



## BEACH AND COASTAL IMPACT ASSESSMENT

### THE PROPOSED REFURBISHMENT AND CONSTRUCTION OF COASTAL INFRASTRUCTURE WITHIN THE KING SABATA DALINDYEBO LOCAL MUNICIPALITY, COFFEE BAY

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**Compiled for: Acer (Africa) Environmental  
Consultants**

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# THE PROPOSED REFURBISHMENT AND CONSTRUCTION OF COASTAL INFRASTRUCTURE WITHIN THE KING SABATA DALINDYEBO LOCAL MUNICIPALITY, COFFEE BAY & HOLE IN THE WALL, EASTERN CAPE

## Contents

### Executive Summary

1. Introduction.....	7
2. Project Description.....	8
3. Method.....	11
4. Regional Perspective of Site.....	12
5. Site Specific Review.....	18
6. Analysis of Impacts and Management Recommendations.....	29
7. Conclusion and Management Recommendations.....	41

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<b>Front page image</b>	Dune cordon at Hole in the Wall

## List of Figures

Figure 1.	Regional map showing subject areas	6
Figure 2.	Aerial image of Coffee Bay Main Beach study site	8
Figure 3.	Aerial image of Hole in the Wall study site	8
Figure 4.	Sampling points across both study sites	9
Figure 5.	Subject site in regional context	12
Figure 6.	Vegetation types at Coffee Bay (SANBI)	13
Figure 7.	Vegetation types at Hole in the Wall (SANBI)	14
Figure 8.	DEFFE screening report map for Coffee Bay & Hole in the Wall	17
Figure 9.	The extent of marine “Critical Biodiversity Areas”	18
Figure 10.	Topographic map of Coffee Bay	20
Figure 11.	Lifeguard tower at Coffee Bay	21
Figure 12.	Dune positioned seaward of Nenga estuary	23
Figure 13.	The dune heel and Nenga estuary	23
Figure 14.	Image of pebble wash below dune heel	23
Figure 15.	Polychaetes within concretions at dune heel	23
Figure 16.	Key features identified at the Coffee Bay main beach	24
Figure 17.	Topographic map of Hole in the Wall	26
Figure 18.	Key features identified at Hole in the Wall	27
Figure 19.	Estuary and wooded flood terrace at Hole in the Wall	28
Figure 20.	Sand bypass north of the Hole in the Wall site	28
Figure 21.	Recommended plans for Coffee Bay	31
Figure 22.	Recommended plans for Hole in the Wall	33

## List of Tables

Table 1.	Review of ecological impacts arising from proposed activities	37
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## List of Appendices

Appendix A1.	Proposed refurbishments for Coffee Bay and Hole in the Wall	41
Appendix A2.	The proposed refurbishments for Coffee Bay	42
Appendix A3.	The proposed refurbishments for Hole in the Wall	43
Appendix A4.	The practical high-water mark at the Hole in the Wall hotel	44
Appendix A5.	The estimated Estuarine Functional Zone (EFZ) at Coffee Bay	45

## Glossary of Terms and Abbreviations

DEFFE	Department of Environment, Forestry and Fisheries
Dissipative	A dissipative beach is a wide beach with a low profile associated with high energy surf zones.
Dune heel	The leeward extreme of a dune
Dune toe	The seaward extreme of a dune
Eco-morphological	The physical and ecological result of plant and morphological drivers,
Psammo-	Of dunes
Slack	A valley or depression with the dune cordon

## DECLARATION BY THE SPECIALIST

I, **Simon C. Bundy**, declare that --

- I act as the independent specialist in this application;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the EIA Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Waste Act and NEMA, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Waste Act and NEMA, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).



**SDP Ecological and Environmental Services**

**20 May 2021**

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Simon Bundy has been involved in environmental and development projects and programmes since 1991 at provincial, national and international level, with employment in the municipal, NGO and private sectors, providing a broad overview and understanding of the function of these sectors. From a technical specialist perspective, Bundy focusses on coastal and xeric ecological systems. He is competent in a large number of ecological and analytical methods including multivariate analysis and canonical analysis. Bundy is competent in wetland delineation and has formulated ecological coastal set back methodologies for EKZN Wildlife and Department of Environmental Affairs. Bundy acts as botanical and environmental specialist for Eskom. Based in South Africa, he has engaged in projects in the Seychelles, Mozambique, Mauritius and Tanzania as well as Rwanda, Lesotho and Zambia. Within South Africa, Bundy has been involved in a number of large scale mega power projects as well as the development of residential estates, infrastructure and linear developments in all provinces. In such projects Bundy has provided both technical support, as well as the undertaking of rehabilitation programmes.

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Ecological investigations National EGI and Gas pipelines KZN component : CSIR –(2018 - 2020)

Ecological investigations and Rehabilitation Planning : Sodwana Bay :iSimangaliso Wetland Park Authority – (2014 - 2018)

Ecological evaluation and monitoring: Plastic pellet (nurdles) clean-up MSC Susanna Marine Pollution Event : West of England Insurance, United Kingdom (2018 - 2020)

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Natalie de Wet has been working at SDP Ecological and Environmental Services since January 2021. Her honours thesis assessed the population genetics of the Critically Endangered Riverine Rabbit. Further course work included research projects on Proteaceae, Sugarbird *Promerops cafer*, rocky intertidal communities as well as climate change. Natalie has previously interned at EnviroPro where she job-shadowed Environmental Assessment Practitioners and Environmental Control Officers.

## EXECUTIVE SUMMARY

The proposed refurbishment and construction of the coastal infrastructure at Coffee Bay Main Beach and Hole in the Wall, both located in the Eastern Cape, are the subjects of a basic assessment evaluation in terms of the National Environmental Management Act (107 of 1998). The applicant has appointed ACER Africa as their environmental assessment practitioners (EAP) who in turn, have commissioned SDP Ecological and Environmental Services to undertake an assessment of the coastal environment to support and guide the Basic Assessment process. This report has been compiled to evaluate the bio physical impacts that the refurbishment and construction of coastal infrastructure would have on the various components of the coastal environment at Hole in the Wall and Coffee Bay Main Beach and discusses options for incorporation into the planning of the area. In addition the provision of recommendations on environmental management measures to be employed following construction is presented.

Coffee Bay Main Beach and Hole in the Wall are two regionally important tourism destinations that lie within the supra tidal environment. The proposed developments at both Hole in the Wall and Coffee Bay Main Beach include viewing decks, ablution facilities and parking facilities, which are expected to increase tourist numbers while maintaining the ecological integrity of the site.

The sites are subject to a number of marine, aeolian and fluvial factors associated with the coastal environment, as well as the proximal estuaries at each site. A report submitted on the 17<sup>th</sup> of February highlighted a number of minor planning and construction recommendations. The report discussed the following aspects and recommendations:

1. At Coffee Bay Main Beach, infrastructure should be positioned primarily leeward of the identified sand sharing system, with infrastructure confined to the north of the dune, effectively avoiding the more southerly dune form.
2. The wet dune slack should be maintained to ensure that sub surface hydrology is not altered by such developments.
3. At Hole in the Wall, the proposed footpaths and formalized walkways should avoid or skirt the identified sand bypass system.
4. Infrastructure within the flood terrace of the Mpako River should be minimized.

