal parts of fenders, access ladders, and so on, have also been colonised by encrusting fauna and these will also be destroyed when this quay furniture is removed to allow construction of the counterfort wall.

The loss of the sheet pile biological communities will impact on the ecological productivity of the port and possibly also in the neighbouring marine environment. It is not easy to estimate the loss in ecological productivity in the port since the productivity of the biological communities in the port has not been quantified. The biological communities on the sheet pile wall are neither species diverse nor high in biomass, as concluded from a visual survey of the communities in the upper part of the intertidal at various points along the sheet pile wall and based on a comparison to communities in the same part of the intertidal elsewhere in the port. The reason is uncertain but could be related to the fact the sheet pile wall is composed of metal, which may exclude colonisation by some types of fauna (the material from which artificial structures are composed is known to influence the composition of encrusting biological communities). The loss of biological communities, and hence the temporary loss in ecological productivity will not be immediate since the counterfort wall will be constructed progressively. Fauna will probably colonise newly laid parts of the counterfort wall as construction proceeds, but these will probably be impacted by other construction activities and may not be very productive during the construction period.

The loss of the sheet pile fauna and associated productivity will be temporary since fauna will colonise the new counterfort wall. The colonisation will probably be quite rapid, but it will take some time (possibly years) for a ‘mature’ biological community to develop.

The destruction of the sheet pile wall biological communities and associated loss in ecological productivity is an unavoidable consequence of the proposed project. The associated loss in ecological productivity is anticipated to be medium-term in duration since although biota will colonise the new counterfort wall it may potentially take years for the community to reach a similar species composition, abundance, and biomass to that which presently exists on the quay wall. The impact is anticipated to be of a low intensity since although biological communities and ecological productivity will be lost and modified this will be temporary, and because the biological communities on the sheet pile wall are neither species diverse nor high in biomass and their temporary loss is thus unlikely to have a major impact on ecosystem processes in the port. The impact will be local since the loss in ecological productivity will impact on the wider port environment and possibly also the adjacent marine environment, if only temporarily and to a minor degree. The impact is fully reversible since biological communities will colonise the new counterfort wall and these will probably resemble those presently on the quay wall in terms of species composition, abundance, and biomass, and hence also productivity. The significance rating for this impact without mitigation is thus LOW.

11.3.24 Ecological impacts due to underwater noise

Construction activities for the proposed project will lead to the generation of underwater noise. The noise may arise from the engines of construction support vessels, dredging vessels, heavy machinery, and in Phase 2 by pile insertion for the deck-on-pile structure. The most significant source of underwater noise will be associated with piling. A yet to be determined number of tubular piles of 600 mm diameter will be driven into place. The piling period is unknown at this time and will be finalised when the engineering design is finalised. There are two ways in which steel piles can be inserted. The first is vibratory piling, which uses a vibratory hammer. The second is percussive (or hammer) piling, which uses a heavy weight (hammer) to ram piles into the substrate. Percussive piling generates a much higher level of noise than vibratory piling, which can be well above the ambient and can travel over considerable distances underwater.

There is little information on the effect of anthropogenic noise on estuarine and marine invertebrates, but that which is available suggests that some benthic invertebrates do respond behaviourally to anthropogenic noise (Solan et al., 2016; Wang et al., 2022). Various invertebrates use mechanoreception to locate food and prey (e.g. Klages et al., 2002) and are probably sensitive to noise. Solé et al. (2022) exposed European common cuttlefish (Sepia officinalis) adults, larvae, and eggs to playback drilling and percussive pile driving sounds in the laboratory. After exposure, damage was observed in the statocyst sensory epithelia (hair cell extrusion) in adults compared to controls, and no anti-predator reaction was observed. The exposed larvae showed a decreased survival rate with an increasing received sound level when they were exposed to maximum pile-driving and drilling sound levels, but lower sound levels were not found to elicit severe damage. A decrease in the hatching success of eggs was observed with increasing received sound levels.

The potential effects of underwater noise on fish include a range of non-auditory tissue damage to mortality, auditory tissue damage that may permanently reduce hearing ability, a temporary reduction in hearing sensitivity, and behavioural effects such as startle (diving or tighter shoaling) or avoidance responses (Popper and Hastings, 2009; Mueller-Blenkle et al., 2010). Fish near (few meters) active percussive piling operations can be killed by underwater noise, while those within about 15 m can suffer serious non-lethal injury. Behavioural effects occur over large distances of up to □150 m, but potentially further. Although many fish will avoid an area of piling due to the impact of noise, small weak swimming fish and larvae carried by currents may or will be unable to avoid the area.

The potential effects of underwater noise on birds include causing diving them to move away from the area, in which case the consequence is essentially the same as habitat loss, albeit temporary. Underwater noise may also cause diving birds to temporarily interrupt their normal activity leading to, for example, reduced feeding rates, or increased energy expenditure through movement away from sources of disturbance. There is some evidence to suggest that underwater noise from ships has contributed to a marked decline on the population of African Penguins (Spheniscus demersus) in Algoa Bay (Pichegru et al., 2022).

Marine mammals use acoustics for communication, navigation, and foraging, and are particularly sensitive to underwater noise (Clark et al., 2009; Leunissen et al., 2019). Underwater noise emissions can result in disruption of foraging behaviour, displacement, masking of communications, disturbance, and injury (Carstensen et al., 2006; Tougaard et al., 2009; Thompson et al., 2010; Brandt et al., 2011; Paiva et al., 2015; Leunissen et al., 2019). Stress-related responses from increased ambient and local noise levels can include rapid swimming away from ship(s), changes in surfacing, breathing, and diving patterns, changes in group composition, changes in migration routes, and changes in vocalisations (Richardson et al., 1995; Weilgart, 2007). The noise emitted by percussive piling can have serious, permanent impacts on the hearing of cetaceans at distances of up to 250 m from the point of origin, while their behaviour may be affected at distances of 2.5 km pr more from the point of origin.

Construction activities, particularly piling, will thus generate underwater noise that will probably impact on fauna. Dolphins are known to periodically enter the port, presumably to feed. Dolphins and whales are also known to utilise the marine environment near the port - this is in fact one of the preferred habitats for southern right whales (Eubalaena australis), Indian Ocean humpback dolphins (Sousa plumbea), and Indo-Pacific bottlenose dolphins (Tursiops aduncus) in Algoa Bay (Melly et al., 2018). Underwater noise generated by piling in Phase 2 may propagate beyond the port, but it likely to be substantially reduced by the presence of surrounding infrastructure. Dredgers will travel to the dredged spoil disposal site in Algoa Bay, but they are unlikely to significantly increase the amount of noise above existing levels. The spatial extent of this impact is thus regional. The impact on the most sensitive of fauna may be high in intensity in the case of piling. The impact will be short-term and is reversible as the generation of underwater noise will cease when construction ceases. The significance rating for this impact without mitigation is thus MEDIUM.

11.3.25 Ecological impacts due to above water noise disturbance

Construction activities for the proposed project will lead to the generation of above water noise. In phase 1 of the proposed project, the noise will arise from the operation of generators and other machinery, vehicles, and construction support and dredging vessels amongst a host of other noise generating activities usually associated with construction sites. In Phase 2, piling will present an additional source of noise. The above water noise will principally affect aquatic birds, which may as a result avoid the area near construction activities for the period that high noise levels are generated. The consequence is essentially the same as habitat loss (albeit temporary). A field survey provided little evidence that birds use the immediate area near the Old Tug Jetty quay area, probably because of the high levels of human and vessel activity in the area. Birds that do frequent the area are undoubtedly habituated to and tolerant of noise associated with ongoing port activities but are not (at least regularly) exposed to sounds as intense as those that are generated by percussive piling. Even in the case of percussive piling some degree of habituation for some bird species will probably be an outcome (Hill et al., 1997). High levels of noise will not last all day as construction will be limited to daylight hours, meaning birds will be able to roost near the proposed project area at night. However, the noise will go on for some time and may cause sensitive birds to leave the area until construction ceases.

Construction activities, particularly piling in Phase 2 for the deck-on-pile structure, will generate above water noise that will probably impact on birds in the area. Birds that feed in, roost, or otherwise frequent the proposed project area are undoubtedly habituated to the prevailing above water noise associated with port operations. The intensity of noise generated by percussive piling will, however, exceed that generated by prevailing port operations and may present a substantial disturbance for the most sensitive birds. Some birds will probably become habituated to the above water noise, but others might leave the immediate area. Few birds use the proposed project area due to ongoing human and vessel activities. Noise will be generated throughout the construction period, but piling, which will generate the largest amount of noise, will be restricted to daylight hours over a relatively short period. The impact intensity is thus considered low, the duration as short-term, and the extent as site specific. This impact is fully reversible as birds will use the area once the noise recedes after construction. The significance rating for this impact without mitigation is thus LOW.

11.3.26 Impact of altered quay wall geometry on hydrodynamics

Phase 1 of the proposed project calls for the installation of a counterfort wall in front of the existing Old Tug Jetty sheet pile wall. The counterfort wall will result in the permanent loss of open water and sediment habitat since at its maximum extent it will project 6 m further into the port than the existing sheet pile wall. The total surface area of counterfort wall extension is estimated at 1003 m2. Phase 2 of the proposed project calls for the construction of a deck-on-pile structure extension to part of the counterfort wall. The construction will require the installation of a yet to be determined number of piles to support the deck. Changes to the geometry of quay walls and other infrastructure in ports and the installation of piles can lead to changes in the strength and direction of currents and in this way can negatively impact on ecological processes by altering sediment erosion and deposition patterns and the flushing and turnover of the water column (and in the worst case scenario lead to the development of (periodically) stagnant conditions in the water column), and can concentrate the settlement of toxic contaminants on the bottom in specific areas. Altered current strengths can affect the migration of fauna, such as larval or very small fish and invertebrates. No modelling has been performed to determine how the altered geometry of the Old Tug Jetty quay wall and the installation of piles for the deck-on-pile structure will impact on hydrodynamic processes in the Port of Port Elizabeth. The change caused by the quay wall extension will probably be insignificant considering the small increase in its projection into the port and because the new quay wall will be aligned to the existing quay wall. The existing deck-on-pile structures near and joined to the Old Tug Jetty quay area have affected sediment accumulation in the area. This is evident in the shallower water beneath these structures, as evident from the bathymetric survey of the area (see Figure 9). It is probable the accumulation is a result of the difficulty of dredging sediment beneath the deck-on-pile structures.

A permanent change in port hydrodynamics will thus occur and will be irreversible. However, it is unlikely the altered hydrodynamics will have a significant impact on ecological processes and the intensity is thus minor.

The impact will likely only affect a small area near the rehabilitated and new structures and is thus site specific. The significance rating for this impact is thus VERY LOW.

11.3.27 Ecological impact due to permanent habitat loss

Phase 1 of the proposed project will involve for the installation of a counterfort wall in front of the existing Old Tug Jetty sheet pile wall. The counterfort wall will result in the permanent loss of open water and sediment since at its maximum extent it will project 6 m further into the port than the existing sheet pile wall. The total surface area of counterfort wall extension is estimated at 1003 m^2. Phase 2 of the proposed project will involve the construction of a deck-on-pile structure extension to part of the counterfort wall. The construction will require the installation of a yet to be determined number of piles to support the deck. The area encompassed by the piles will result in the permanent loss of open water and sediment. The surface area of sediment that will be lost comprises of sediment surface area in the port. The volume of open water that will be lost comprises a similarly small proportion of the open water available in the port.

The permanent loss of open water and sediment will diminish the available habitat for pelagic and benthic biological communities. The permanent loss of open water and sediment habitat will impact on the ecological productivity of the port and may have a minor impact on the ecological productivity of the adjacent marine environment as these environments are connected. It is impossible to estimate the loss in ecological productivity as there is no information on the productivity of water column and benthic habitat in the proposed project footprint. The area and volume of open water and sediment habitat that will be permanently lost is, as stated above, small in relation to the overall open water and sediment habitat in the Port of Port Elizabeth and comparable habitat is available elsewhere in the port. The open water and sediment habitat that will be lost are already disturbed and are thus not in a pristine state. The loss of habitat will not result in habitat fragmentation since the extended quay will follow the line of the existing quay wall/shoreline.

The proposed project will thus result in the permanent loss of open water and sediment habitat. The loss is essentially irreversible since the quay wall extension will be designed for a 50-year service life. The volume and area of open water and sediment that will be lost is small in relation to the overall water volume and sediment in the port but will affect ecological processes beyond the development footprint and the spatial extent is thus local. The loss of open water and sediment will diminish the available habitat for biological communities but is unlikely to have population level effects nor a major effect on ecological processes in the port. Nevertheless, habitat will be permanently lost and the intensity is thus moderate. The significance rating for this impact without mitigation is thus LOW.

11.3.28 Ecological impact due to habitat modification by the deck-on-pile structure

If there is demand for deeper berth, Phase 2 of the proposed project will involve the construction of a deck-on-pile structure seaward of the counterfort wall. The current conceptual engineering design has the deck-on-pile structure extending 5.8 m from the counterfort wall.

Deck-on-pile structures present several ecological impacts apart from habitat loss due to the presence of piles (as addressed above – see Impact 26). The most obvious is shading of the water environment beneath.

Shading by overwater structures has been shown to reduce macrophyte and macroalgal density by inhibiting photosynthesis (Pardal-Souza et al., 2017). In this way communities of aquatic vegetation that provide valuable nursery habitat for invertebrates and fish and foraging habitat for invertebrates, fish, and birds, are damaged or completely lost (Sanger et al., 2004; Castellan and Kelty, 2005; Pardal-Souza et al., 2017). Shading in this context is insignificant for the proposed project as there are no macrophytes in the project area and virtually no macroalgae on piles on jetties alongside the Old Tug Jetty. The absence of macroalgae may be a dual consequence of shading by the existing deck-on-pile structures and by vessels that moor alongside these structures.

Shading by overwater structures also has consequences for fish and invertebrates. Haas et al. (2002), Morley et al. (2012), and Pardal-Souza et al. (2017) found that densities and assemblages of epibenthic organisms were reduced or altered beneath overwater structures compared to areas with no such structures. Many fish are visually oriented and a sudden change in light can reduce their performance in visual tasks, such as spatial orientation, prey capture, schooling, predator avoidance, and migration, and cause them to avoid shaded areas under overwater structures (Bulleri et al., 2004; Munsch et al., 2017). Abundances of fish can thus be substantially reduced under overwater structures (Able et al., 1998; Able and Duffy-Anderson, 2005; Southard et al., 2006; Able et al., 2013; Munsch et al., 2017). Other fish take advantage of overwater structures, especially ambush predators like large teleost fish and sharks (Cermak, 2002; Able et al., 2013; Grothues et al., 2016; Munsch et al., 2017). There is evidence that pylons attract more adult piscivorous species and fewer juveniles than adjacent habitats. By concentrating predators, such structures may pose a threat to other fish. Toft et al. (2004) reported significantly greater abundance of several fish species beneath overwater structures compared to open water habitat, while Able et al. (1998) and Able and Duffy-Anderson (2005) also found that certain fish preferred this habitat. In this case the fish were not visual predators but rather rely on other senses, such as olfaction, to detect and capture prey. This provides support for a reduced light regime impact of overwater structures favouring species adapted to a low light intensity niche.

The piles on overwater structures provide habitat for encrusting fauna, such as mussels, barnacles, and oysters. When these organisms die, including through predation, their shell remains may be displaced by other fauna from the pile and sink to the bottom, modifying the nature of the substrate (to become donated by shell hash) and a consequent change in benthic invertebrate communities (Able and Duffy-Anderson, 2005). The shell hash will displace native invertebrates unable to live in and on this substrate and favour colonisation by those that can.

Overwater structures thus lead to changes in habitat that have implications for ecosystem processes. A benefit of overwater structures is they do not result in the complete loss of habitat as do bulkhead structures (e.g. the proposed counterfort wall) and provide habitat for fauna and perhaps also flora, albeit that the biological assemblages are usually modified compared to the absence of such a structure, as discussed above.