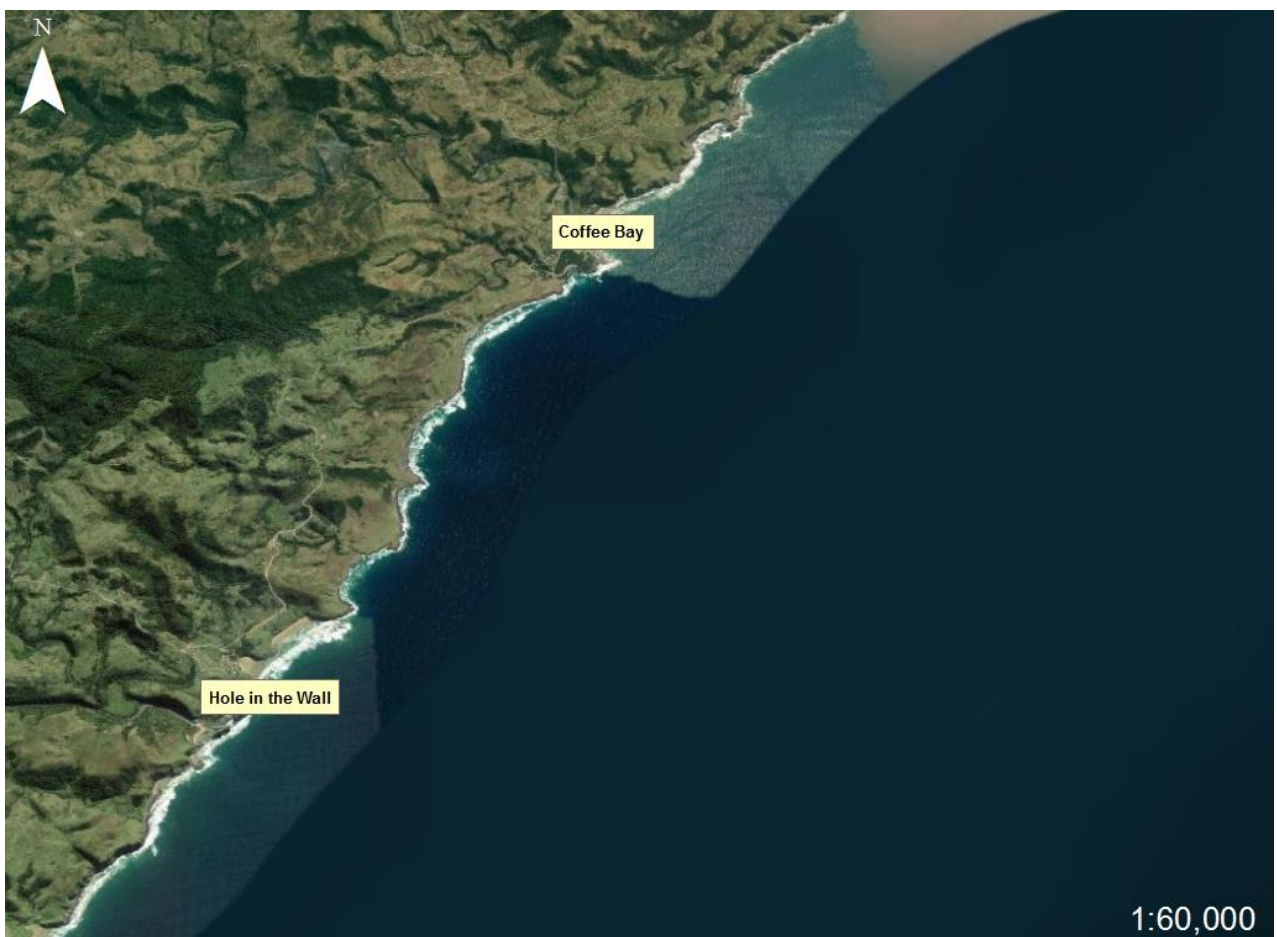
Following the submission of this report, the layout plans for both Coffee Bay and Hole in the Wall were revised taking the ecological input into consideration. This report is a revised version of the report submitted in February and reflects the lower impacts associated with the revised layout plan.

### STATEMENT

**It is contended that the establishment of coastal infrastructure at Coffee Bay Main Beach and Hole in the Wall, will, if implemented according to the recommendations presented in this report, have minor ecological repercussions for the subject area in general, and it is anticipated, will serve to mitigate or reverse negative impacts being affected on the sites, through the uncontrolled passage of beach visitors.**

## 1. INTRODUCTION

Acer (Africa) Environmental Consultants have commenced with an environmental impact assessment process (through a basic assessment application) to review and obtain authorisation from the National Department of Environment, Forestry and Fisheries (DEFFE) for the refurbishment and expansion of coastal infrastructure on a portion of coastline in the Eastern Cape. The refurbishment and construction of facilities is proposed for Coffee Bay Main Beach and Hole in the Wall, destinations located within the King Sabata Dalindyebo Local Municipal area (Figure 1). At Coffee Bay Main Beach, the proposed site for construction is positioned at  $31^{\circ}59'0.57''\text{S} / 29^{\circ} 9'1.57''\text{E}$  and is located on the northern bank of the Nenga river mouth. Hole in the Wall lies at  $32^{\circ} 2'0.16''\text{S} / 29^{\circ} 6'39.89''\text{E}$  and is located on the northern bank of the Mpako River.



**Figure 1.** Regional map image showing subject areas at Coffee Bay and Hole in the Wall.

This report serves to provide a bio-physical overview of the coastal environment, including the beach and dune cordon within and adjacent to the proposed construction and refurbishment of facilities. This investigation has been undertaken utilising various, selected parameters and identifies factors associated

with the coast that may be considered drivers that determine the status and ecological function of the inter-tidal environment, beach and dune cordon. In addition, the investigation considers the ecological impacts that may arise within the beach and coastal dune system from the refurbishment and construction of tourism facilities, the most appropriate development approach, as well as mitigation and management measures that may be employed during and post the construction phase.

This report is a revision of a report dated 17<sup>th</sup> of February. The recommendations discussed in this report have been taken into consideration for the proposed layout of facilities, which are shown in Appendices A2 and A3.

## 2. PROJECT DESCRIPTION

The Department of Environment, Forestry and Fisheries, through the Working for the Coast Programme (WfC), aims to create access routes to and along the affected portions of coastline at Coffee Bay Main Beach and Hole in the Wall (Figure 2 and Figure 3; Annexures A1 to A3). The proposed projects entail the formalisation of a number of existing informal features and as such entail the following activities:

1. At Coffee Bay Main Beach, the following refurbishments and expansion to the beach facilities are:

- The construction of parking bays and level areas for the movement of traffic.
- The establishment of a new lifeguard tower.
- The establishment of poly-timber walkways and three viewing decks.
- Construction of new braai facilities.
- Demolition of existing ablution facilities.
- Construction of new ablution facilities.
- Establishment of a picnic area and poly-timber playground.

(see Annexure A2)

2. At Hole in the Wall the following refurbishments and expansions to the beach facilities are:

- The establishment of a footpath, formalised poly-timber walkway, walkway rest areas and a viewing deck.
- Six picnic areas and two parking areas.
- Establishment of concrete stairs to access a fishing spot.
- Refurbishments to facilities at the Hole in the Wall hotel, such as formalise the existing boat launch site, installation of braai facilities, and the formalisation of a road from the hotel to boom gate (100 m).

(See Annexure A3)



In addition, street lighting and other aesthetic landscaping features and activities may be implemented in and around the facilities.



**Figure 2.** Aerial image presenting Coffee Bay - Main Beach study site.



**Figure 3.** Aerial image of the Hole in the Wall study site.

## **2.1 Seasonality and limitations**

The assessment was undertaken during January 2021, which is representative of a summer period and generally inflated beach environment. The seasonality is given due consideration in the interpretation of data. No data or observations for other seasons were available for comparison. Where such data was required for assessment models, assumptions were made, based on accepted trends and predictable seasonal changes. Notably, this study did not consider antecedent weather conditions and was conducted during COVID-19 beach restrictions.

## **2.2. Applicable legislation**

### **The National Environmental Management Act (Act no. 107 of 1998)**

This Act serves to control the disturbance of land and its utilisation within certain habitats. Legislation applicable to the proposed activity include Section 19 of Listing Notice 1, which states –

*“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) a watercourse;*

*(ii) the seashore; or*

*(iii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater; or*

*(iii) the sea”*

### Integrated Coastal Management Amendment Act (36 of 2014)

ICMA presents several principles that relate to sound coastal management practices. Principles applicable to the proposed activity include Chapter 7, Section 58, which stipulates the duty of care and remediation of environmental damage which includes the duty to avoid negative effects on the receiving environment. As such, this Act applies to any activity that has an adverse effect on the coastal environment.

## **3. METHOD**

In the compilation of this eco-morphological report a desktop review of literature and pertinent information relating to the site was undertaken. Specific consideration was also given to aerial imagery of the shoreline and dune cordon. Such desktop investigations included the following:

- Review of recent and historical aerial imagery dating from 2000 to 2020.
- Dominant coastal processes were evaluated using available wave and wind data.
- Review of the change in eco-morphology (stable vs unstable) dune form.

In addition, field reconnaissance was undertaken on the 22<sup>nd</sup> and 23<sup>rd</sup> January 2021 and 27 January 2022 whereby:

- Specific features within the supra-tidal environment were identified and logged using a Garmin Montana GPS. Features of significance included various geomorphological features of the sand sharing system including dune, beach and inter tidal environment.
- Consideration was given to riverine and estuarine environments in close proximity to the sites.
- Dominant and significant habitat forms were identified and recorded across the sites.
- General observations were noted along the dune cordon in terms of the gradient of the dune face and the nature and structure of the vegetation at the beach–dune interface.
- Using site knowledge and contour data, the estimated Estuarine Functional Zone (EFZ) at Coffee Bay was defined, as shown in Appendix A5.



**Figure 4.** Image indicating sampling points across study area.

#### 4. REGIONAL PERSPECTIVE OF THE SUPRA TIDAL ENVIRONMENT

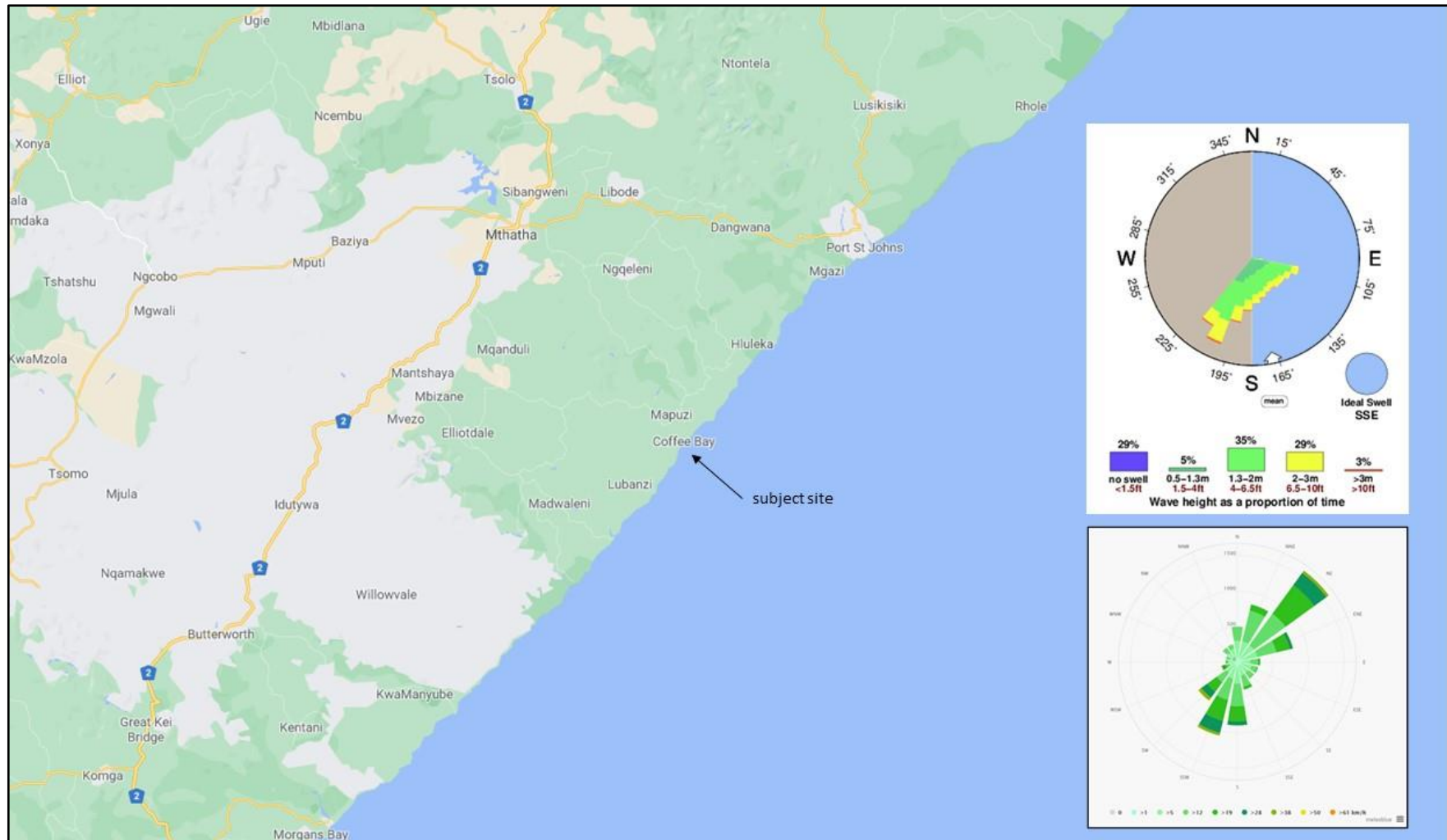
Coffee Bay occurs within a transition zone between the warm-temperate and subtropical regions of South Africa (Harrison *et al.* 2000). Figure 5 below, presents the wind and wave rose for the region. This data indicates that the region is affected by primarily, a southerly swell associated with a ground swell originating from the sub 40° latitude. However, the dominant wind, namely the north easterly, is not the primary driver of larger swells affecting the coast. In real terms, the coastline of the Wild Coast, whereby Coffee Bay and Hole in the Wall are located, is known for its extreme wave heights, a product of variations in the Agulhas Current coinciding with meteorological events (Mallory 1974). These extreme wave and storm surge events arise from the south, as shown by the wave rose, and lead to significant run ups along the shoreline, giving rise to erosion and the reshaping of shorelines.