The proposed deck-on-pile structure will thus cause shading and will modify the sediment habitat beneath. These negative impacts will be slightly offset by the positive impact of the piles offering habitat for encrusting biological communities. It is probable the species diversity and biomass of the fauna that colonise the piles will exceed that in the sediment habitat lost by their placement, but this will might not offset the total adverse impact of the structure on ecological processes. The impact of the deck-on-pile structure will be local as it will affect ecological processes in the wider port area by modifying ecological productivity, but this is unlikely to be a significant effect and the intensity is thus considered low. The impact will be permanent and irreversible since the structure will be designed for a 50-year service life. The significance rating for this impact without mitigation is thus LOW.

11.3.29 The damage and disruption of paleontological resources as preserved in its host rocks within the development footprints.

The proposed developmental layout is located in an area highlighted as palaeontological interest due to the surficial geological cover with fossiliferous potential. The construction phase of the old tug jetty redevelopment will entail the removal of the previous concrete, cement plaster, cast, foundation, and pile and re-casting and framing on the underlying bedrock. Therefore, ground disturbance and strains on the environmental integrity and the potential palaeontological resources within the project vicinity are inevitable.

The probability of discovery is considered likely (3) due to the information drawn from the SAHRIS palaeo-map and review, even though the field investigation suggests otherwise. The spatial extent is considered local as the impact would compromise the integrity of adequate representation only within the local area. The temporal dimension was rated long-term due to the possible lifespan of hydrochemical alteration resulting from the disturbance of paleontological reserves.

11.3.30 Planning Phase-Employment creation

The planning phase of the proposed project resulted in appointment of a range of experts such as consulting engineers for design and project management, environmental practitioners for conducting EIAs etc. This positive impact was limited to the region, the magnitude is low and duration is short term. The probability of the impact occurring is definite.

11.3.31 Construction Phase-Employment creation

The investment that would be required for the construction phase of the proposed Rehabilitation of the Old Tug Jetty is R240 million. It can therefore be considered as a reasonably large construction project. For this reason, a noteworthy outcome of this development, throughout its construction phase, will be the creation of 397 direct employment opportunities in the semi-skilled category.1

The employment situation in the NMB Metro has drastically deteriorated over the last few decades, among others due to the medium-term slowdown of local economic growth and the more recent lingering economic effects of the Covid-19 pandemic. Currently, the unemployment rate in the NMB Metro is on average somewhere between 36% and 42%. Despite the severity of such figures, even the higher of the two figures (42%) is forgiving, because it hides local extremes in places on the urban periphery where unemployment far exceeds the 50% mark. Furthermore, the poverty rate which is naturally allied to unemployment, shows a steady year-on-year increase (over the past decade). These realities are naturally prioritised for intervention in the most recent Integrated Development Plan of the NMB Metro (NMBM, 2022a). When looked at in this context, job creation is an important impact of the proposed development.

The creation of direct employment opportunities is not the only job related advantage of the construction phase of the proposed development. A number of indirect and induced employment opportunities would naturally follow. Whereas a direct job is something that is directly related to the construction of a project, indirect jobs are created due to the provision of goods and services by suppliers and distributers to the on-site construction activities. Induced jobs lastly result from the spending and consumption by direct and indirect workers (IFC, 2013). Using the same methodology as above, the number of indirect and induced employment opportunities that will be created by the proposed development's construction phase and activities is estimated at 426.

The creation of employment opportunities (direct, indirect and induced jobs) is likely to have a considerable socio-economic impact in the form of increased economic activity, poverty alleviation and favourable socio-economic implications (such as improved access to and consumption of goods and services, greater freedom of choice, better quality of life, and so on) for the affected individuals and their dependants. Using local household size estimates (StatsSA, n.d.), the latter translates into a total of slightly more than 1349 people for the direct job category alone. In a Metro where unemployment is no doubt a challenge and where the economy grows slower than the population, employment creation translates into a significant impact.

11.3.32 Skills development and transfer

The commitment by developers to recruit local labour, as far as possible, in order to benefit local communities in general and the unemployed in particular, is almost standard practice in South Africa when construction projects are proposed. The proposed Rehabilitation of the Old Tug Jetty is no different and a number of employment opportunities stand to be created within the semi-skilled category. This is likely to have a considerable socio-economic impact in the form of poverty alleviation and favourable socio-economic implications (improved access to and consumption of goods and services, greater freedom of choice, better quality of life and so on) for the affected individuals and their dependants.

One well-known limiting factor that is expected to complicate the 205ransshipment205 of local labour during the construction phase of the proposed development, is the educational attainment of the prospective labour force, particularly in the case of semi-skilled and unemployed workers. The twin problems of illiteracy and low levels of post-school education and/or training are clear obstacles in this case. Thus, in order to supply the construction phase of the proposed development with the necessary local labour, the developer will most likely have to engage in a process of skills development and transfer.

In a Metro that is burdened by poverty and high unemployment rates and where many of the unemployed may actually be unemployable without some form of intervention, skills development and transfer are likely to have a substantial socio-economic impact. The benefits would essentially revolve around the improved socio-economic mobility of people and should extend well beyond the construction phase of the proposed development. Relevant individuals would for example be able to sell their newly acquired skills within and beyond the boundaries of the local economy long after the completion of the construction phase. Although the Construction Sector is not the largest employer in the local economy, it shows tremendous growth potential if recent positive trends in building plan approvals in the NMB Metro are taken into account (NMBM, 2022b). The Construction Sector would therefore be in a good position to absorb purposefully skilled labour in the future.

11.3.33 Economic stimulation of NMBM

The above impacts are not the only impacts of the construction phase of the proposed Rehabilitation of the Old Tug Jetty. Other important impacts are likely to occur in addition to these, but the lack of quantifiable particulars (in spite of their importance) saw them consigned to this section. The following impacts are singled out here:

a) The first impact concerns the positive contribution of the proposed Rehabilitation of the Old Tug Jetty to the Gross Domestic Product (GDP) of the NMB Metro.

GDP provides a measure of the total economic and sectoral activity within a particular area (municipalities, regions, etc.). Expressed as the Rand (market) value of all final goods and services that are produced and sold within a given period of time, GDP is a well-known measure of the status of a municipality's economic activity. It can therefore be used to reflect the capability of a municipality to create, sustain and develop its own economy. Contributions to the GDP of any particular place therefore carry an obvious importance, something that is particularly associated with construction projects (Lewis, 2008; Nhlapo, 2013). Although the actual contribution of the proposed development to the local GDP may appear relatively small in real terms (albeit positive), it will nevertheless happen at a time when the local economy is struggling to reflect a growth rate of rarely more than 1.5% year-on-year (NMBM, 2022b). The slow post-Covid recovery rate and of course the problem of energy insecurity in the country and obviously in the NMB Metro as well, add to the woes of the local economy. These realities alone justify the special mention of the above impact.

b) The second impact that deserves reference is the positive affect that construction projects such as the proposed Rehabilitation of the Old Tug Jetty are certain to have on the local economy via the demand for goods and services.

Higher levels of local economic activity normally follow the demand for goods and services (and the supply thereof) and this in turn is likely to culminate into various socio-economic benefits, such as employment creation and poverty reduction. The extent of this impact is of course a factor of the size and health of the local economy in question and the subsequent ability of local service providers to meet such demands. It follows that the more limited this ability, the more leakage will take place from the local economy as developers would be compelled to source relevant goods and services elsewhere (DBIS, 2008). Although some leakage will inevitably occur, albeit not much given the nature of the proposed development, the impact remains relevant in the context of the positive effect that the demand for goods and services will have on the local economy.

The proposed development by virtue of its nature (construction / civil engineering) is generally not known to have operational phase socio-economic impacts that are always directly measurable and/or apparent. That some impacts in this case are mostly secondary in effect does however not distract from the importance thereof as will be evident in the notes below.

11.3.34 Secondary operational phase impacts

The following socio-economic impact of the proposed Rehabilitation of the Old Tug Jetty is singled out here due to its relevance and socio-economic importance:

a) Enabling economic continuity of the Port of Port Elizabeth.

The link between the site and nature of the proposed Rehabilitation of the Old Tug Jetty and the fishing industry is an important one. In this context, the Old Tug Jetty provides berthing for fishing vessels and trawlers and supports an industry with far reaching economic consequences. According to Brick & Hasson (2016:iv) "The fishing industry does not exist in isolation but has multiple backward and forward linkages with other sectors in the economy. By considering these linkages, one is able to determine the total value of fishery production to the entire economy." They estimate direct employment to be 27 000 while indirect employment is estimated to be between 81 000 and 100 000. Although these estimates were done in 2016 and for the fishing industry as a whole, considering the position of the Port of Port Elizabeth as the second most important centre in this industry outside Cape Town, the number of employment opportunities that it supports in the fishing industry can be assumed to be substantial. The Old Tug Jetty therefore contributes positively to the functionality and economic continuity of the port (the ability to continue to perform the socio-economic role that it does in support of the fishing industry.

11.3.35 Policy and Legislative Context

There is a risk of non-compliance with the environmental laws and policies of South Africa which could lead to pollution of the aquatic environment, unnecessary delays in construction activities, and potentially criminal cases, based on the severity of the noncompliance, being brought against the Applicant and the appointed contractors. The magnitude of the impact is very high, spatial extent is regional, duration is short term and the probability of the impact occurring is likely. This is a negative impact, and the significance is medium.

11.3.36 Scheduling of Construction

The proposed project requires careful planning and scheduling so that construction activities take place during the driest times. The appointed contractor should avoid delays in the construction program and thus also avoid prolonged environmental impacts. Some delays are caused by natural events such as heavy rains. Thus, the timing of construction as well as the rate at which progress takes place may impact the environment as well as the surrounding businesses and communities. The impact is thus negative in nature but is reversible. The magnitude of the impact is low, spatial extent is site specific, duration is short term, and the probability is likely. This is a negative impact however the significance is low.

11.3.37 Air Quality

The proposed development will entail potential air pollutants during construction which may be dust emanating from site preparation and excavations. Minor exhaust gases are expected to be emitted by construction vehicles, equipment and plant**.** The magnitude of the impact is low and the spatial extent is local, the duration of the impact is short term as the dust and other fumes emitted will subside when construction activity ceases, The probability of the impact occurring is highly likely. This is a negative impact however the significance is very low.

11.3.38 Disturbance of existing land uses and visual impact

As the development of the Port of Port Elizabeth is closely linked to the inhabitants of the NMBMM due to the national and regional importance of the port it is imperative that attention should be directed to the potential social impacts of the development. The importance of assessing the impact of any development of the social environment is also reflected in the prominence of social environment in the principles adopted by the international community for the assessment of environmental impacts such as the Equator Principles and the Performance Standards adopted by the International Finance Corporation. It is noted that there are several businesses in the vicinity of the proposed project area which includes boat repairers/maintainers, fishing vessels and 208ransshipment of supplies, It is expected that the operational times of these businesses may be disturbed during construction phase of the project due to inaccessibility of their working areas and conflicting time schedules with the contractor, Prior and during the construction stage, the business currently relying on the quay wall must be consulted to understand their operations and to ensure that business activities are not negatively impacted. Adequate planning and completion of the project on time will be key to reducing the financial risk to surrounding businesses. A grievance mechanism will be established on site during construction so that there is open and ongoing communication between the appointed contractor and the surrounding businesses.

During construction, the presence of large construction vehicles and plant may cause visual disturbance to the surrounding landowners and occupants. The stockpiling of material and equipment on site may also disturb the existing land uses. The internal roads within the port may also be inaccessible or have slow traffic due to delivery of materials to site. The magnitude of the impact is low and the spatial extent is site, the duration of the impact is short term as the impact will subside when construction activity ceases, The probability of the impact occurring is highly likely. This is a negative impact however the significance is very low.

11.3.39 Climate Change

According to DFFE Oceans & Coasts (2023), the coastal flooding risk is non-existent within the port itself but area around the port have has a very high to moderate risk of flooding due to exposure to open waters(Figure 52). The long-term risk of coastal erosion is very low in the area where the port infrastructure is located, however, the area on the outer sides of the port has a very high to moderate risk of long-term erosion (Figure 53). The risk related to estuarine erosion within the port is mostly moderate with some areas showing high risk, and upstream, the risk is low (Figure 54). The risk for estuarine flooding is mostly moderate, with a small area having high risk of exposure to flooding with the port (Figure 55).

The infrastructure must be designed to be resilient against anticipated climate change events such changes in sea levels and wind and waves. It is important to understand that the proposed sheet pile wall design wall will be sufficient to prevent any overtopping and flooding of the port infrastructure from the sea. This would be a negative impact which is reversible at a high cost.

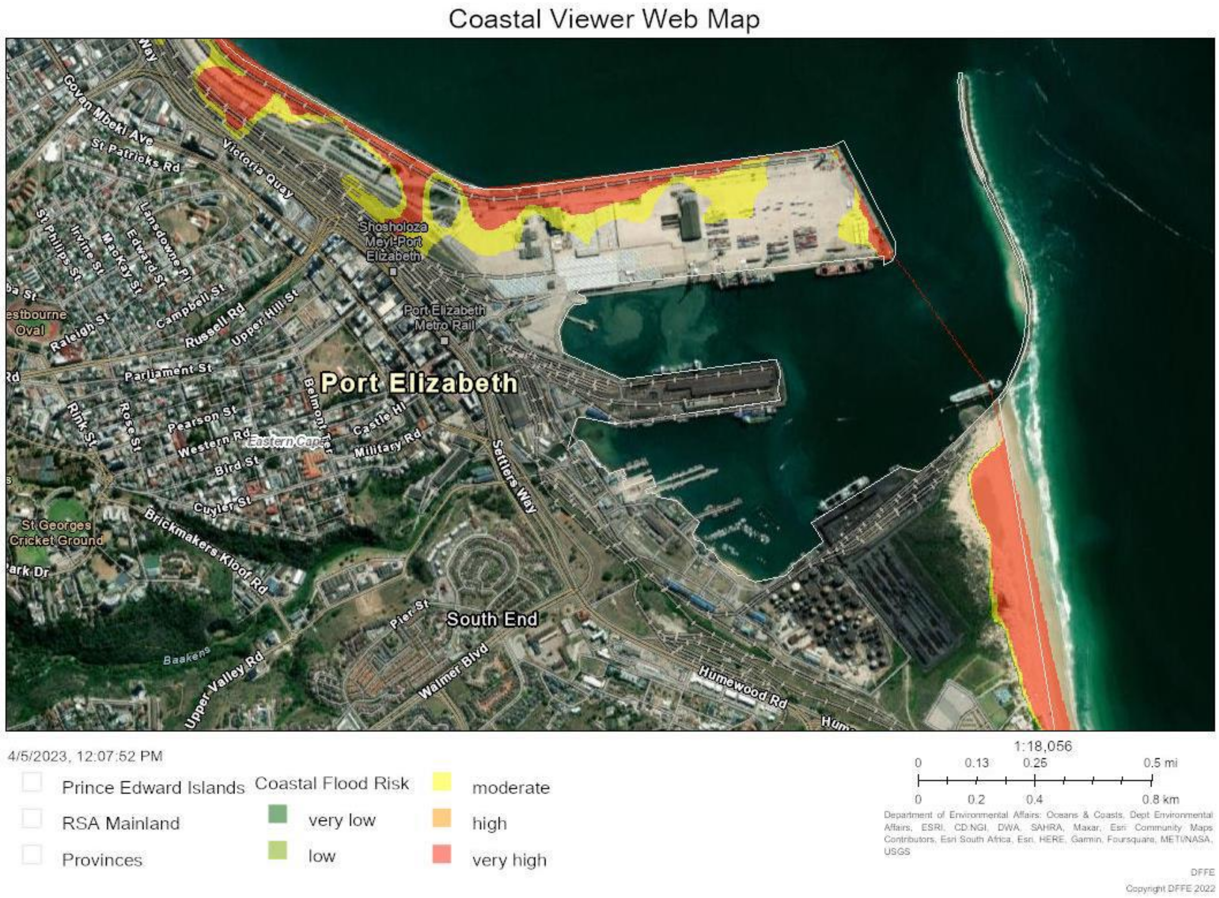

Figure 52: Coastal Flooding Risk Profile of Old Tug Jetty (DFFE O&C. 2023)