The coastline along most of the northern Eastern Cape or “Transkei” region is a mix of rocky cliff, interspersed with shallow pocket beaches giving rise to a rugged coast. Such variable coastline is a product of the extreme wave conditions experienced in this area and the geological history of the region. As a consequence, the coastline is susceptible to severe erosion events, particularly affecting the narrow beach and dune systems associated with the regular bays and estuaries.

In addition, the coast is punctuated by numerous rivers and small streams (sometimes called ‘hapua’), which are often associated with diverse geological features, such as the *Hole in the Wall*, and often form the southern boundary of soft pocket beaches, as in the case of the Coffee Bay Main Beach.

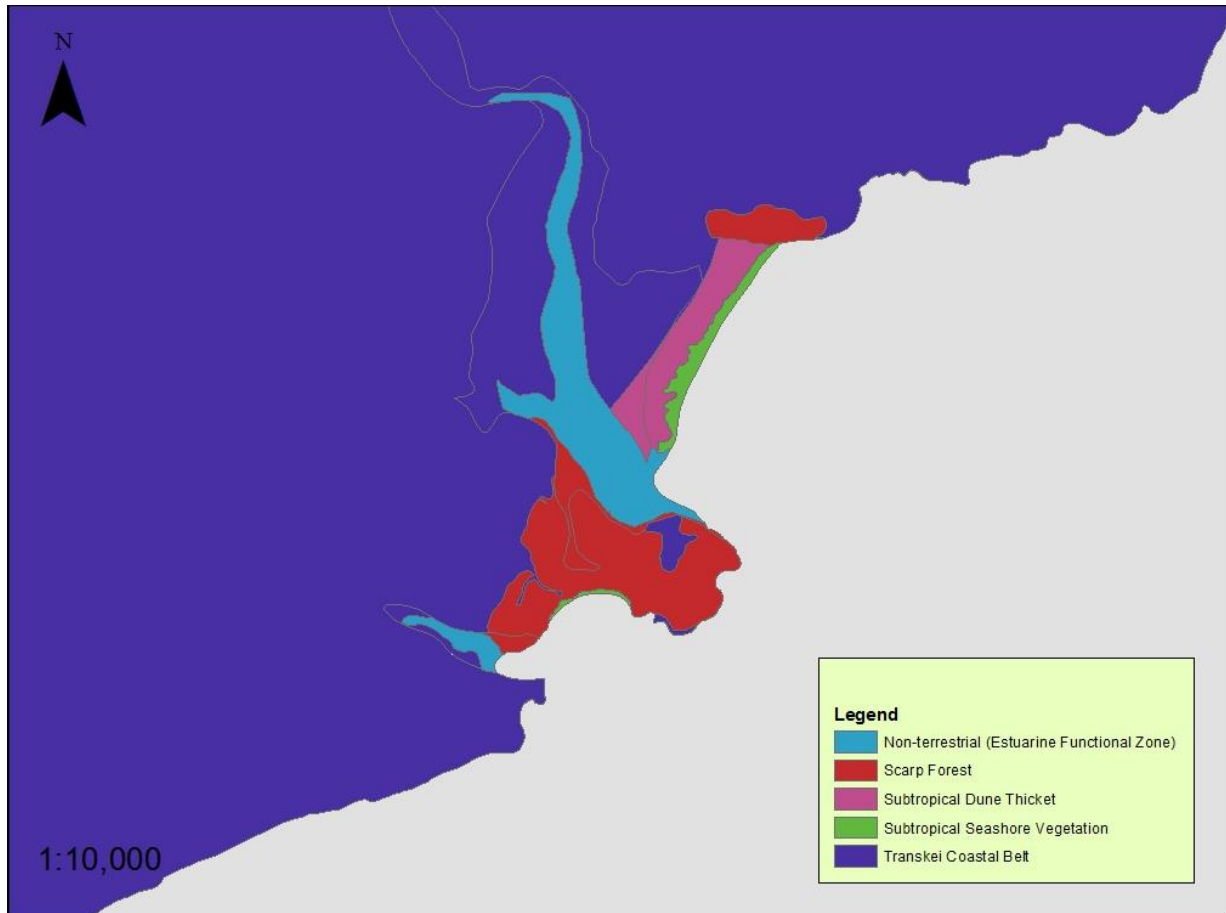
While the rock cliff environments of the Transkei are generally robust and resistant to short term maritime factors, the beach environments, as previously mentioned, are susceptible to erosion and wash out due to long term maritime factors. Marine sediments from the inshore environment are driven by waves onto beaches, while wind forcing drives the formation of dunes above the high-water mark. Extreme waves under high tide conditions can result in the undercutting and collapse of dunes, while strong onshore winds, often focused by coastal features, give rise to dune formations. The same winds can be destructive, leading to the formation of parabolic dunes and blowouts. Vegetation plays a significant role in stabilizing dune systems and where vegetative cover is compromised; increased dune transgression can be anticipated.

Climate change has become a notable factor affecting coastal processes along most coastlines, including the south east African coast. No regional data is available for the Coffee Bay region, however Sea Level Rise (SLR) between Durban (to the north of the region) and East London (to the south of the region) varies from 1.49mm/yr to 0.77mm/yr, respectively. (<https://www.tidesandcurrents.noaa.gov>). This suggests there is significant variation in sea levels between the north and the south of the coast, although such variance is accounted for by isostatic change relative to the coast. Nonetheless, an increasing sea level, accompanied by increasing storms (Beralldi 2019) is likely to lead to greater coastal transgression.



**Figure 5.** Map showing subject site in regional context. The wind rose (bottom) was sourced from [www.meteoblue.com](http://www.meteoblue.com), and the wave rose (top) was sourced from [www.surf-forecast.com](http://www.surf-forecast.com).

From an ecological perspective, habitat complexity and species diversity play a significant role in determining the state of a dune form (Hesp 2012). Using SANBI data (Mucina and Rutherford 2006), the Coffee Bay region can be noted to comprise of five habitat types, namely a non-terrestrial habitat (referring to the estuarine environment), Scarp Forest, Subtropical Dune Thicket, Subtropical Seashore Vegetation, and Transkei Coastal Belt (Figure 6).

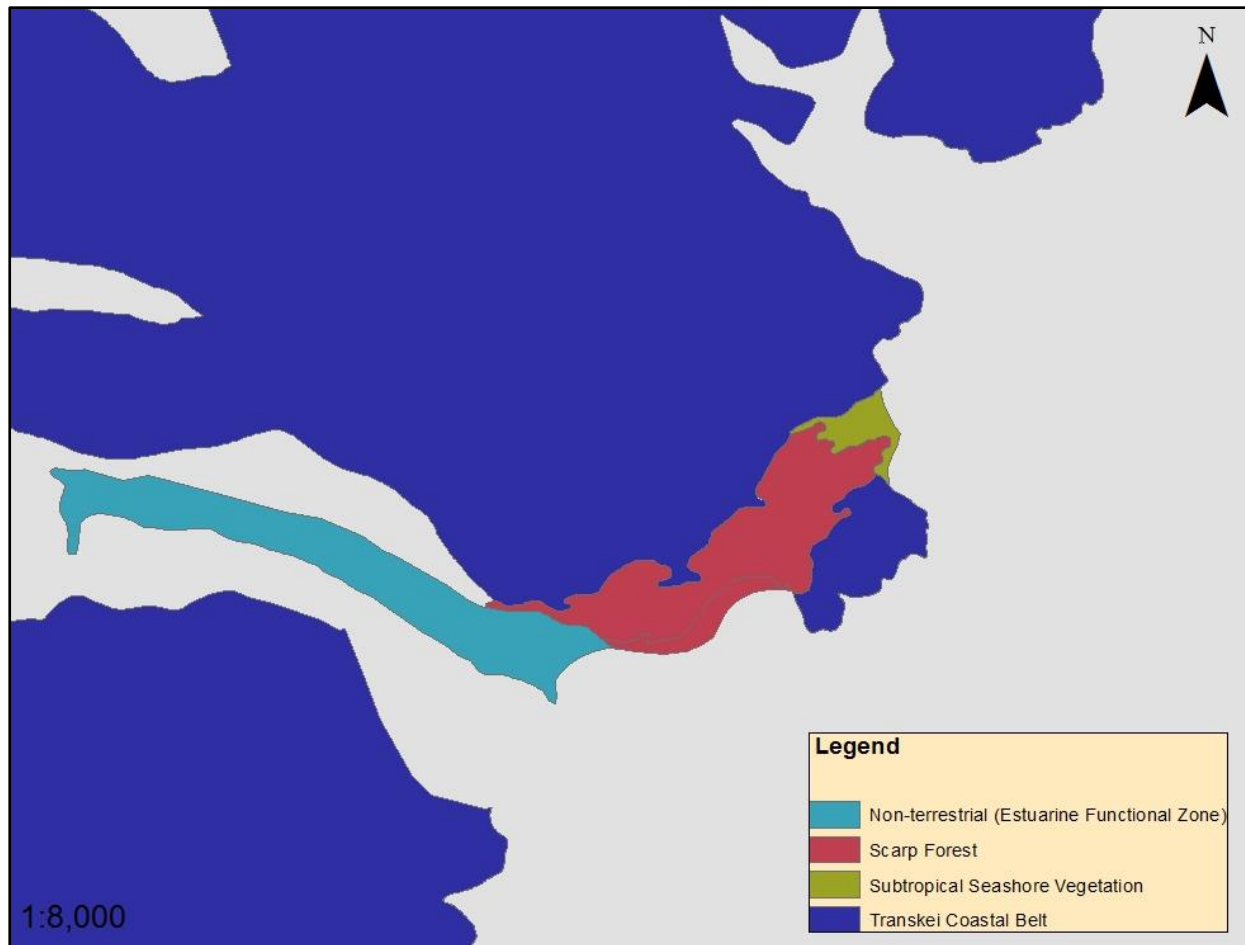


**Figure 6.** Map indicating subject site and the five habitat types at Coffee Bay (SANBI 2006).

From a conservation perspective the Scarp Forest, Subtropical Seashore Vegetation and Subtropical Dune Thicket are classified as “Least threatened”, however in parts, these habitats are vulnerable to over-exploitation, overgrazing and habitat degradation (Mucina and Rutherford 2006). Notably, Subtropical Seashore Vegetation is most threatened by urban development for tourism purposes (Mucina and Rutherford 2006).

At Hole in the Wall, SANBI data shows a similar complex of habitat forms. As shown in Figure 7, The Hole in the Wall site comprises of four vegetation types, namely Non-terrestrial (referring to the estuary of the Mpako), Scarp Forest, Subtropical Seashore Vegetation, and Transkei Coastal Belt. As mentioned, the latter habitat type, Transkei Coastal Belt, is of greatest concern and is currently under threat due to cultivation and land use change (Mucina and Rutherford 2006). Notably, Figure 7 exhibits