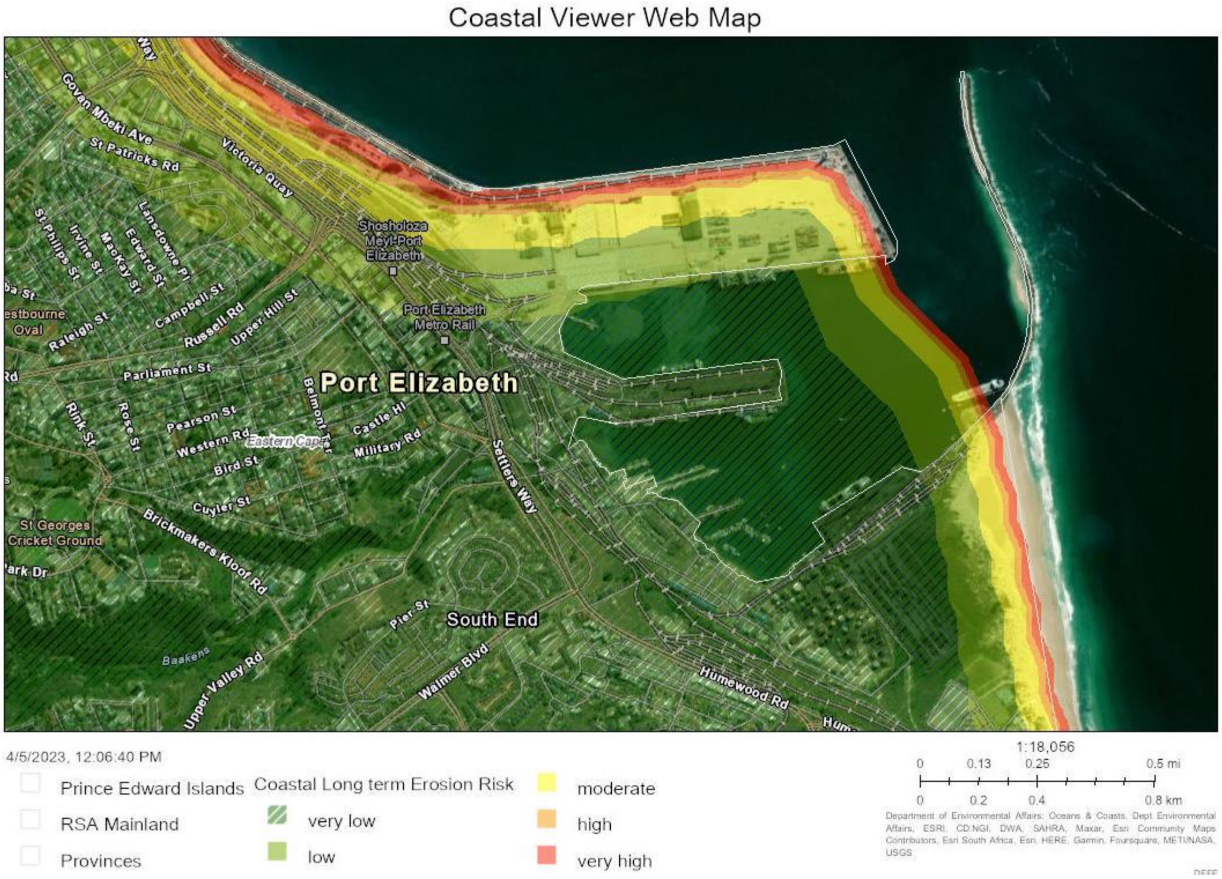

Figure 53: Coastal Erosion profile of Old Tug Jetty (DFFE O&C. 2023)

Figure 54: Estuarine erosion risk profile of Old Tug Jetty (DFFE O&C. 2023)

Figure 55: Estuarine flood risk profile (DFFE O&C. 2023)

The magnitude of the impact is medium, the spatial extent is local, the duration is long term and the probability of the impact occurring is likely. An allowance of an additional 40cm height was included in the designs to cater for climate change sea level height increases.

11.3.40 Safety-Injuries and fatalities during construction

It may be possible that there may be fatalities and injuries during construction due to failure of equipment, untrained workers of natural disasters. This is a negative impact and is reversible with mitigation such as training of workers and providing PPE. The magnitude of the impact is low and the spatial extent is site, the duration of the impact is short term as the impact will subside when construction activity ceases, The probability of the impact occurring is highly likely especially without mitigation.

11.3.41 Improved Jetty stability and safety

The proposed project will result in a safer and structurally stable jetty which will allow the current transportation and berthing activities to continue. This is a positive impact with a medium magnitude, spatial extent is local, duration is permanent, and the probability is highly likely. This is a negative impact, and the significance is medium.

11.4 IMPACT ASSESSMENT AND SIGNIFICANCE

A summary of all the identified preliminary impact, their associated phase, as well as their impact calculations and significance are presented in **Table *19*** below. The preferred alternative is labelled (Alt 1), modified design (Alt 2)and No-Go is identified as (Alt 3).

Table 19: Impact Assessment and Significance

			PRE-MITIGATION						POST-MITIGATION					
Impact	**Phase**	**Alternatives**	**Nature**	**Magnitude**	**Spatial Extent**	**Duration**	**Probability**	**Significance**	**Nature**	**Magnitude**	**Spatial Extent**	**Duration**	**Probability**	**Significance**
1.Impacts due to the ingress of non-hazardous solid waste into the port	Construction	Alt 1& 2	-1	5	5	5	4	-60	-1	4	5	5	2	-28
2.Environmental deterioration due to spillages from portable toilets	Construction	Alt 1& 2	-1	3	1	2	2	-12	-1	1	1	1	1	-3
3.Impacts to soil, sediment, and geology	Construction	Alt 1& 2	-1	1	1	5	1	-7	-1	1	1	5	1	-7
4.Deterioration in water and sediment quality due to	Construction	Alt 1& 2	-1	4	2	4	4	-40	-1	1	1	2	2	-8

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
hazardous material spills and leaks														
5.Ecological impacts due to the spillage of construction material and demolition debris into the port	Construction	Alt 1& 2	-1	1	1	1	4	-12	-1	1	1	1	4	-12
6.Deterioration in water quality due to increased suspended sediment concentrations and turbidity caused of construction activities	Construction	Alt 1& 2	-1	1	1	1	2	-6	-1	1	1	1	2	-6

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
7.Ecological impacts due to the deposition of sediment mobilised and introduced into the water column by construction activities	Construction	Alt 1& 2	-1	2	1	1	2	-8	-1	2	1	1	2	-8
8.Deterioration in water quality due to the release of oxygen depleting substances from sediment by construction activities	Construction	Alt 1& 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3

		PRE-MITIGATION							POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
9.Deterioration in water quality due to the release of nutrients from sediment by construction activities	Construction	Alt 1& 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
10.Deterioration in water and sediment quality due to the mobilisation of toxic chemicals from sediment by construction activities	Construction	Alt 1& 2	-1	2	1	1	3	-12	-1	2	1	1	3	-12

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
11.Deterioration in water quality due to dredging related increases in suspended sediment concentrations and turbidity	Construction	Alt 1& 2	-1	3	2	1	5	-30	-1	1	1	2	5	-20
12.Ecological impacts due to the deposition of sediment outside the dredging footprint	Construction	Alt 1& 2	-1	2	1	2	2	-10	-1	2	1	2	2	-10
13.Deterioration in water quality due to the release of oxygen depleting substance	Construction	Alt 1& 2	-1	2	1	2	5	-25	-1	1	1	1	5	-15

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
s from sediment by dredging														
14.Deterioration in water quality due to the release of nutrients from sediment by dredging	Construction	Alt 1& 2	-1	1	1	2	2	-8	-1	1	1	2	2	-8
15.Deterioration in water quality due to the release of toxic chemicals from sediment by dredging	Construction	Alt 1& 2	-1	2	1	2	4	-20	-1	2	1	2	4	-20

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
16.Ecological impacts due to the removal, injury, and disturbance of biological communities in dredging footprints	Construction	Alt 1& 2	-1	2	1	3	5	-30	-1	2	1	3	5	-30
17.Deterioration in water quality due to an increase in suspended sediment concentrations during dredged sediment disposal	Construction	Alt 1& 2	-1	1	1	1	5	-15	-1	1	1	1	5	-15

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
18.Deterioration in water quality due to the release of oxygen depleting substances from sediment during disposal	Construction	Alt 1& 2	-1	1	1	1	4	-12	-1	1	1	1	4	-12
19.Deterioration in water quality due to the release of nutrients from sediment during disposal	Construction	Alt 1& 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
20.Ecological impacts due to the transfer of toxic chemicals in dredged sediment	Construction	Alt 1& 2	-1	2	1	2	3	-15	-1	2	1	2	3	-15

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
to the dredged spoil disposal site														
21.Ecological impacts due to physical effects of sediment disposal at the dredged spoil disposal site	Construction	Alt 1& 2	-1	2	1	2	5	-25	-1	2	1	2	5	-25
22.Impacts associated with the disposal of sediment leading to an elevated seabed at the dredged spoil	Construction	Alt 1& 2	-1	2	2	3	2	-14	-1	1	2	2	1	-5

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
disposal site														
23. Ecological impacts due to the temporary loss of sheet pile wall biological communities	Construction	Alt 1& 2	-1	2	2	3	2	-14	-1	2	2	3	2	-14
24. Ecological impacts due to underwater noise	Construction	Alt 1& 2	-1	4	3	2	4	-36	-1	3	2	2	4	-28
25. Ecological impacts due to above water noise	Construction	Alt 1& 2	-1	2	1	2	4	-20	-1	2	1	2	4	-20

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
disturbance														
26. Impact of altered quay wall geometry on hydrodynamics	Operation	Alt 1& 2	-1	1	1	5	1	-7	-1	1	1	5	1	-7
27. Ecological impact due to permanent habitat loss	Operation	Alt 1& 2	-1	3	2	5	2	-20	-1	3	2	5	2	-20
28. Ecological impact due to habitat modification by the deck-on-pile structure	Operation	Alt 1& 2	-1	2	2	5	2	-18	-1	2	2	5	2	-18

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
29.The damage and disruption of paleontological resources as preserved in its host rocks within the development footprints.	Construction	Alt 1& 2	-1	3	2	4	3	-27	-1	1	1	1	3	-9
30.Employment creation	Construction	Alt 1& 2	1	4	2	2	5	40	1	4	2	2	5	40
31.Skills development and transfer	Construction	Alt 1& 2	1	4	2	2	5	40	1	4	2	2	5	40
32.Scheduling of Construction	Planning	Alt 1& 2	-1	1	2	3	4	-24	-1	1	2	2	3	-15
33.Employment creation	Planning	Alt 1& 2	1	1	2	2	3	15	1	1	2	2	3	15
34.Policy and	Construction	Alt 1& 2	-1	5	2	3	3	-30	-1	3	2	3	2	-16

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
Legislative Context														
35.Air Quality	Construction	Alt 1& 2	-1	2	2	2	3	-18	-1	2	2	2	2	-12
36.Disturbance of existing land uses and visual impact	Construction	Alt 1& 2	-1	2	2	2	4	-24	-1	2	2	2	4	-24
37.Climate Change	Operation	Alt 1& 2	-1	3	2	5	3	-30	-1	3	2	5	2	-20
38.Safety-Injuries and fatalities during construction	Operation	Alt 1& 2	-1	5	3	2	3	-30	-1	3	2	2	2	-14
39.Improved Jetty stability and safety	Operation	Alt 1& 2	1	4	3	5	5	60	1	4	3	5	5	60
40.Economic stimulation of NMBM	Operation	Alt 1& 2	1	2	2	3	3	21	1	2	2	3	3	21

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
1.Impacts due to the ingress of non-hazardous solid waste into the port	Construction	Alt 3	-1	1	2	5	4	-32	-1	1	2	5	4	-32
2.Environmental deterioration due to spillages from portable toilets	Construction	Alt 3	-1	1	1	2	1	-4	-1	1	1	2	1	-4
3.Impacts to soil, sediment, and geology	Construction	Alt 3	-1	1	1	5	1	-7	-1	1	1	5	1	-7
4.Deterioration in water and sediment quality due to hazardous material spills and leaks	Construction	Alt 3	-1	2	2	4	1	-8	-1	2	2	4	1	-8

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
5.Ecological impacts due to the spillage of construction material and demolition debris into the port	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
6.Deterioration in water quality due to increased suspended sediment concentrations and turbidity caused of construction activities	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
7.Ecological impacts due to the deposition of sediment mobilised and introduced	Construction	Alt 3	-1	2	1	1	1	-4	-1	2	1	1	1	-4

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
into the water column by construction activities														
8.Deterioration in water quality due to the release of oxygen depleting substances from sediment by construction activities	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
9.Deterioration in water quality due to the release of nutrients from sediment by construction activities	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3

		PRE-MITIGATION							POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
10.Deterioration in water and sediment quality due to the mobilisation of toxic chemicals from sediment by construction activities	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
11.Deterioration in water quality due to dredging related increases in suspended sediment concentrations and turbidity	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
12.Ecological impacts due to the deposition	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
of sediment outside the dredging footprint														
13.Deterioration in water quality due to the release of oxygen depleting substances from sediment by dredging	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
14.Deterioration in water quality due to the release of nutrients from sediment by dredging	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
15.Deterioration in water quality due	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3

		PRE-MITIGATION							POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
to the release of toxic chemicals from sediment by dredging														
16.Ecological impacts due to the removal, injury, and disturbance of biological communities in dredging footprints	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
17.Deterioration in water quality due to an increase in suspended sediment concentrations during dredged	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
sediment disposal														
18.Deterioration in water quality due to the release of oxygen depleting substances from sediment during disposal	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
19.Deterioration in water quality due to the release of nutrients from sediment during disposal	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
20.Ecological impacts due to the transfer of toxic	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
chemicals in dredged sediment to the dredged spoil disposal site														
21.Ecological impacts due to physical effects of sediment disposal at the dredged spoil disposal site	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
22.Impacts associated with the disposal of sediment leading to an elevated seabed at the dredged spoil	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
disposal site														
23. Ecological impacts due to the temporary loss of sheet pile wall biological communities	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
24. Ecological impacts due to underwater noise	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
25. Ecological impacts due to above water noise disturbance	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
26. Impact of altered quay wall geometry	Operation	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
on hydrodynamics														
27. Ecological impact due to permanent habitat loss	Operation	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
28. Ecological impact due to habitat modification by the deck-on-pile structure	Operation	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
29.The damage and disruption of paleontological resources as preserved in its host rocks within the developme	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
nt footprints.														
30.Employment creation	Construction	Alt 3	1	1	1	1	1	3	1	1	1	1	1	3
31.Skills development and transfer	Construction	Alt 3	1	1	1	1	1	3	1	1	1	1	1	3
32.Scheduling of Construction	Planning	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
33.Employment creation	Planning	Alt 3	1	1	1	1	1	3	1	1	1	1	1	3
34.Policy and Legislative Context	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
35.Air Quality	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
36.Disturbance of existing land uses and visual impact	Construction	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
37.Climate Change	Operation	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
38.Safety-Injuries and fatalities during construction	Operation	Alt 3	-1	1	1	1	1	-3	-1	1	1	1	1	-3
39.Improved Jetty stability and safety	Operation	Alt 3	1	1	1	1	1	3	1	1	1	1	1	3
40.Economic stimulation of NMBM	Operation	Alt 3	1	1	1	1	1	3	1	1	1	1	1	3

11.5 ASSESSMENT OF POTENTIALLY SIGNIFICANT IMPACTS

For the purposes of this EIA Study, potentially significant impacts are defined as those impacts with a significance score greater than 10 and up to greater than 60 points. These are provided in the table below:

Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probabilit	Significan	Nature	Magnitude	Spatial Extent	Duration	Probabilit	Significan	Reversibilit	Loss of Resources	Cu,ulative Impact	PF	Final Significance
1.Impacts due to the ingress of non-hazardous solid waste into the port	Construction	Alt 1& 2	-1	5	5	5	4	-60	-1	4	5	5	2	-28	1	1	2	1,333333	-37,3333
2.Environmental deterioration due to spillages from portable toilets	Construction	Alt 1& 2	-1	3	1	2	2	-12	-1	1	1	1	1	-3	2	1	2	1,666667	-5
4.Deterioration in water and sediment quality due to hazardous material spills and leaks	Construction	Alt 1& 2	-1	4	2	4	4	-40	-1	1	1	2	2	-8	2	1	1	1,333333	-10,6667
5.Ecological impacts due to the spillage of construction material and demolition debris into the port	Construction	Alt 1& 2	-1	1	1	1	4	-12	-1	1	1	1	4	-12	1	1	2	1,333333	-16

Impact	Phase	Alternativ es	Nature	Magnitude	Spatial Extent	Duration	Probabilit	Significan	Nature	Magnitude	Spatial Extent	Duration	Probabilit	Significan	Reversibilit	Loss of Resources	Cu,ulative Impact	PF	Final Significanc e
10.Deterioration in water and sediment quality due to the mobilisation of toxic chemicals from sediment by construction activities	Construction	Alt 1& 2	-1	2	1	1	3	-12	-1	2	1	1	3	-12	2	1	1	1,333333	-16
11.Deterioration in water quality due to dredging related increases in suspended sediment concentrations and turbidity	Construction	Alt 1& 2	-1	3	2	1	5	-30	-1	1	1	2	5	-20	2	1	1	1,333333	-26,6667
13.Deterioration in water quality due to the release of oxygen depleting substances from sediment by dredging	Construction	Alt 1& 2	-1	2	1	2	5	-25	-1	1	1	1	5	-15	2	1	2	1,666667	-25

Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probabilit	Significan	Nature	Magnitude	Spatial Extent	Duration	Probabilit	Significan	Reversibilit	Loss of Resources	Cu,ulative Impact	PF	Final Significance
15.Deterioration in water quality due to the release of toxic chemicals from sediment by dredging	Construction	Alt 1& 2	-1	2	1	2	4	-20	-1	2	1	2	4	-20	2	1	1	1,333333	-26,6667
16.Ecological impacts due to the removal, injury, and disturbance of biological communities in dredging footprints	Construction	Alt 1& 2	-1	2	1	3	5	-30	-1	2	1	3	5	-30	2	1	1	1,333333	-40
17.Deterioration in water quality due to an increase in suspended sediment concentrations during dredged sediment disposal	Construction	Alt 1& 2	-1	1	1	1	5	-15	-1	1	1	1	5	-15	2	1	2	1,666667	-25

Impact	Phase	Alternativ es	Nature	Magnitude	Spatial Extent	Duration	Probabilit	Significan	Nature	Magnitude	Spatial Extent	Duration	Probabilit	Significan	Reversibilit	Loss of Resources	Cu,ulative Impact	PF	Final Significanc e
18.Deterioration in water quality due to the release of oxygen depleting substances from sediment during disposal	Construction	Alt 1& 2	-1	1	1	1	4	-12	-1	1	1	1	4	-12	3	1	2	2	-24
20.Ecological impacts due to the transfer of toxic chemicals in dredged sediment to the dredged spoil disposal site	Construction	Alt 1& 2	-1	2	1	2	3	-15	-1	2	1	2	3	-15	2	1	2	1,666667	-25
21.Ecological impacts due to physical effects of sediment disposal at the dredged spoil disposal site	Construction	Alt 1& 2	-1	2	1	2	5	-25	-1	2	1	2	5	-25	2	1	1	1,333333	-33,3333
22.Impacts associated with the disposal of sediment leading to an elevated seabed at the	Construction	Alt 1& 2	-1	2	2	3	2	-14	-1	1	2	2	1	-5	3	1	2	2	-10

Impact	Phase	Alternatives	Nature	Magnitude	Spatial Ext[ent]	Duration	Probabilit	Significan	Nature	Magnitude	Spatial Ext[ent]	Duration	Probabilit	Significan	Reversibilit	Loss of Resources	Cu,ulative Impa[ct]	PF	Final Significance
dredged spoil disposal site																			
23. Ecological impacts due to the temporary loss of sheet pile wall biological communities	Construction	Alt 1& 2	-1	2	2	3	2	-14	-1	2	2	3	2	-14	3	1	2	2	-28
24. Ecological impacts due to underwater noise	Construction	Alt 1& 2	-1	4	3	2	4	-36	-1	3	2	2	4	-28	2	1	2	1,666667	-46,6667
25. Ecological impacts due to above water noise disturbance	Construction	Alt 1& 2	-1	2	1	2	4	-20	-1	2	1	2	4	-20	2	1	2	1,666667	-33,3333
27. Ecological impact due to permanent habitat loss	Operation	Alt 1& 2	-1	3	2	5	2	-20	-1	3	2	5	2	-20	1	2	1	1,333333	-26,6667

Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Reversibility	Loss of Resources	Cu,ulative Impact	PF	Final Significance
28. Ecological impact due to habitat modification by the deck-on-pile structure	Operation	Alt 1& 2	-1	2	2	5	2	-18	-1	2	2	5	2	-18	1	2	1	1,333333	-24
29.The damage and disruption of paleontological resources as preserved in its host rocks within the development footprints.	Construction	Alt 1& 2	-1	3	2	4	3	-27	-1	1	1	1	3	-9	1	2	1	1,333333	-12
30.Employment creation	Construction	Alt 1& 2	1	4	2	2	5	40	1	4	2	2	5	40	2	1	1	1,333333	53,33333
31.Skills development and transfer	Construction	Alt 1& 2	1	4	2	2	5	40	1	4	2	2	5	40	2	1	1	1,333333	53,33333
32.Scheduling of Construction	Planning	Alt 1& 2	-1	1	2	3	4	-24	-1	1	2	2	3	-15	3	1	1	1,666667	-25
34.Policy and Legislative Context	Construction	Alt 1& 2	-1	5	2	3	3	-30	-1	3	2	3	2	-16	2	1	1	1,333333	-21,3333
35.Air Quality	Construction	Alt 1& 2	-1	2	2	2	3	-18	-1	2	2	2	2	-12	2	1	1	1,333333	-16
36.Disturbance of existing land	Construction	Alt 1& 2	-1	2	2	2	4	-24	-1	2	2	2	4	-24	3	1	2	2	-48

Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Reversibility	Loss of Resources	Cumulative Impact	PF	Final Significance
uses and visual impact																			
37.Climate Change	Operation	Alt 1& 2	-1	3	2	5	3	-30	-1	3	2	5	2	-20	2	1	2	1,666667	-33,3333
38.Safety-Injuries and fatalities during construction	Operation	Alt 1& 2	-1	5	3	2	3	-30	-1	3	2	2	2	-14	2	1	2	1,666667	-23,3333
39.Improved Jetty stability and safety	Operation	Alt 1& 2	1	4	3	5	5	60	1	4	3	5	5	60	2	1	2	1,666667	100
40.Economic stimulation of NMBM	Operation	Alt 1& 2	1	2	2	3	3	21	1	2	2	3	3	21	2	1	2	1,666667	35

11.6 MITIGATION MEASURES

Appendix 3 of the EIA Regulations, 2014 requires that possible mitigation measures that could be applied to avoid or mitigate negative impacts and optimize positive impacts must be identified in the EIA Report. Many of the impacts can be readily mitigated and it is not foreseen that they are likely to pose a significant risk. Where necessary, the EMPr will identify and recommend specific mitigation measures applicable to the project.

Table 20 identities mitigation measures that have been proposed by specialists in the respective reports as well as those tabled by the EAP as identified during the Environmental Impact Assessment. These mitigation measures will also be included in the EMPr for implementation during the construction and operational phases.

Table 20: Mitigation measures that will be applied to the project

Impact	Nature	Mitigation measures
1.Impacts due to the ingress of non-hazardous solid waste into the port	Negative	• The construction contractor must provide comprehensive and compulsory environmental awareness training for the site workforce. The training must sensitise construction personnel to the negative environmental impacts of non-hazardous solid waste (especially plastic waste) on the marine environment and the consequent need to limit the ingress of such waste into the port. Environmental awareness training should be ongoing through the life of the project for the workforce involved in the project since inception and must be provided to contractor personnel appointed and brought onsite after project inception (e.g. sub-contractors). • A reduce, reuse, recycle waste philosophy should be followed at the construction site. • The intentional disposal of non-hazardous solid waste into the port must be strictly prohibited. Procedures to remove personnel from site if they have received environmental awareness training yet intentionally dispose of non-hazardous solid waste into the port should be formulated, and if necessary, implemented. • Construction personnel must be encouraged to collect plastic litter and other non-hazardous solid waste they see in the construction area, even if it does not originate from the construction site. • If necessary, litter sweeps should be carried out across the construction site. • If non-hazardous solid waste from the construction site enters the port this must be recovered immediately where practicable. This might be difficult from the quayside, but pool cleaning nets can be used for this purpose if a construction support vessel is available. • Onsite temporary storage areas for non-hazardous solid waste must be clearly demarcated, signposted, and maintained. These should ideally be situated as far as practicable from the water's edge. • Bins, skips, and/or other receptacles for the temporary storage of non-hazardous solid waste must be sealed and secured to avoid them becoming a source of litter in the port, noting the proposed project area is often characterised by gale force winds that can blow plastic and other light non-hazardous solid waste from unsealed receptacles, and can blow light waste receptacles over. • Non-hazardous solid waste receptacles must be vermin proof. • Non-hazardous solid waste must be regularly removed from the construction site and disposed of at a registered waste disposal site in accordance with national and local waste legislation, using a licensed waste disposal contractor. The waste contractor must provide proof that the waste was disposed at a registered waste disposal site. The contractor should keep such records onsite for the benefit of an Environmental Control Officer.

Impact	Nature	Mitigation measures
		• Non-hazardous solid waste receptacles must not be washed onsite unless the wash water is captured and disposed to sewer. The washing water must not be allowed to enter surface runoff channels or stormwater drains as these will flow to the port.
2.Environmental deterioration due to spillages from portable toilets	Negative	• Portable toilets must be maintained in a good, clean condition. • Portable toilets must be regularly checked for signs of leaks. Should a leak be found, a sorbent material must be used to contain and absorb the waste. The portable toilet should be removed and replaced as soon as is practically possible and the sorbent material used to clean the leaked waste must be treated as hazardous waste and disposed of accordingly. • Portable toilets must be placed in areas where there is little possibility of them being toppled over by the gale force winds that are common in the proposed project area. If necessary, portable toilets must be secured to the ground to avoid them being toppled over by wind or any other cause. • Portable toilets must be placed in areas where there is little possibility of potential leaks or overflows reaching the port. Portable toilets should not be positioned near surface (stormwater) runoff drains or surface water drainage areas as these will inevitably lead to the port. If these controls are not possible then portable toilets must have secondary containment. • Portable toilet waste must be regularly removed from site by a licensed waste disposal contractor and disposed at a permitted wastewater treatment works. The waste disposal contractor must provide proof of that the waste was disposed of at a registered wastewater treatment works. The contractor should keep such records onsite. • If other forms of temporary sanitary facilities are provided onsite, such as showers, the water must either be adequately contained in storage devices until it can be removed from the site or these must be connected to the existing sewer infrastructure.
3.Impacts to soil, sediment, and geology	Negative	As little geological material should be removed or brought onto the construction site as possible, and the geological material disturbed should be restricted to the minimum.
4.Deterioration in water and sediment quality due to hazardous material spills and leaks	Negative	**<u>General</u>** • A Hazardous Material Spill Response and Contingency Plan must be developed by the Contractor/s. • The Hazardous Material Spill Response and Contingency Plan must identify appropriate response procedures in the event of a hazardous material spill on land and in water. The plan must provide specific responses for spills of different types of hazardous materials that may be handled onsite. • Hazardous materials must be stored and handled in accordance with appropriate legislation and standards, including the Hazardous Substances Act (Act No. 15 of 1973) and Occupational Health and Safety Act (No. 85 of 1993).

Impact	Nature	Mitigation measures
		• Hazardous material spills and leaks must be reported immediately. The contractor personnel to whom a spill or leak must be reported must be outlined in the Hazardous Material Spill Response and Contingency Plan. The plan must also outline subsequent lines of reporting as deemed necessary (e.g. Transnet National Ports Authority, relevant authorities). • Spill containment and clean-up kits must be readily available onsite in areas where there is a risk of a hazardous material spill or leak and must be appropriate to the type of possible spill or leak. • Responsible and trained personnel must be available to deal with hazardous material spills and leaks. Training/drills must be implemented to enable personnel to respond appropriately to hazardous material spills and leaks. • Appropriate methods for the disposal of cleaned up spilled material and clean-up materials must be identified in the Hazardous Material Spill Response and Contingency Plan – this material must not be disposed with 'normal' waste but rather at an appropriately licensed waste disposal site. • The intentional disposal of hazardous materials into the port or into stormwater drains and surface drainage channels is strictly prohibited. Procedures to remove contractor personnel from site if they have received environmental awareness training yet are observed intentionally disposing of hazardous waste into the port or into stormwater or other drainage channels that lead to the estuary should be formulated, and if necessary, implemented. Construction personnel must be educated that stormwater drains lead to aquatic ecosystems, and in the case of the construction site for the proposed project these will lead to the port. • All construction personnel must receive comprehensive environmental awareness training and must be sensitised to the negative environmental impacts of hazardous material spills and leaks on the environment. Environmental awareness training must be ongoing throughout the life of the project. • Only authorised and trained personnel must be allowed to handle hazardous materials. Landside • Develop a site drainage plan that shows the positions of sewers, surface drainage channels, and stormwater drains, including where the channels and drains flow into the port. • Only authorised and trained personnel must be allowed to refuel or lubricate construction machinery, equipment, and vehicles, and to perform emergency repairs of machinery, equipment, and vehicles onsite. Refuelling of construction machinery, equipment, and vehicles, and emergency repairs of the same onsite must take place in areas demarcated for this purpose. These areas must be as far as practically possible from the edge of the estuary, on hard topped (impermeable) surfaces, and must include measures to prevent the migration of possibly spilled or leaked hazardous material from the area (e.g. bunding, drip trays). If construction machinery and equipment cannot be easily removed for

Impact	Nature	Mitigation measures
		refuelling but this must be down from a bowser, a drip tray must be used to capture any spillage that might occur. • No routine maintenance (servicing) of construction machinery, equipment, and vehicles should be performed onsite. However, it is recognised that it might not be possible to easily move certain construction machinery and equipment that might require emergency repairs to a dedicated repair site (e.g. pile driving machinery). In this case emergency repairs should be allowed onsite, but the contractor and Transnet National Ports Authority must reach agreement in this regard. • Construction machinery, equipment, and vehicles must be properly maintained and regularly checked for leaks of hazardous materials. No vehicles should be allowed onsite if they have visible leaks, including the vehicles of suppliers. • Hydraulically operated machinery should ideally use a synthetic biodegradable hydraulic oil. • Hazardous material storage containers must be labelled, sealed, and stored in accordance with Material Safety Data Sheet requirements. • Only authorised and trained personnel must be allowed access to areas where hazardous materials are stored or used. Personnel with responsibilities for the use, handling, and storage of hazardous materials must be provided with competency training and environment, health, and safety training. The training should enable the personnel to perform their tasks efficiently without resulting in any contamination, as well as knowing the appropriate actions to take in response to an emergency (e.g. fire) or spill incidents. • All hazardous materials must be stored with adequate spill protection (bunding) in secured (locked) and covered areas to prevent wash-off of hazardous material by rainfall/surface runoff as far as is practicable (fuel bowsers, for example, might need to be stored in the open). Secondary containment (including bunding) must be appropriate to the volume and nature of the hazardous material being stored but should at a minimum be ≥110% of the volume of the stored material. The base and bund walls must be impermeable to the material stored and of adequate capacity. • Hazardous materials storage and handling areas should not be positioned near surface (stormwater) runoff drains or surface water drainage areas as these will lead to the estuary. If this is impossible, stormwater drains must have protection facilities. • The volume of hazardous materials stored onsite should be kept to the minimum practicable. • A register/inventory of chemical and hazardous materials stored/used on-site should be maintained and regularly updated.

Impact	Nature	Mitigation measures
		• Construction machinery, equipment, and vehicles must not be washed onsite unless this is unavoidable, and measures are in place to retain and then remove the wash liquid (e.g. in conservancy tanks). • Photographic records of hard surfaces should be maintained to provide an Environmental Control Officer (if required) with evidence that hazardous material spills and leaks have not occurred, or if they did occur were properly contained and cleaned. • Sufficient, marked receptacles for the disposal of hazardous waste, such as oily rags, sorbent material used to clean up spills, and so must be present onsite. Waterside • Construction vessels must be properly maintained and regularly checked for leaks of hazardous materials. • Emergency equipment to contain spills on water must be easily accessible, including floating booms. • Fuel tanks of small vessels should not be refilled onboard, but at a dedicated site on land.
5.Ecological impacts due to the spillage of construction material and demolition debris into the port	Negative	• During demolition alongside and over water, structurally adequate debris shields should be used where practicable to contain debris and prevent it from entering the water. • The intentional disposal of construction material and waste into the port must be strictly prohibited. Any construction material and waste spilled onto the quay apron must not be swept into the port but must be recovered and disposed of at an appropriate waste disposal site by a licensed contractor. • Implement appropriate controls to minimise wind and surface runoff erosion of construction materials stored onsite, including soil and other fine-grained materials. If erosion from construction material stockpiles onsite becomes a problem, then these must be covered. • Where practicable and possible, minimise the amount of construction materials stored onsite that can be easily mobilised or eroded by wind and rain. • Where practicable and possible, store stockpiles of construction materials that can be easily mobilised or eroded by wind and rain as far from the water's edge as possible. • Where practicable and possible, and without unduly delaying the project, the handling of construction materials that can be easily mobilised by wind (such as soil) should be avoided when the wind speed is excessive. • Fresh concrete and cement are highly alkaline and corrosive and can cause significant water and sediment quality impairment. The use of wet concrete and cement near, over, and in the port thus requires careful control to minimise the risk of spillage. Wherever possible, pre-cast concrete structural elements should be used.

Impact	Nature	Mitigation measures
		• Concrete and cement batching should ideally not occur at the construction site but concrete and cement should rather be delivered in ready-mix form. It is, however, acknowledged that some batching will probably be required at the construction site. • If concrete is poured with a concrete pump, ensure that hoses and couplings are sealed and secured. • Concrete forms or tubular piles must not be filled to overflowing. • Concrete should ideally not be poured when the weather is adverse. • For concrete placed under water, fast-setting concrete should be used to limit losses from shuttering and to minimise the period over which impacts can occur. • Concrete forms must be properly sealed to prevent the loss of concrete into the port. • Concrete mixing and pouring equipment must not be washed onsite unless this is unavoidable. In these instances, the wash water must be collected in a dedicated wastewater collection system and disposed of appropriately.
6.Deterioration in water quality due to increased suspended sediment concentrations and turbidity caused of construction activities	Negative	• During demolition works over water or near the water's edge, debris shields should ideally be used to contain debris and prevent it entering the water. •The intentional disposal of construction material and waste into the estuary must be strictly prohibited. Any construction material spilled onto the quay apron must not be swept into the water but must be recovered and reused, or must be disposed at an appropriate waste disposal site by a licensed contractor. • During demolition works over water or near the water's edge, debris shields should ideally be used to contain debris and prevent it entering the water. • Where practicable and possible, minimise the amount of construction materials stored onsite that can be easily mobilised or eroded by wind and rain. • Where practicable and possible, store stockpiles of construction materials that can be easily mobilised or eroded by wind and rain as far from the estuary edge as possible, and on level ground. Stockpiles of construction materials must not be stored near surface runoff (stormwater) drains or surface runoff drainage channels. • If losses from construction material stockpiles onsite become a problem, these must be covered with a tarpaulin or similar fabric. • Where practicable and possible, and without unduly delaying the project, the handling of construction materials that can be easily mobilised by wind (such as soil) should be avoided when the wind speed is excessive or during heavy rainfall.

Impact	Nature	Mitigation measures
		• If increases in suspended sediment concentrations are observed to be more frequent and wide ranging in spatial extent than predicted, construction methods must be reviewed to identify areas for improvement to prevent this occurrence.
7.Ecological impacts due to the deposition of sediment mobilised and introduced into the water column by construction activities	Negative	• During demolition over water, construct structurally adequate debris shields to contain debris and prevent it from entering the water. • Implement appropriate controls to minimise wind and surface runoff erosion of construction materials stored onsite, especially soil and other fine-grained materials. • Where practicable and possible, minimise the amount of construction materials stored onsite that can be easily mobilised or eroded by wind and rain. • Where practicable and possible, store stockpiles of construction materials that can be easily mobilised or eroded by wind and rain as far from the water's edge as possible, and on level ground. Stockpiles of construction materials must not be stored near surface runoff (stormwater) drains or surface runoff drainage channels. • Where practicable and possible, and without unduly delaying the project, the handling of construction materials that can be easily mobilised by wind (such as soil) should be avoided when the wind speed is excessive. • If losses from construction material stockpiles onsite become a problem, then these must be covered. • The intentional disposal of construction material and waste into the port must be strictly prohibited. • Any construction material spilled onto the quay apron must not be swept into the port but recovered and reused, or must be disposed at an appropriate waste disposal site by a licensed contractor. • If increases in suspended sediment concentrations are observed to be more frequent and wide ranging in spatial extent than predicted, construction methods must be reviewed to identify areas for improvement to prevent this occurrence.
8.Deterioration in water quality due to the release of oxygen depleting substances from sediment by construction activities	Negative	None required due to the very low significance rating.
9.Deterioration in water quality due to the release of nutrients from sediment by construction activities	Negative	No mitigation is required due to the very low significance rating.
10.Deterioration in water and sediment quality due to the mobilisation of toxic	Negative	No mitigation is required considering the VERY LOW significance rating for this impact. Indeed, little can be done to directly mitigate this impact other than not proceeding with the project at all.

Impact	Nature	Mitigation measures
chemicals from sediment by construction activities		
11.Deterioration in water quality due to dredging related increases in suspended sediment concentrations and turbidity	Negative	• Use dredging methods that limit the mobilisation and release of fine-grained sediment from dredging equipment. Mechanical dredging with a backhoe usually releases a higher concentration of sediment into the water column than hydraulic dredging. • Dredge in winter when most fauna and flora will not be breeding, the significance being that larval and juvenile stages of marine fauna and the propagules of marine flora are more susceptible to the effects of suspended sediment than are adult stages. • Hopper overspill should be directed down rather than laterally into the water column, to minimise to the extent possible the dispersion of suspended sediment. • Dredging should be completed within the shortest timeframe possible to reduce the period over which fauna and flora might be exposed to increased suspended sediment concentrations and associated turbidity. • The dredging footprint should be restricted to the smallest area and depth possible (i.e. do not over dredge), thereby minimising the amount of sediment mobilised and released into the water column.
12.Ecological impacts due to the deposition of sediment outside the dredging footprint	Negative	• Dredging should ideally be performed in winter when ecological productivity is lowest and dependencies by other biota on biological communities in and near the dredging footprints is lowest. • Dredging should be completed within the shortest timeframe possible so that recolonisation of the exposed can proceed. • The dredging footprint should be restricted to the smallest area and depth possible (i.e. do not over dredge) to minimise the area disturbed and the duration of dredging.
13.Deterioration in water quality due to the release of oxygen depleting substances from sediment by dredging	Negative	• Dredging should ideally be performed in winter when most components of biological communities will not be reproducing, the significance being the larval and juvenile stages of marine fauna and the propagules of marine flora are more susceptible to the effects of lower dissolved oxygen concentrations than the adult stages. • Dredging should be completed within the shortest timeframe possible to limit the period over which biological communities might be exposed to lowered dissolved oxygen concentrations. • The dredging footprint should be restricted to the smallest area and depth possible (i.e. do not over dredge), to minimise the amount and time over which oxygen depleting substances are mobilised and released from sediment. • If possible, there should be no return flow from dredger hoppers or dredging barges.

Impact	Nature	Mitigation measures
14.Deterioration in water quality due to the release of nutrients from sediment by dredging	Negative	• Dredging should ideally be performed in winter when the growth of flora is limited by temperature. • The dredging footprint should be restricted to the smallest area and depth possible (i.e. do not over dredge), thereby minimising the amount of nutrients released from sediment.
15.Deterioration in water quality due to the release of toxic chemicals from sediment by dredging	Negative	• Use dredging methods that limit the loss of fine-grained sediment from dredging equipment, the significance being that many types of toxic chemicals preferentially adsorb onto fine-grained material in the sediment (e.g. mud grains, particulate organic matter) and this material has the potential to be transported by currents over the widest area and hence to transfer adsorbed contaminants beyond the dredging footprints. • Use a silt curtain to limit the dispersion of fine-grained material onto which contaminants may be adsorbed from the dredging area. • Dredging should ideally be performed in winter when most fauna and flora will not be breeding, the significance being the larval and juvenile stages of marine fauna and the propagules of marine flora are more susceptible to the effects of toxic chemicals than the adult stages. • Dredging should be completed within the shortest timeframe possible to reduce the period over which biological communities might be exposed to toxic chemicals mobilised from sediment. • The dredging footprint should be restricted to the smallest area and depth possible (i.e. do not over dredge), thereby minimising the amount of toxic chemicals mobilised from sediment.
16.Ecological impacts due to the removal, injury, and disturbance of biological communities in dredging footprints	Negative	• Dredging should ideally be performed in winter when ecological productivity is lowest and dependencies by other biota on biological communities in and near the dredging footprints is lowest. • Dredging should be completed within the shortest timeframe possible so that recolonisation of the exposed can proceed. • The dredging footprint should be restricted to the smallest area and depth possible (i.e. do not over dredge) to minimise the area disturbed and the duration of dredging.
17.Deterioration in water quality due to an increase in suspended sediment concentrations during dredged sediment disposal	Negative	• Dredged sediment should ideally be disposed in late winter to early spring when most fauna and flora will not be breeding, the significance being that larval and juvenile stages of marine fauna and propagules of marine fauna are more susceptible to the effects of suspended sediment than adult stages. • Dredging should be completed within the shortest timeframe possible to reduce the period over which fauna and flora might be exposed to elevated suspended sediment and turbidity due to the disposal of dredged sediment. • The dredging footprint should be restricted to the smallest area and depth possible (i.e. do not over dredge), thereby minimising the amount of sediment that needs to be disposed at the dredged spoil disposal site.

Impact	Nature	Mitigation measures
18.Deterioration in water quality due to the release of oxygen depleting substances from sediment during disposal	Negative	• Dredging, and hence dredged sediment disposal, should ideally be performed in winter when most fauna and flora will not be breeding, the significance being the larval and juvenile stages of marine fauna and the propagules of marine flora are more susceptible to the effects of low dissolved oxygen concentrations than the adult stages
19.Deterioration in water quality due to the release of nutrients from sediment during disposal	Negative	• Dredging should ideally be performed in winter when the growth of flora is limited by temperature.
20.Ecological impacts due to the transfer of toxic chemicals in dredged sediment to the dredged spoil disposal site	Negative	• Dredged sediment should be disposed in as thin a layer on the dredged spoil disposal site as is possible as this will facilitate the dispersion of contaminated sediment from the spoil disposal site over as large an area possible, and in this way dilute the toxic chemical concentrations. Thin layer placement will also oxygenate sediment, facilitating the oxidation (breakdown) of toxic chemicals such as hydrogen sulphide. However, this will lead to elevated suspended sediment concentrations and turbidity over a far wider area compared to the disposal of sediment in a confined area of the dredged spoil disposal site. • Dredging, and hence the disposal of dredged sediment, should ideally be done in winter when most fauna and flora will not be breeding, the significance being that larval and juvenile stages of marine fauna and propagules of marine flora are more susceptible to the effects of toxic chemicals than adult stages.
21.Ecological impacts due to physical effects of sediment disposal at the dredged spoil disposal site	Negative	• Dredged sediment should be spread in as thin a layer as is practicable on the dredged spoil disposal site (i.e. thin layer placement). This will aid in the migration of benthic invertebrate fauna through the deposited sediment. • Dredged sediment should ideally be disposed in late winter to early spring when most fauna and flora will not be breeding. This will aid in the recolonisation of the site in late spring to summer by the larvae and settling stages of benthic invertebrate fauna. • The dredging footprint should be restricted to the smallest area and depth possible (i.e. do not over dredge), in this way minimising the volume of sediment that needs to be disposed at the dredged spoil disposal site.
22.Impacts associated with the disposal of sediment leading to an elevated seabed at the dredged spoil disposal site	Negative	• The dredged sediment should be spread in as thin a layer as is practicable on the spoil disposal site (i.e. thin layer placement), to avoid impacts that might arise due to a significantly elevated seabed. • Large vessels should not use the area near the dredged spoil disposal site for anchoring.
23. Ecological impacts due to the temporary loss of sheet pile wall biological communities	Negative	None required due to very low significance rating. No mitigation is in fact possible.
24. Ecological impacts due to underwater noise	Negative	• In so far as conditions permit, vibratory piling should be used in preference to percussive piling.

Impact	Nature	Mitigation measures
		• Piling should ideally be limited to a time outside the breeding period for fauna likely to be most adversely impacted by underwater noise, since noise exposure might force fauna to forage or breed in sub-optimal areas or to avoid the area entirely. The ideal period is autumn/winter. It is, however, acknowledged that this might not be practical for the project and that the piling period may extend over several months. • A pre-piling survey for the presence of marine mammals (in this case likely to be restricted to dolphins) of the area near the piling activity should be performed for 15 minutes. If dolphins should be observed, piling must not commence until at least 15 minutes after dolphins were last observed. It is especially important to ensure that dolphins left the area in the direction of the estuary mouth, to avoid them being trapped in the upper part of the estuary by an underwater noise barrier. • A 'soft-start'/'ramp-up' regime should be followed at the commencement of piling on each day to allow those fauna that can an opportunity to move away from the area before the sound pressure increases to a level that they might be injured. This procedure should also be followed if there is a temporary halt in piling on any given day. • If dolphins are observed near the piling operation when in full power, there is no need to cease piling as the dolphins can be assumed to have entered the area 'voluntarily' and to not be overly disturbed by the underwater noise. • Driving tubular steel piles into the substrate one at a time will reduce the magnitude of underwater noise exposure. However, this will prolong the period over which high intensity underwater noise is generated by piling. No recommendation is thus made on whether piles should be driven individually or concurrently, although it is probable this will be individually. • If dead fish are observed near the piling operation the ramp up regime should be lengthened.
25. Ecological impacts due to above water noise disturbance	Negative	• In so far as conditions allow, vibratory piling must be used in preference to percussive piling. • Piling should ideally be limited to a time outside the breeding period for fauna likely to be most adversely impacted by underwater noise, since noise exposure might force the fauna to forage or breed in sub-optimal areas or to avoid the area entirely. The ideal period is autumn/winter. It is, however, acknowledged that this might not be practical for the project and that the piling period will extend over many months. • A 'soft-start'/'ramp-up' regime should be followed at the commencement of piling on each day to allow any dolphins that might not have been observed and fish to move away from the area before the sound pressure increases. This procedure should also be followed if there is a temporary halt in piling on any given day. • Driving tubular steel piles into the substrate one at a time will reduce the magnitude of underwater noise exposure. However, this will prolong the period over which high intensity underwater noise is