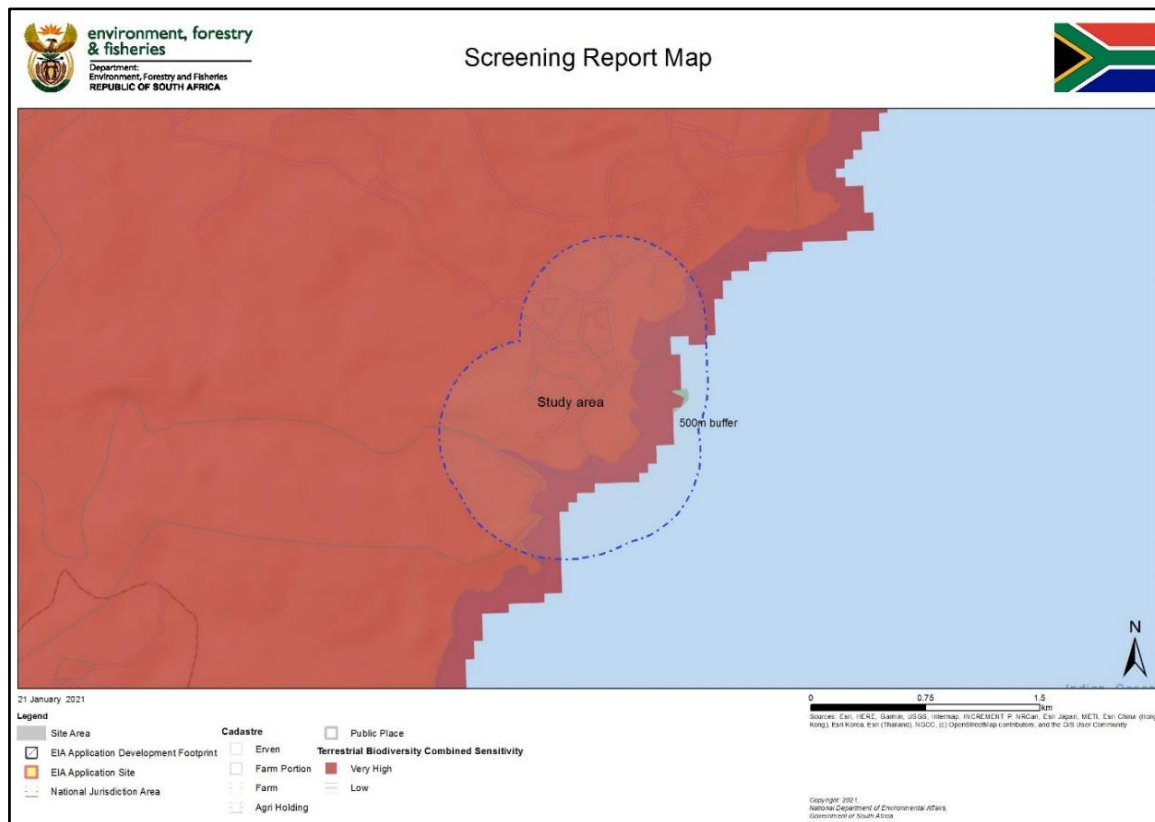
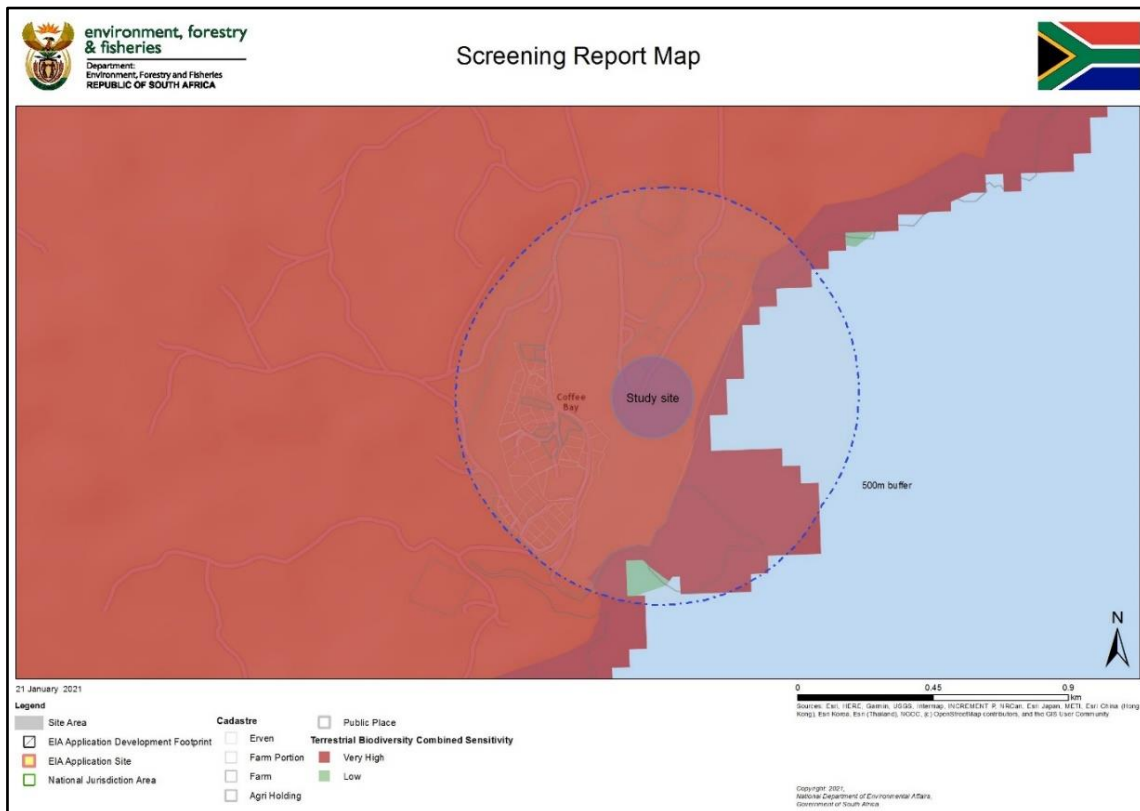
an arrangement of vegetation forms in this area which have largely been established by maritime and aeolian coastal processes, and in particular changes in sea level.



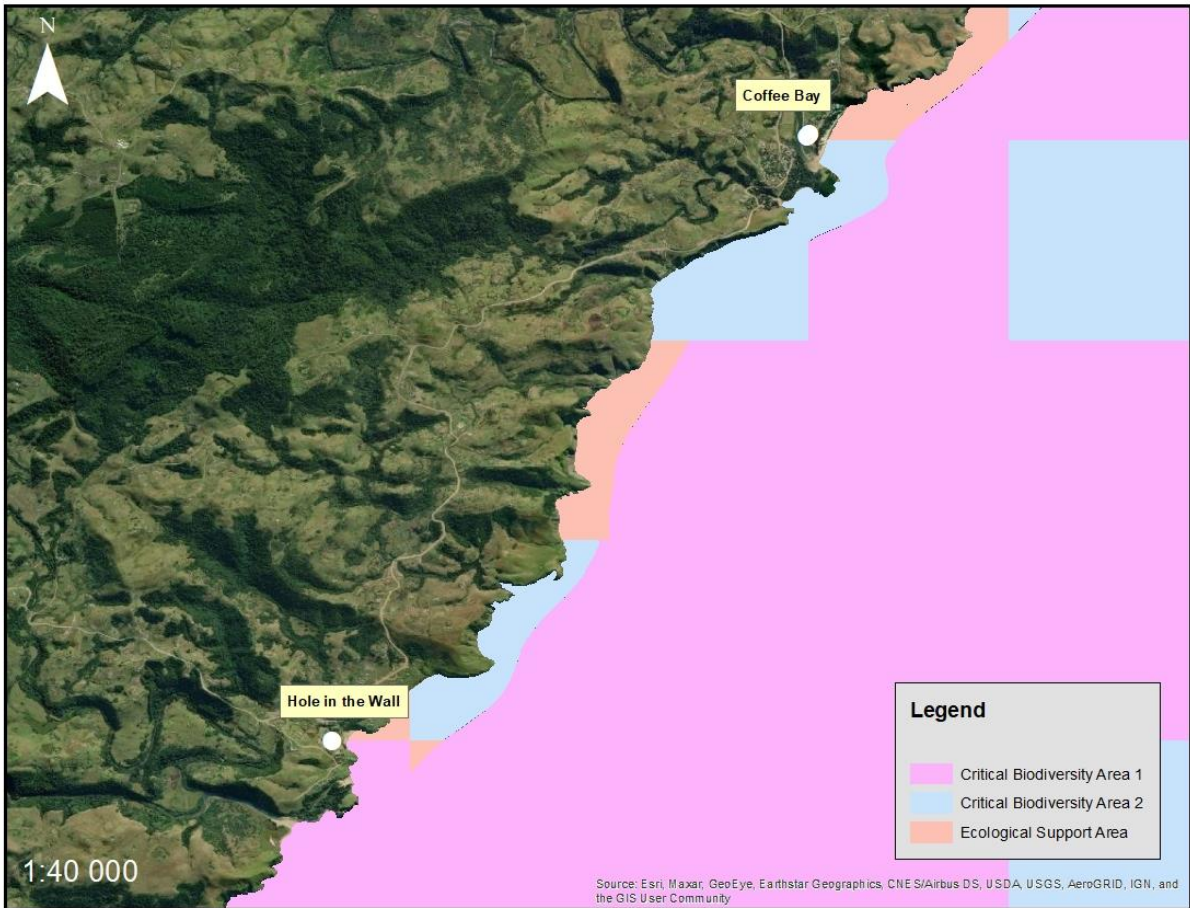
**Figure 7.** Map indicating subject site and habitat types at Hole in the Wall (SANBI 2006).