Impact	Nature	Mitigation measures
		generated by piling. No recommendation is thus made on whether piles should be driven individually or concurrently, although it is probable this will be individually.
26. Impact of altered quay wall geometry on hydrodynamics	Negative	There is nothing that can be done to directly mitigate this impact other than not proceeding with the project (the 'Do Nothing' option).
27. Ecological impact due to permanent habitat loss	Negative	There is nothing that can be done to directly mitigate this impact other than not proceeding with the project (the 'Do Nothing' option).
28. Ecological impact due to habitat modification by the deck-on-pile structure	Negative	• The number of piles used should be limited to the smallest number possible, to decrease the shade cast by pilings. • If possible, inserts should be incorporated into the deck of the deck-on-pile structure to transmit light to the water beneath.
29.The damage and disruption of paleontological resources as preserved in its host rocks within the development footprints.	Negative	• The initial mitigation involves the detailed assessment of geological detrital for the paleontological footprints. •The unearthing of the geological portion of the development area must be done with precautions and due observation, considering the possibility of discovering new paleontological data. • Though the present deduction suggests the mutilation of the development footprints, should a fossil discovery be made, the SAHRA must be reached to oversee the extraction and safeguarding of the resource for sampling and preservation purposes. • A licensed or professional paleontologist must extract and recover the fossil.
30.Employment creation	Positive	No mitigation required, however, use of local labour and businesses wherever possible is encouraged.
31.Skills development and transfer	Positive	No mitigation required, however, use of local labour and businesses wherever possible is encouraged.
32.Scheduling of Construction	Negative	• The duration of the construction phase should be kept to a minimum, to reduce the period of disturbance on fauna; and • Wherever possible, construction activities should be undertaken during the driest part of the year to minimize downstream sedimentation due to excavation, etc. • When not possible, sediment traps must be used to ensure the watercourses are not negatively impacted by construction activity
33.Employment creation	Positive	Use of local labour and Small to Medium Enterprises is recommended whenever it is possible.
34.Policy and Legislative Context	Negative	• Application for required environmental authorisations and licenses prior to commencement of construction. • The applicant must appoint an ECO to monitor compliance throughout construction by undertaking monthly audits until rehabilitation is completed. The contractor's appointed DEO must be on site on a daily basis to monitor implementation of the environmental specifications contained in this EMPr and all authorisations

Impact	Nature	Mitigation measures
		• Copies of all applicable licenses, permits and managements plans (EA, EMPr, Water Use Licenses, Permits, etc.) must be always available on-site. Should ECO audits identify that additional authorisation is required during construction due to non-compliance or deviation from the approved EMPr, the contractor will be responsible for the process of EA application. • Environmental Awareness Training must be provided by the ECO at the start of the construction phase all personnel involved in the project.
35.Air Quality	Negative	Cleared surfaces must be dampened whenever possible, especially during dry and windy conditions, to avoid excessive dust generation. • Any soil excavated, and not utilised for rehabilitation, must be removed from site or covered and no large mounds of soil may be left behind after construction. Record daily dust observations, and where excessive dust is found, detail measures implemented to control dust. • Dust suppression using water trucks or a hosepipe
36.Disturbance of existing land uses and visual impact	Negative	• The construction footprint must be surveyed and demarcated prior to construction commencing to ensure that there is no unnecessary use of land areas within the port. • Laydown and stockpiling of construction materials must be done in areas that have been approved by the ECO and Engineer. • No construction related activities should take place outside of the development footprint. •Minimize disturbance of new areas. • The site camp must be decommissioned, and the area rehabilitated once construction has been completed. • All waste, materials and equipment must be removed from site. • The project area is to be kept tidy and free of litter.
37.Climate Change	Negative	Consider the anticipated sea level rise over the next 100 years the engineering design team to conduct analysis on the sufficiency of the cope levels of the proposed structure.
38.Safety-Injuries and fatalities during construction	Negative	• The contractor must ensure that workers adhere to all safety regulations as per Occupational Health and Safety Act. • Appropriate PPE must be worn by workers at all times. • Regular training/talks must be given to all workers on site regarding safe working procedures. • Appropriate warning signs must be in place to notify the public regarding construction activities. • The construction site and camp must have access control and be demarcated, where possible. • Hazardous Chemical Substances Regulations promulgated in terms of the Occupational Health and Safety Act 85 of 1993 and the SABS Code of Practise must be adhered to. This applies to solvents and

Impact	Nature	Mitigation measures
		other chemicals possibly used during the construction process. • The individual(s) that will be handling hazardous materials must be trained to do so. • All hazardous chemicals must be stored properly in a secure, bunded and contained area. • The contractor must ensure that operational firefighting equipment is present on site at all times as per Occupational Health and Safety Act. • All construction foremen must be trained in fire hazard control and firefighting techniques. • All flammable substances must be stored in dry areas which do not pose an ignition risk to the said substances. • No open fires will be allowed on site unless in a demarcated area identified by the ECO. No smoking near flammable substances. • All cooking shall be done in demarcated areas considered safe in terms of runaway or uncontrolled fires. • The level of firefighting equipment must be assessed and evaluated thorough a typical risk assessment process. • Fires shall only be allowed in facilities or equipment specially constructed for this purpose. The need for a firebreak shall be determined in consultation with the Engineer and the relevant authorities, and if required a firebreak shall be cleared and maintained around the perimeter of the camp and office sites.
39.Improved Jetty stability and safety	Positive	A maintenance and management plan must be compiled for the Old Tug Jetty sheet pile wall.
40.Economic stimulation of NMBM	Positive	No mitigation required.

11.7 MOTIVATION FOR NOT CONSIDERING ALTERNATIVE DEVELOPMENT FOOTPRINTS

No other development footprint alternatives were considered for this project because the location of the rehabilitation works is defined and dictated by the position of the existing sheet pile wall which needs to be constructed in order to improve structural stability.

PRDW were appointed by Transnet to conduct a pre-feasibility (FEL 2) study for the rehabilitation of the Old Tug Jetty sheet pile wall. A set of rehabilitation concepts for the Old Tug Jetty sheet pile wall were developed based on typical marine structure types, construction techniques, functional requirements, and existing site conditions. A prescreening assessment of the concepts was then undertaken using a high level, qualitative, multi-criteria analysis to eliminate options that were not considered viable, or which had fatal flaws. Thereafter, the remaining options were assessed in a multi-criteria analysis to determine the preferred solution. The full set of Old Tug Jetty sheet pile wall rehabilitation options that were considered for the pre-screening assessment are detailed in **Table 8**. All the rehabilitation options presented assume that the existing Old Tug Jetty sheet pile wall will be abandoned and buried and the back of quay area remediated. This means that the counterfort units will be placed proud of the existing sheet pile wall. There will be infilling of rock material between the old sheet pile wall and the new counterfort units with the construction of a new elevated cope, totally encasing the existing sheet pile wall, hence the term "buried and abandoned" (**Figure *5***). Although the old sheet pile wall will remain, it will no longer be in use and will be encased by the new structure, covered by the counterfort wall and will not be visible due to backfilling and concrete capping. Please refer to the full optioneering and multicriteria analysis report which has been attached as Appendix C.

The preferred development footprint will be kept to what is required for safe and efficient construction and operation of the structures. The mitigation measures proposed in the specialist reports will be implemented in order to avoid or minimize negative social and environmental impacts. Compliance with the Environmental Authorisation, EMPr and any other permits obtained will be monitored by the appointed ECO on a regular basis.

12. SUMMARY OF SPECIALIST FINDINGS

Table 21 below presents a summary of the key specialist recommendations on the proposed development A summary of each specialist findings is integrated into Section 10 to Section 13.1 of the report while the full specialist reports are found in Appendix D.

Table 21: Key Specialist Findings and Recommendations

Name and Surname	Role	Key Recommendations on proposed alternatives
CSIR: Dr Brent Newman Ms Aadila Omarjee	Marine Water and Sediment Quality Specialist Aquatic Biodiversity Marine Ecological Specialist (Zoology)	The rehabilitation of the Old Tug Jetty sheet pile quay wall in the Port of Port Elizabeth is needed to prevent the ongoing deterioration of this infrastructure to a degree that it poses operational, human health, and environmental risks. The proposed rehabilitation of the sheet pile quay wall in Phase 1 and the possible construction of a deck-on-pile structure in Phase 2, should the need arise, will obviously impact on the biophysical environment in the port and at and near the dredged spoil disposal site in Algoa Bay. The recent demolition and reconstruction of the leading jetties for the vessel maintenance operation near the Old Tug Jetty quay area had no apparent significant impact on biological communities and ecological processes in the port. This lends confidence that the proposed rehabilitation of the Old Tug Jetty quay area will also not have a major long-term impact on ecological processes in the port. The identification and assessment of environmental impacts in the current assessment provides an opportunity to mitigate some impacts through the engineering design and construction method. There is similarly an opportunity to include in the engineering

Name and Surname	Role	Key Recommendations on proposed alternatives
		design strategies for reducing existing impacts, such as surface runoff storage systems to limit the ingress of contaminants into the estuary. Considering that of the environmental impacts identified were assessed to have a very low or low significance there is no need to implement detailed aquatic environmental monitoring programme for the proposed project. It seems probable the construction period will overlap with surveys for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth, which should identify if there are any unforeseen major changes to the aquatic environment in the port associated with the proposed construction activities. The proposed project will thus have a very low to low negative overall impact on the biophysical environment. The specialist that prepared this specialist report is thus of the opinion that, based on purely biophysical environmental considerations, the proposed project can be approved provided recommended and/or other more effective mitigation that might be identified is implemented and the final engineering design and construction method statement do not identify additional environmental impacts or increase the significance of assessed impacts.
Dr Solomon Owolabi	Palaeontological Specialist/ Landscape Assessment	The SAHRIS Palaeomap proposed that moderately sparse fossils and subfossil biota mainly characterize the study vicinity. The high

Name and Surname	Role	Key Recommendations on proposed alternatives
		palaeontological sensitivity could be due to the disconformable layering between the Nanaga Formation and the Alexandria Formation, which is richly fossiliferous within its arenaceous particulate. Moreover, the study point is bounded by the highly potential lithostratigraphic units at the north and south, thus, requiring a primary palaeontological assessment. The possibility of uncovering fossilized detrital in the proposed developmental layout depends on the in-depth geological field analysis of the area, the availability of exposed outcrops, and their accessibility. The biostratigraphy of the constituent lithostratigraphy is associated with different genres of land snails, calcretized rhizoliths, and termitaria. Due to the high degree of urban encroachment and outcrop nonavailability to ascertain the area's geological attribute and substantiate the information on the envisaged footprint, a sequence stratigraphy correlation (SSC) was conducted. The detailed geologic survey showed that the fossiliferous strata lay at greater depth, deeply buried from the surface within a 4 km radius. The layering within the vicinity is the thick overburden, mainly boulders interspersed by rich sands and superficial sand cover. Within the extensively evaluated portion, sedimentary exposure was mostly unconsolidated, stabilized, or artificial surface, with no sight of

Name and Surname	Role	Key Recommendations on proposed alternatives
		fossil remains of any sort. The superficial sediments of the late Pleistocene to the Recent age, including the alluvium, the unconsolidated soil, calcrete, and silcrete hardpan, are unfossiliferous. Moreover, the impact risk assessment carried out showed that without (with) mitigations, the impact rating for the old tug jetty is 1.8 (0.6), suggesting a low (very low) risk assessment. Considering the nonavailability of fossil content within the study portion, the paleontological condition allows the proposed rehabilitation of the old tug jetty at the Port Elizabeth port to move into the construction phase. However, extenuation measures such as preventive and exploratory excavation are advisable during foundation digging, considering the possibility of encountering new fossils. Moreover, should a substantially new fossil discovery be made during the development's construction phase, the South Africa Heritage Research Agency (SAHRA) must be duly alerted to ensure a prompt and appropriate extenuation overseen by a professional paleontologist.
Dr Anton De Wit	Social Impact Assessment	The construction phase of the proposed development will see the creation of temporary (short-term) employment opportunities. This will culminate in positive socio-economic impacts in the form of increased economic activity, poverty alleviation and favourable socio-economic implications (such as improved access to and consumption of goods and services, greater freedom of choice, better quality

Name and Surname	Role	Key Recommendations on proposed alternatives
		of life, and so on) for the affected individuals and their dependants. **Empowerment impacts:** The construction phase of the proposed development could see the development and transfer of skills taking place in order to meet the necessary labour requirements. This will have a socio-economic importance that extends well beyond the period of the proposed development's construction phase. Relevant individuals (beneficiaries) will be able to sell their newly acquired skills within and beyond the boundaries of the local economy long after the completion of the construction phase. **Other construction and operational phase impacts** a) The proposed development, during the construction phase, will make a positive contribution to the Gross Domestic Product (GDP) of the NMB Metro. The demand for goods and services during the construction phase will also have a positive impact on the local economy. b) The proposed development, during the operational phase, will make a positive contribution to the functionality and economic continuity of the Port of Port Elizabeth (particularly with regards to the ability to continue to perform the socio-economic role that it does in support of the fishing industry).
Transnet	Geotechnical Assessment	In 2015, Jeffares & Green (Pty) Ltd conducted a geotechnical investigation in the Port of Port Elizabeth. The investigation was undertaken for the construction of the proposed 40 ton slipway

Name and Surname	Role	Key Recommendations on proposed alternatives
		as well as for the construction of the two Lead-in jetties. The geotechnical investigation comprised of a drilling campaign consisting of 12 rotary drilled boreholes cores, 6 along the proposed slipway and 6 cores along the two Lead in jetties. The investigation used rotary core drilling to depths between -21.96m CD to -25.56m CD. The boreholes along the Lead-in jetties are the closest available to the Old Tug Jetty and are considered to give a good indication of the likely geotechnical conditions for the purposes of this pre-feasibility study. Boreholes 3, 5 and 6 are the closest to the Old Tug Jetty and considered the most relevant and will provide sufficient information for the required level of design. According to Jeffares & Green, alluvium/fill dominated all boreholes and is mainly comprised of sub-angular to rounded gravel, cobbles and minor boulders of quartzitic sandstone and gravelly sand. The boreholes indicate the absence of hard rock and the harbour area is significantly inconsistent in its horizontal and vertical profile, showing wide variability in strata levels. Founding in gravel and cobbles may, however, be problematic as variable settlement may occur. It is thus recommended that if a piling option is considered, a specific driving set be maintained, to which the piling installation must adhere to. Taking all factors into account, it is considered that conditions prevailing on site are

Name and Surname	Role	Key Recommendations on proposed alternatives
		potentially suitable for the specific development of the structures, provided the recommendations given in this report are adhered to. To progress this project further a number of site investigations are required, assumptions in the feasibility study (FEL 2) need to be verified and detailed design work needs to be carried out in the detailed design (FEL 3) before the construction stage (FEL 4) can commence. These uncertainties include, and are not limited to, the structural integrity of the sheet piles, dead man anchors, the depth of the sheet pile toe, condition of the rock fill in front of the existing sheet pile wall and finally the geotechnical conditions

All specialist studies have been prepared in line with Appendix 6 of the EIA Regulations of 2014 as amended and have been undertaken by qualified, experienced, and registered specialists with experience in the region. The specialist studies will take into consideration the Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes in terms of Section 24(5) (a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation ("the Protocols") promulgated in Government Notice ("GN") No. 320 on 20 March 2020, which came into effect on 09 May 2020. All the recommended specialist studies will be initiated after 09 May 2020; therefore, the requirements apply.