As per the requirements of Government Gazette 43110 “Protocol for the specialist assessment and minimum reporting content requirements”, consideration of The DEFFE screening tool (<https://screening.environment.gov.za>), indicates the subject sites at Coffee Bay Main Beach and Hole in the Wall to be of a “very high terrestrial biodiversity sensitivity” (as shown in Figure 8). As such, an assessment of terrestrial ecological aspects was undertaken using the method and approaches indicated above. In addition, the Provincial Conservation Authority considers both the Yzerf Coffee Bay and Hole in the Wall study sites to be of critical importance from a conservation perspective, as they fall within CBA irreplaceable areas (CBA 1), CBA Optimal Areas (CBA 2) and Ecological Support Areas (Figure 9).





**Figure 8.** DEFFE screening report map for Coffee Bay (top); and Hole in the Wall (bottom) (2021).



**Figure 9.** The extent of marine “Critical Biodiversity Areas” in the vicinity of Coffee Bay and Hole in the Wall.

## 5. SITE SPECIFIC REVIEW OF COFFEE BAY & HOLE IN THE WALL

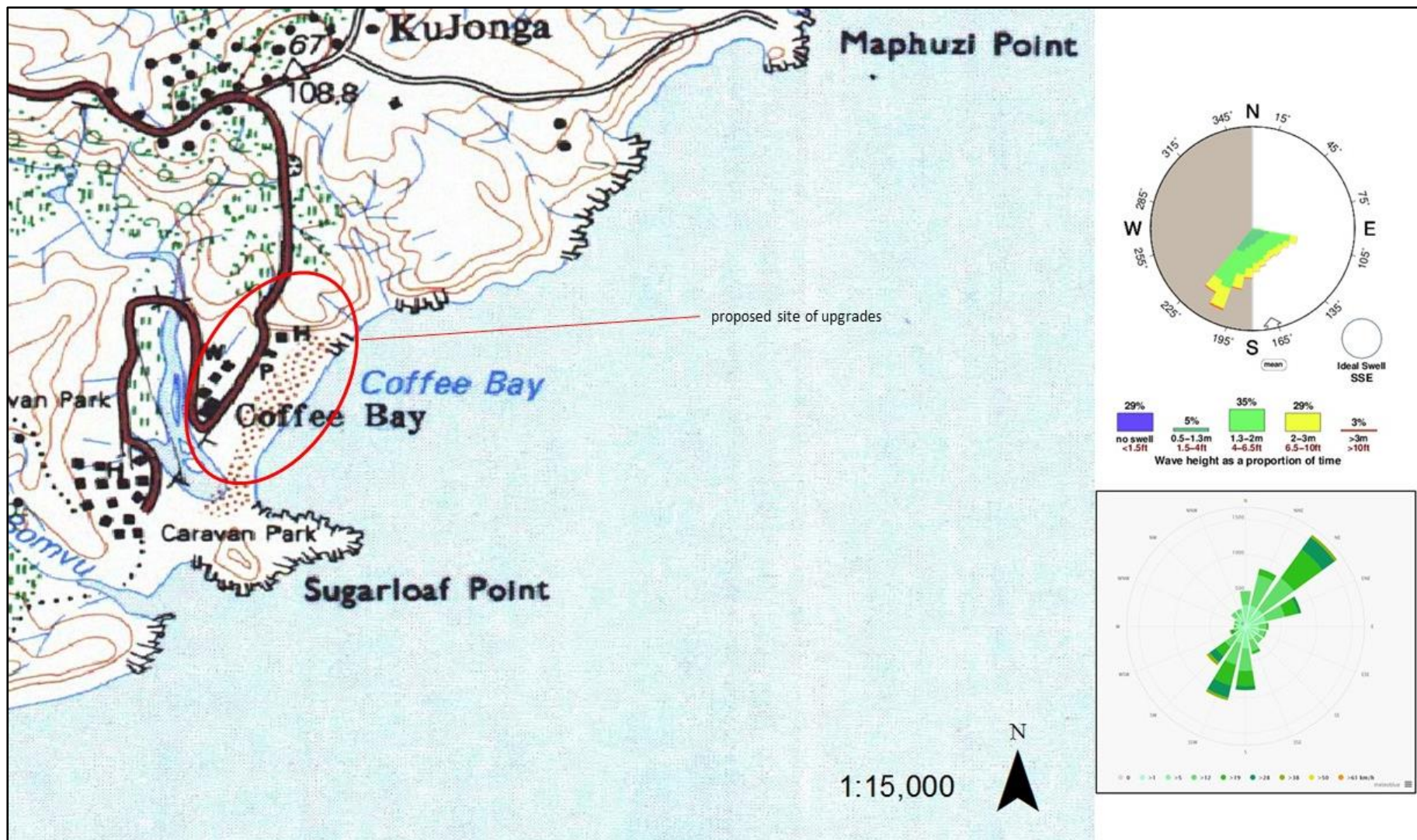
The two study areas form part of a phased development that encompasses trails and other supporting coastal infrastructure that covers some 12 to 15 kilometres of the Eastern Cape coastline. The two focal points that form the initial phases of this project are at Coffee Bay Main Beach and Hole in the Wall. These sites are considered independently, below.

### **5.1. Coffee Bay, Main Beach**

The proposed development site at the Coffee Bay Main Beach is a portion of primary and secondary dune form that lies between the Nenga River in the south and a steep sandstone cliff form in the north. As such, the inter tidal and supra tidal environment can be considered to be a geologically bound embayment with much of its sediment arising from not only the marine littoral transport system, but also the Nenga system, which is a permanently open estuarine system (Figure 10).