13. ENVIRONMENTAL IMPACT STATEMENT

13.1 SUMMARY OF FINDINGS OF THE EIA

A summary of the key findings of the environmental impact assessment is outlined below:

- The project application area falls in ERF Humewood 1051 Portion 0, a property which is owned by the applicant, thus no landowner consent is required.
- No alternative development options or footprints were feasible for this project due to the site specific nature of the proposed rehabilitation of the Old Tug Sheet Pile Wall. Three alternatives assessed in the EIA were the preferred alternative(Alt 1),the modified design alternative (Alt 2) and the no-go alternative (Alt 3). The preferred alternative involves construction of a counterfort wall and deck on pile hybrid structure. The modified design includes design strategies for reducing existing impacts, such as surface runoff storage systems to limit the ingress of contaminants into the waterbody. The no-go alternative means doing nothing and eventually decommissioning the Old Tug Jetty Sheet Pile Wall.
- The Water quality of the site was always rated good or excellent apart from some stations in the southern basin. In these instances the fair or marginal water quality rating was largely a consequence of high faecal indicator bacteria counts.
- The sediment at 13 of the 18 stations was not toxic to sea urchin embryo-larvae. The sediment at four of the remaining five stations was very slightly toxic, and at one station was marginally toxic. The sediment at one station sampled alongside the Old Tug Jetty quay area was very slightly toxic.
- According to the South African Air Quality Information System (SAAQIS), the Air quality Index (AQI) of Port Elizabeth has a good (Index 1) for most air quality parameter.
- The benthic macrofaunal community at virtually all stations was dominated by annelid worms, with gastropods and/or ostracods contributing importantly at many stations.
- Hard structures in the port are encrusted by a range of fauna, including barnacles, mussels, sponges, bryozoans, and ascidians. The encrusting fauna on the sheet pile wall at the Old Tug Jetty is rather depauperate when compared to communities on hard structures elsewhere in the port, but especially when compared to pile on jetties (Figure 42) and on walk-on moorings at the Algoa Bay Yacht Club.
- Literature indicates that Fish recorded include Cape stumpnose, pufferfish, kob, elf, garrick, subtropical kingfish, and queen mackerel. The study by Dickens (2010) highlighted an unexpected abundance and diversity of shark species in the port, including bronze whalers, hammerheads, various cat sharks, dusky sharks, and gully sharks. The dolosse provided a habitat within which the highest number species were recorded (43 species) in comparison to the quay wall (24 species) and sandy shore (21 species).
- Other faunal species that are expected to occur on site include sea birds such as penguins and marine reptiles such as turtles.
- The receiving area of the proposed project is within the mouth of the Baakens River, which is one of the major freshwater ecosystems in the NMBMM. The Baakens River mouth is in the Port Elizabeth harbour adjacent to the central business district of the City.
- The project area is underlain by a combination of land-fill material and Quaternary alluvial sand, gravel, cobbles and boulders. This material is underlain, at depth, by the Peninsula Formation of the Table Mountain Group.
- No vegetation will be affected by the proposed rehabilitation of the Old Tug Jetty Sheet pile wall.
- The site falls within a Critical Biodiversity Area (CBA 2) and within 5km of a formally protected area.
- The paleontological and archaeological sensitivity of the site is very high.

- NMBMM has a high unemployment rate (36,6%) and an economy that is highly dependent on the automotive sector.

13.2 POSITIVE AND NEGATIVE IMPLICATIONS OF THE PROPOSED PROJECT

The following negative and positive impacts are anticipated from the proposed development:

NEGATIVE IMPACTS	POSITIVE IMPACTS
1.Impacts due to the ingress of non-hazardous solid waste into the port	30.Employment creation
2.Environmental deterioration due to spillages from portable toilets	31.Skills development and transfer
3.Impacts to soil, sediment, and geology	39.Improved Jetty stability and safety
4.Deterioration in water and sediment quality due to hazardous material spills and leaks	40.Economic stimulation of NMBM
5.Ecological impacts due to the spillage of construction material and demolition debris into the port	
6.Deterioration in water quality due to increased suspended sediment concentrations and turbidity caused of construction activities	
7.Ecological impacts due to the deposition of sediment mobilised and introduced into the water column by construction activities	
8.Deterioration in water quality due to the release of oxygen depleting substances from sediment by construction activities	
9.Deterioration in water quality due to the release of nutrients from sediment by construction activities	
10.Deterioration in water and sediment quality due to the mobilisation of toxic chemicals from sediment by construction activities	
11.Deterioration in water quality due to dredging related increases in suspended sediment concentrations and turbidity	
12.Ecological impacts due to the deposition of sediment outside the dredging footprint	
13.Deterioration in water quality due to the release of oxygen depleting substances from sediment by dredging	
14.Deterioration in water quality due to the release of nutrients from sediment by dredging	
15.Deterioration in water quality due to the release of toxic chemicals from sediment by dredging	

NEGATIVE IMPACTS	POSITIVE IMPACTS
16.Ecological impacts due to the removal, injury, and disturbance of biological communities in dredging footprints	
17.Deterioration in water quality due to an increase in suspended sediment concentrations during dredged sediment disposal	
18.Deterioration in water quality due to the release of oxygen depleting substances from sediment during disposal	
19.Deterioration in water quality due to the release of nutrients from sediment during disposal	
20.Ecological impacts due to the transfer of toxic chemicals in dredged sediment to the dredged spoil disposal site	
21.Ecological impacts due to physical effects of sediment disposal at the dredged spoil disposal site	
22.Impacts associated with the disposal of sediment leading to an elevated seabed at the dredged spoil disposal site	
23. Ecological impacts due to the temporary loss of sheet pile wall biological communities	
24. Ecological impacts due to underwater noise	
25. Ecological impacts due to above water noise disturbance	
26. Impact of altered quay wall geometry on hydrodynamics	
27. Ecological impact due to permanent habitat loss	
28. Ecological impact due to habitat modification by the deck-on-pile structure	
29.The damage and disruption of paleontological resources as preserved in its host rocks within the development footprints.	
32.Scheduling of Construction	
34.Policy and Legislative Context	
35.Air Quality	
36.Disturbance of existing land uses and visual impact	
37.Climate Change	
38.Safety-Injuries and fatalities during construction	

13.3 CUMULATIVE IMPACTS

The following potential cumulative impacts have been identified through specialist assessments:

1. The ingress of non-hazardous solid waste into the port by construction activities will add to the burden of such solid waste entering the port from the surrounding urban area, including via the Baakens River. It is, however, not possible to assess the significance of this possible cumulative effect as the amount of waste entering the port is unknown.
2. The ingress of hazardous materials to the port will add to the burden of contaminants entering the port from the surrounding urban area and port operations. However, with effective mitigation the additional impact posed by spilled and leaked hazardous materials should be minimal.
3. The proposed project will coincide with the berthing and de-berthing of vessels in the port. The proposed project may coincide with maintenance dredging in the port. There is a possibility that sediment mobilised by vessel propeller wash and maintenance dredging will magnify the impact of increased suspended sediment concentrations and turbidity due to construction activities for the proposed project, and vice versa, because vessel movements and dredging will occur very near the proposed project area. However, the cumulative impact will probably not be highly significant considering the small amount of sediment that is anticipated to be mobilised into the water column by construction activities. To mitigate this potential cumulative effect construction for the proposed project and maintenance dredging in the port should be scheduled so they do not overlap, although this is not a necessity considering the significance rating for the impact without mitigation.
4. Furthermore, the toxicity testing of sediment sampled in the port in August 2022 showed that the sediment at most stations not including those in the proposed project area was not toxic, but when so that toxicity was slight or marginal. To mitigate this potential cumulative effect, construction for the proposed project and maintenance dredging in the Port of Port Elizabeth should be scheduled so they do not overlap.
5. Dredging for the proposed project may coincide with maintenance dredging in the Port of Port Elizabeth. There is thus a possibility that toxic chemicals in sediment maintenance dredged elsewhere in the port and transferred to the dredged spoil disposal site could magnify the impact of toxic chemicals transferred in sediment dredged for the proposed project. However, the cumulative impact will probably not be significant considering sediment across the Port of Port Elizabeth is not severely contaminated by chemicals apart from manganese, and that the toxicity testing of sediment sampled in the port in 2022 showed slight toxicity for sediment in parts of the port, but in most parts the sediment was not toxic. To mitigate this potential cumulative effect, dredging for the proposed project and maintenance dredging in the Port of Port Elizabeth should be scheduled so they do not overlap. The period between the last disposal event for sediment dredged for the proposed project and the start of dredged sediment disposal for the next maintenance dredging cycle should be as long as possible as this will provide time for contaminated sediment to be dispersed from the disposal site.
6. There is also a possibility that the impact of toxic chemicals transferred in sediment to the dredged spoil disposal site could be magnified by the accumulation on the site of toxic chemicals introduced

from other sources into Algoa Bay, including via surface (stormwater) runoff from urban areas and the discharge of wastewater via the Papenkuils River. However, any toxic chemicals introduced into Algoa Bay from other sources are unlikely to accumulate to any significant degree on the dredged spoil disposal site since the site is about 1.6 km from the nearest shoreline. Toxic chemicals that are introduced from shoreline sources into Algoa Bay are thus likely to undergo substantial dilution, transformation, and deposition by the time currents might cause them to pass over the dredged spoil disposal site. Furthermore, the sediment on the dredged spoil disposal site is comprised predominantly of sand, which has a low propensity for accumulating toxic chemicals.

7. Above water noise generated by construction activities for the proposed project will add to the above water noise generated by other (normal) port activities, such as the movement of tugs, large vessels, and dredging vessels. This may magnify the degree of disturbance to birds that feed in the port.
8. Transnet National Ports Authority has no plans for projects in the short-term in the Port of Port Elizabeth that will lead to the further loss of open water and sediment habitat (TNPA, 2019). However, longer-term projects may lead to a further loss of habitat and ecological productivity in the port. However, in the absence of confirmed and concrete longer-term plans it is difficult to estimate the significance of the cumulative loss.
9. The deck-on-pile structure will add to the shading and other impacts of the extensive area already affected by deck-on-pile structures near the Old Tug Jetty quay area, including the jetty leading from the quay area and the leading jetties nearby.

13.4 SENSITIVITY RATINGS

Based on the observed conditions on site, provides a motivation of the verified or different use of land and environmental sensitivity.

Table 22: Site sensitivity verification

Theme	NWBEST Sensitivity	Motivation or verification of land use and environmental sensitivity	Revised Sensitivity
Agriculture			
Agricultural theme: No **sensitivity** rating assigned	The National Web Based Environmental Screening Tool Report did not assign a sensitivity rating for the agricultural theme.	From what has been observed on site, it is confirmed that most of the application area has very low potential for cultivation of plants due to existing development that would hinder that land use. The site is currently used as a Port and is highly transformed.	None
Biodiversity			

Theme	NWBEST Sensitivity	Motivation or verification of land use and environmental sensitivity	Revised Sensitivity
Animal species theme: Medium **sensitivity**	According to the National Web Based Environmental Screening Tool (NWBEST), the animal species sensitivity of the application area is rated as medium.	A few bird species were recorded on site during the site verification, it is likely that these species are present in the surrounding environment. Mitigation measures will be put in place to minimize impact on animal species during construction and impact on the surrounding habitat will be kept minimal, it is not foreseen that the low impact on faunal species will continue post construction phase. Due to the location of the proposed project in a marine environment, a Marine faunal impact assessment will be undertaken.	Medium
Aquatic Biodiversity theme: Low	The NWBEST has characterised the aquatic sensitivity of the project area as "low".	During the site visit, it was confirmed that the project inherently takes place in the sea and within the regulated area of a watercourse. However, due to the highly transformed nature of the site, the low sensitivity in terms of aquatic biodiversity is confirmed.	Low
Plant Species & Terrestrial Biodiversity theme: Low sensitivity	According to the Screening Tool, the sites have low sensitivity for plant species and terrestrial biodiversity.	The site verification confirmed that there is no terrestrial vegetation present in the project area. Thus, the sensitivity rating provided in the screening tool report is confirmed. No botanical or terrestrial biodiversity specialist study will be undertaken in the EIA phase.	Low
Heritage			
Archaeological and Cultural	The NWBEST has characterised the	Due to the presence of a Grade II Heritage site within 2 km of the site, the very high	Medium

Theme	NWBEST Sensitivity	Motivation or verification of land use and environmental sensitivity	Revised Sensitivity
Heritage Theme: Very High **sensitivity.**	archaeology and cultural heritage sensitivity of the site as "**Very High**"	sensitivity rating shows. However, the structure is less than 60 years hence exempt from any heritage impact assessment.	
Palaeontology theme: Very High sensitivity	The NWBEST characterised the palaeontological sensitivity of the site and surrounding environment as "**Very High**"	This rating is consistent with the finding from the South African Heritage Resources Agency Palaeontology map for the area. A specialist has been appointed to conduct a Palaeontological Impact assessment.	Low
Other			
Civil aviation theme: Very High **sensitivity**	According to the DFFE Screening Tool, the site has a very high sensitivity to civil aviation.	The proposed site falls between 8 and 15 km of other civil aviation aerodrome and within 5 km of an air traffic control or navigation site. However, it is not envisaged that the proposed works would extend beyond a 1km radius of the application area in terms of physical disturbance. No high-flying equipment such as drones will be operated during construction and therefore no specialist assessment for civil aviation is recommended.	Medium
Defence theme: Very High	According to the NWBEST, the site has assigned a very high sensitivity for defence.	It is noted that the site is located near Military and Defence Site. However, it is recommended that **no** assessment for defence is required for this application due to the fact that these land uses are already taking place in the Port without disturbance from the existing construction activities.	Medium

13.5 FATAL FLAWS

There are no fatal flaws identified for this project.

13.1 FINAL COMPOSITE MAP

The environmental sensitivities/constraints of the site are illustrated in **Figure *56*** below. The river and wetland habitat 100m buffer have been demarcated as a no-go area due to high sensitivity while a 100m buffer has been set around the heritage features within 2km of the site.

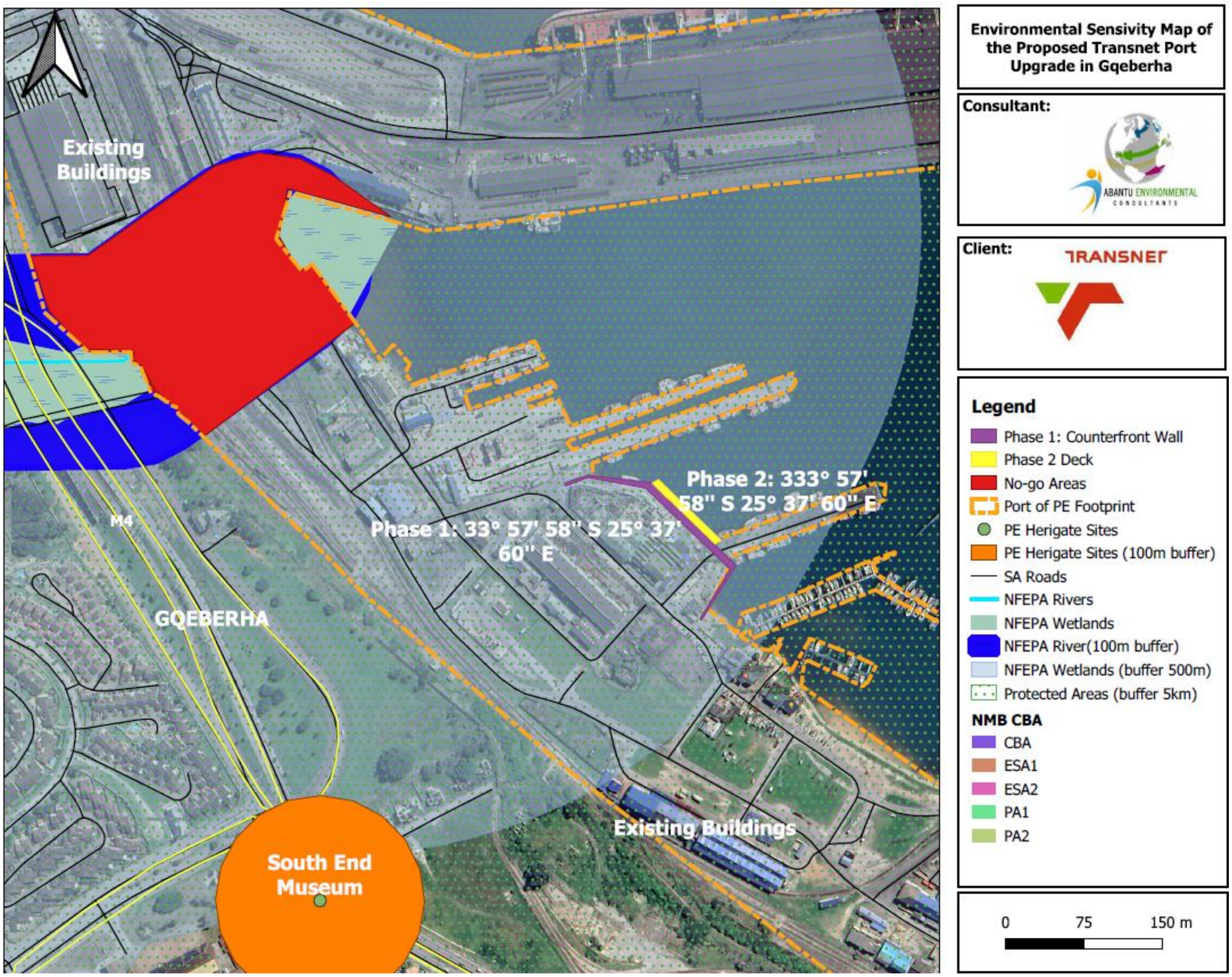

Figure 56: Final composite map

14. CONCLUSIONS AND RECOMMENDATIONS

14.1 RECOMMENDATIONS FROM SPECIALIST REPORTS AND IMPACT MANAGEMENT OUTCOMES

Marine Ecology

The rehabilitation of the Old Tug Jetty sheet pile quay wall in the Port of Port Elizabeth is needed to prevent the ongoing deterioration of this infrastructure to a degree that it poses operational, human health, and environmental risks. The proposed rehabilitation of the sheet pile quay wall in Phase 1 and the possible construction of a deck-on-pile structure in Phase 2, should the need arise, will obviously impact on the biophysical environment in the port and at and near the dredged spoil disposal site in Algoa Bay. A total of 25 impacts were identified for the construction phase and three for the operational phase of the proposed project, as summarised in Table 3. Most construction phase impacts are anticipated to be site specific in their spatial extent and of a minor or low intensity since the affected area and associated biological communities is already disturbed by existing port operations. Most of the identified impacts are fully reversible and biological communities in the affected area, and hence also ecological processes, will recover and re-establish after construction ceases to a degree permitted by ongoing port activities and notwithstanding the permanent loss of some open water and sediment habitat.

The recent demolition and reconstruction of the leading jetties for the vessel maintenance operation near the Old Tug Jetty quay area had no apparent significant impact on biological communities and ecological processes in the port. This lends confidence that the proposed rehabilitation of the Old Tug Jetty quay area will also not have a major long-term impact on ecological processes in the port.

Certain aspects of the proposed rehabilitation of the Old Tug Jetty sheet pile quay wall and the deck-on-pile structure are yet to be finalised, including the final engineering design and construction and dredging methods. The identification and assessment of environmental impacts in the current assessment provides an opportunity to mitigate some impacts through the engineering design and construction method. There is similarly an opportunity to include in the engineering design strategies for reducing existing impacts, such as surface runoff storage systems to limit the ingress of contaminants into the estuary.

Considering that of the environmental impacts identified were assessed to have a very low or low significance there is no need to implement detailed aquatic environmental monitoring programme for the proposed project. It seems probable the construction period will overlap with surveys for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth, which should identify if there are any unforeseen major changes to the aquatic environment in the port associated with the proposed construction activities. There is also no need for a detailed aquatic environmental monitoring programme at and near the dredged spoil disposal site in Algoa Bay for the same reasons, although having information of the status of biological communities at and near this site would be beneficial in the long-term.

14.2 THE FINAL PROPOSED ALTERNATIVES

Three alternatives have been assessed in this study, the preferred alternative is labelled (Alt 1), modified design (Alt 2) and No-Go is identified as (Alt 3). After consideration on the types of alternatives that exist (i.e. property, type, design, technology, operational and the no-go options), no other feasible fundamental alternatives other than the preferred (Alt 1) and No-Go (Alt 3) alternatives could be identified. Alternative Two (Alt 2) was identified as an incremental alternative based on recommendations by the Marine Ecology specialist specialist to include in the engineering design strategies for reducing existing impacts, such as surface runoff storage systems to limit the ingress of contaminants into the waterbody. Both the preferred alternative (Alt 1) and the Modified Design Alternative (Alt 2) are similar as they entail decommissioning of the existing sheet pile wall and construction of a counterfort wall and deck on pile hybrid structure which would provide certainty with regards to the future life span of the facility. The **Modified Design Alternative (Alternative 2) is the final proposed alternative** for the proposed rehabilitation of the Old Tug Jetty Sheet Pile Wall due to the additional environmentally sensitive design measure which will protect water resources from contaminated runoff. All impacts identified would be applicable to both alternatives and thus the combined significance of impacts for (Alternative 2) slightly lower than that of Alternative (1) due to the added benefit of reduction of existing surface runoff impacts.

The no-go alternative (Alt 3) means doing nothing, which would eventually result in the abandoning or condemning of the quay due to safety concerns. Although the no-go alternative has a less significant impact on the aquatic environment, the socio-economic impact that would be linked to abandonment of the current operations would be detrimental to the local economy of Nelson Mandela Bay Municipality, This makes Alternative 3 the least desirable option in terms of the proposed site and development.

14.3 ASPECTS TO BE INCLUDED AS CONDITIONS OF AUTHORISATION

The following aspects should be included as conditions of authorization:

1. The construction Site Manager, appointed independent Environmental Control Officer, and/or the local Transnet National Ports Authority environmental specialist must audit the construction site against the mitigation recommended above and/or that which is included in an Environmental Management Programme Report prepared by the appointed consultant and approved by Transnet National Ports Authority, by regularly (ideally daily in the case of the Site Manager or nominated representative) walking through the construction site. If there is evidence for litter or other solid waste entering the port the procedures, checks, and controls in the Environmental Management Programme Report should be reviewed and revised to eliminate the source of litter or any other solid waste entering the port.
2. It is strongly recommended that all parties routinely take photographs of the construction site to document the occurrence or absence of leaks from portable toilets on the site.
3. The construction Site Manager, appointed independent Environmental Control Officer, and/or the local Transnet National Ports Authority environmental specialist must verify through observations from the quay wall that construction activities are not resulting in such intense and large plumes of suspended sediment in the port that these are clearly visible from the water surface and are causing

a marked increase in suspended sediment concentrations over a large area. If this is the case, the construction method/s should be reviewed to identify areas for improvement to ensure sediment is not excessively mobilised into the water column.

4. If construction for the proposed project coincides with water quality surveys for the Long-Term Ecological Monitoring Programme for the Port of Port Elizabeth then the turbidity of the water column could be measured at stations positioned along a gradient from very near to distant from the construction activities to provide a measure of the validity of the impact significance rating.
5. Since the proposed project will take place in the Port of Port Elizabeth and this is not a common forage area for dolphins it is not considered necessary to have a trained and certified marine mammal observer onsite to aid in identifying if dolphins are present in the area. Precautions must nevertheless be taken by the contractor to ensure that dolphins and other marine mammals are not harmed by underwater noise, particularly that generated by piling in Phase 2 of the proposed project. Prior to the commencement of piling on any given day a nominated representative of the contractor that has received some training in identifying marine mammals should undertake a visual survey (using binoculars) of the port area near the Old Tug Jetty quay area for the presence of dolphins, for a period of 20 minutes. If dolphins are observed piling must not proceed until the dolphins have left the area. If dolphins are observed to enter the area while piling is underway the piling does not need to cease if it has been continuous. The piling pre-survey procedure and soft start must also be followed if there is a pause of more than 30 minutes in piling at any time.
6. Periodic bathymetric surveys of the area will show if there is increased sediment erosion or deposition as a result of the new quay wall and deck-on-pile structure.
7. A discovery of any palaeontological resource must be protected so that a professional paleontologist will make appropriate mitigation. If fossil remains are discovered during any phase of construction, either on the surface or uncovered by excavations the ECO/site manager in charge of these developments must be notified immediately. These discoveries ought to be protected (if possible, in situ) and the ECO must report to SAHRA (Contact details: ECPHRA, Corner Scholl and Amalinda Drive, East London Tel: 0437450888/0434921942; Fax: +27 (0)43 7450889. Web: www.ecprha.org.za) so that correct mitigation (recording and collection) can be carry out by a palaeontologist.

15. ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

The following assumptions and limitations are extracted from the various specialist studies undertaken for this project. The following assumptions are applicable:

- It is assumed that all information received from the client is true and correct

Marine Ecology:

The Environmental Impact Assessment process is not a precise science and relies on the expertise and experience of impact assessors and specialist scientists. A measure of professional judgement is thus involved in assessing the significance of identified impacts associated with an activity. It is assumed the professional judgement of the specialist scientist that assessed the significance of identified impacts is valid.

The emphasis of the Environmental Impact Assessment process is on identifying and assessing 'significant' impacts. It is not possible to identify and assess all impacts that might arise from a proposed project. It is assumed the identified impacts and the assessment of their significance addresses more complex interactions in the environment that might arise because of an impact but are not specifically discussed or assessed.

At this stage several components of the proposed project have not yet been finalised, including:

- A detailed engineering design.
- A detailed geotechnical survey.
- A detailed method of construction, including how often vibratory versus percussive piling will be used, how often drilling will be performed during piling, whether support vessels will be used, the degree of concrete mixing onsite, and the extent of demolition of existing structures that will be required to allow the project to proceed.
- A detailed contractor site plan, including where hazardous and construction materials will be stored and handled.
- The spatial extent of the dredging footprint, the method of dredging, and the method of dredged sediment disposal.

Much of the above information and detail will probably only be finalised shortly before the proposed project is implemented. In the absence of a final engineering design, construction site plan, and methods of construction it is assumed the impacts identified and assessed cover the range of possible scenarios that might arise due to the proposed project.

There is a limited amount of information for some components of the affected physical and biological environment in the Port of Port Elizabeth. It is assumed the specialist's assessment of impacts that might affect these components of the affected environment are valid.

It is assumed the mitigation measures identified are reasonable, feasible, and will be implemented, or that adequate and effective alternate mitigation that might be identified will be implemented, and that the implementation of mitigation will enhance the significance of positive impacts and limit the significance of negative impacts as intended and assumed.

It is assumed that any significant changes made to the proposed project will be communicated to the CSIR to allow for the reassessment of impacts, should this be necessary.

Paleontology

The appropriateness and the dependability of desktop Paleontological Impact Assessments as a significant aspect of heritage impact assessments are commonly limited by the following restrictions:

- Numerous old fossil records were not adequately updated or stored in a computerized repository.
- Several palaeontological records were not correctly georeferenced.
- Uncertainty about geochronological analysis due to insufficient technical support among the available professional paleontologists
- Poor geographic information system knowledge during the compilation of information hampers quality paleo-map.
- The ambiguity of fieldwork or field navigation planning inhibits the quality of palaeontological reports.
- Many of the active hotspots of fossiliferous rock have not been adequately surveyed by the available professional paleontologist.
- Several palaeontological reports were mapped on the poorly calibrated base map and inaccurate geology maps.

16. A REASONED OPINION AS TO WHETHER THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED

Marine Ecology

The Marine Ecology Specialist Study has identified and assessed impacts to the biophysical environment in the Port of Port Elizabeth and at and near the dredged spoil disposal site in Algoa Bay that might or will arise due to the proposed rehabilitation of the Old Tug Jetty sheet pile wall in Phase 1 and the construction of a deck-on-pile structure in Phase 2. As stated elsewhere in this report, if the proposed project proceeds it will entail unavoidable impacts to the biophysical environment. Section 31 (n) of the National Environmental Management Act: Environmental Impact Assessment Regulations, GNR. 543 of 2010 (as amended in 2014), requires that the Environmental Assessment Practitioner provide an opinion on whether the proposed project (activity) should or should not be authorised. The purpose of this section is to provide a reasoned opinion in this context for impacts to the biophysical environment that might or will arise because of the proposed project.

Phase 1 of the proposed project will largely involve improvements to existing infrastructure at the Old Tug Jetty quay area. The improvements will result in an increase in the footprint of the existing infrastructure and will thus lead to the permanent loss of a small amount of open water and sediment habitat. The construction of a deck-on-pile structure in Phase 2 will involve the construction of new infrastructure and will thus lead to a further increase in the infrastructure footprint, but this increase will not be matched by an equivalent permanent loss of open water and sediment habitat as the new infrastructure will be of a deck-on-pile type. The project will primarily affect already disturbed environments in the Port of Port Elizabeth and at and near the dredged spoil disposal site in Algoa Bay and will not substantially affect pristine natural resources. Some rare, threatened, or endangered species may periodically enter the port and/or use the area near the dredged spoil disposal site but these areas, as far as could be established, do not constitute critical habitat for rare, threatened, or endangered species. Most of the biophysical environmental impacts identified will directly and indirectly affect a small area at and near the proposed project site in the port or at and near the dredged spoil disposal site in Algoa Bay and are not anticipated to have major nor long-lasting consequences as most impacts are fully reversible. As stated above the proposed project will result in the permanent loss of open water and sediment habitat in the port. The amount of habitat that will be lost is small in relation to available similar habitat in the port and its loss is not anticipated to result on major changes to populations or ecological processes in the port. In those instances where the significance of identified environmental impacts was rated as greater than low the implementation of mitigation and responsible practices during the construction and operational phases should reduce the significance to acceptable levels. None of the impacts is considered unacceptably significant such that they constitute a fatal flaw for the proposed project.

The proposed project will thus have a very low to low negative overall impact on the biophysical environment. The specialist that prepared this specialist report is thus of the opinion that, based on purely biophysical environmental considerations, the proposed project can be approved provided recommended and/or other more effective mitigation that might be identified is implemented and the final engineering design and construction method statement do not identify additional environmental impacts or increase the significance of assessed impacts. In the event of the latter, the significance assessment of some of the identified environmental impacts might need to be revisited.

Paleontology

The present palaeontological study is a scoping to ensure thorough environmental screening of the study portion for a potential fossil heritage at Port Elizabeth, Eastern Cape, South Africa port. The pedocrete content of the Miocene calcareous sandstone cover is a typical red flag indicating the need for a detailed geo-palaeontological study considering the scientific relevance of the site. The proposition to rehabilitate the old tug Jetty at the Transnet Port of Port Elizabeth, Eastern Cape, is of high socio-economic importance. However, such a project renders the area's palaeontological significance non-available due to the resource's potential for mutilation.

The study vicinity's 3324 geologic maps showed the dominant overlying calcium-rich sandstone strata, thickly overlaid by downwasted calcrete entwined with the awash gravel. Validated by sequence stratigraphy correlation, the geologic portion of the study area was covered by weathered calcareous sandstone (Nanaga Formation) (88%) and quartzite (Peninsula Formation) (12%). The Nanaga Formation geologic cover mainly represents ancient dune sands, as purportedly documented in the regional map.

The detailed field geo-palaeontological study reviewed that the portion is thickly overburdened while the outcropping footprints were buried in great depth. Therefore, no fossil discovery was made in the entire layout. At the same time, the whole study area is padded by artificial sediments or reworked with superficial deposits due to the century-old constructions, which also ensures a careful packing of topsoil sediment for stability. There are, therefore, no objections to the proposed development for palaeontological conservation reasons. However, a substantial threat to the local fossil heritage is imminent should a fossil be recovered during the construction phase.

Consequently, the study recommends that a subsurface geological prognosis be carried out to address the paleontology integrity of the proposed footprint should fossil remains be discovered during the rehabilitation of the proposed intention. To ensure the detailed geological assessment, the EVO responsible for the developments would be alerted immediately. A discovery of any palaeontological resource must be protected so that a professional paleontologist will make appropriate mitigation.

It is the recommendation of the EAP that the preferred alternative for this project may be authorised on condition that the applicant will ensure compliance with all mitigation measures and recommendations contained in this report and associated EMPr.

17. UNDERTAKING

The EAP herewith confirms:

(a) The correctness of the information provided in the reports;

(b) The inclusion of comments and inputs from stakeholders and I&AP's;

(c) The inclusion of inputs and recommendations from the specialist reports where relevant; and

(d) That the information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties are correctly reflected herein.

Signature of the environmental assessment practitioner:

Abantu Environmental Consultants (Pty) Ltd

Name of company:

03 July 2023

Date:

18. REFERENCES

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19. APPENDICES

Appendix A: Declaration and CV of the EAP

Appendix B: Screening tool report and Sensitivity Verification Report

Appendix C: Pre-feasibility Study and Proof of Investigation of Alternatives

Appendix D: Environmental Management Programme (EMPr)

Appendix E: Public Participation: Comments and Responses Report

E-1: I&AP Database

E-2: Site Notices & Adverts

E-3: I&AP Notification & Comments Received

E-4: Site Notice

E-5: Public meeting Presentation

E-6: Correspondence with CA & Stakeholders

E-7: Protected Areas Correspondence

E=8: Response to DFFE Comments on FSR

Appendix F: Specialist Reports & Declarations

F1: Social Impact Assessment Report

F2: Palaeontological Impact Assessment Report

F3: Marine Ecological Impact Assessment Report