Breaker height, wave period and grain size are fundamental drivers of beach state (Short 1981). From Figure 10 it is clear that the shoreline at this point is generally shielded from the impact of large storm surges and “wash outs” that arise from the south, by the presence of the promontory known as “Sugarloaf Point”. Small, pocket beaches, such as the subject site are often affected by the beach rotation phenomenon, whereby seasonal variation in beach width arises according to the swell direction. However, the Nenga estuary to the south, serves to prevent excessive accumulation of sediments in the southern extent of the bay, indicating that the more northerly extent of the beach remains comparatively stable throughout the year. In addition, the shoreline exhibits a wide, dissipative beach which further serves to dissipate incoming high storm surge.

Nonetheless the frontal dune form at Coffee Bay Main Beach is evidently in a state of erosion. No ephemeral dune forms are evident along the back beach while the seaward (stoss) face of the primary dune is evidently undergoing significant undercutting and slumping, as well as transgression (Figure 10). Dune recession is evident in particular, through the dune transgression that has arisen around and seaward of the present lifeguard facility (Figure 11). This structure, established approximately 4 to 5 years ago (D Malherbe *pers comm*) is in imminent risk of collapse due to undermining of the dune face and transgression. While such transgression and regression may also be the product of anthropogenic factors including both pedestrian traverse of the beach and dune, as well as sand mining activities, consideration of recent, comparative aerial imagery suggests that the mobilisation of this dune form is not likely to cease in the short term. As such, coastal management interventions should be implemented that seek to guide beach users away from the stoss slope of the dune and perhaps in a more northerly direction, where the sand sharing system is more robust and the inter tidal reach is extensive.



**Figure 10.** Topographic map showing the Coffee Bay subject site and related features as well as wave and wind roses.



**Figure 11.** Image of beach and dune cordon at Coffee Bay.



**Figure 11.** Image of lifeguard tower on frontal stoss slope of dune at Coffee Bay.

In addition, the Nenga river, located to the south of the study site, is an open barred (i.e., a supratidal barrier) estuary, with the mouth of this river being maintained by freshwater discharge (Figure 13).

This sediment source is of fundamental importance to the maintenance of dynamic sediment equilibrium within the supratidal zone of the site and its natural function should be maintained, and to some extent, subject to improved management.

The dune cordon at the interface with the Nenga estuary is a recent system (Figure 12). Pebble wash, calcrete concretions (Figure 14) and the presence of marine invertebrates within the dune heel (Figure 15), on the leeward portion of the dune, indicate that the mouth of the river was located further north of its present position. The contemporary, more southerly alignment of the mouth is thus a more recent phenomenon. It follows that the mouth of the Nenga may in the short term, train northwards, undercutting the dune form. Such movement may be a geophysical phenomenon associated with high level sediment deposition into the pocket beach and places the entire extent of the dune into the sand sharing system (Figure 16). It follows that stabilization of the dune system in this area, as well as the placement of structures on the more southerly extent of the dune is not a prudent management decision and should be avoided.

Further to the above, the heel of the dune system is supported by the presence of a wet dune slack (Figure 16). This slack is directly associated with the Nenga estuarine system, with possible sub surface geological control. The slack is an important contributory factor to the sand sharing system, acting as the most proximal freshwater source for dune vegetation and thereby promoting the stabilization of the dune form. Dune vegetation, seaward of the dune crest is sparse, comprising of the white milkwood (*Sideroxylon inerme*) and scandent cover dependent species such as *Sporobolus virginicus*, while to the lee, habitat is more verdant, with *S inerme*, *Mimusops caffra* and numerous graminoids (*Stenotaphrum secundatum* ; *Setaria nemfluensis*) and shrubs (*Chrysanthemoides monilifera*) evident. It is strongly recommended that the dune slack be managed as an open system and is not subject to further disturbance, such as infilling, excavation or hardpanning.

There is evidently a need to control and manage pedestrian traverse across the dune environment at Main Beach and from this perspective, the proposed development of a boardwalk should be supported. However given the eco-morphological state of the dune, as described above, a judicious approach to the placement and arrangement of such boardwalk should be taken. In addition, other coastal management aspects should also receive consideration. These matters are discussed in Section 6.



**Figure 12.** Dune positioned seaward of Nenga estuary



**Figure 13.** The dune heel and Nenga estuary



**Figure 14.** Image of pebble wash below dune heel



**Figure 15.** Polychaetes (marine species) within concretions at dune heel



**Figure 16.** Aerial image of the Coffee Bay Main Beach site identifying key features along the subject coastline.



## **5.2. Hole in the Wall**

The study site at Hole in the Wall encompasses the flood pan of the Mpako estuary, as well as a sand bypass system associated with the estuary, which is backed by a sequestered wetland system linked with the flood regime of the Mpako and sub surface flow that arises from the leeward sandstone geologies (Figure 17 and Figure 18).

On the north bank of the Mpako estuary, the study site is generally associated with fluvial deposits with a significant flood terrace being evident. Marine factors are not a regular and significant influence on this area, as the barrier formation that is “the hole in the wall”, acts to diminish wave run up and the influence of storm surge at this point (Figure 17). It however should be considered that flood events, in conjunction with high astronomical tides and driven by storm surge, (a situation that is of low probability, but is not unrecorded) could act synergistically to elevate water levels within the estuary mouth and drive erosion and back flooding.

The beach formation around the estuary comprises of medium grained sands and shingle, the latter being deposited through flood events. Sediment transport along the beach environment is significant and this has given rise to ephemeral dune forms and the presence of cover dependent plant species, in particular *Passerina rigida*. To the immediate north of the estuary, a “drowned sand bypass system” arises (Figure 18). This is in part, incorrectly reflected in the SANBI vegetation data set as “scarp forest”, however much of the closed canopy environment comprises of *S. inerme* and *M. caffra*, which are associated with dune forest habitat forms (Figure 19). Notably, there are a number of psammoseral or dune species, including *Eugenia capensis* and *Chrysanthemoides monilifera*, within this forest form and these are testimony to the former state of this area, namely as a transgressive sand bypass system. This state saw the shifting of sediments from the north, along a sand corridor, which served to augment sediment from the marine environment into the estuary. This bypass has subsequently, and more recently become stabilized by vegetation, under a differing climate regime, and perhaps during a period of excessive rainfall, howsoever in more recent times the bypass system has undergone a shift back towards mobilization and sediment transport. Notably, the bypass aligns with the prevailing north easterly winds (Figure 15), and there have been several interventions by those wishing to stem such movement through the planting of *Casuarina equisetifolia* or stabilization through rock armouring (Figure 20). It is evident that under a changing climate regime, tending towards increasing storminess and rising sea levels, that greater sediment transport is likely to be evident at this point. It follows that activities in this area should be limited and that any infrastructure that is established should be informal or temporary in nature and not exacerbate the mobilization of sands.

The presence of the wetland feature leeward of the estuary should also be noted (Figure 18). Like the dune slack at Coffee Bay, Main Beach, this feature is of ecological importance within the broader environment.

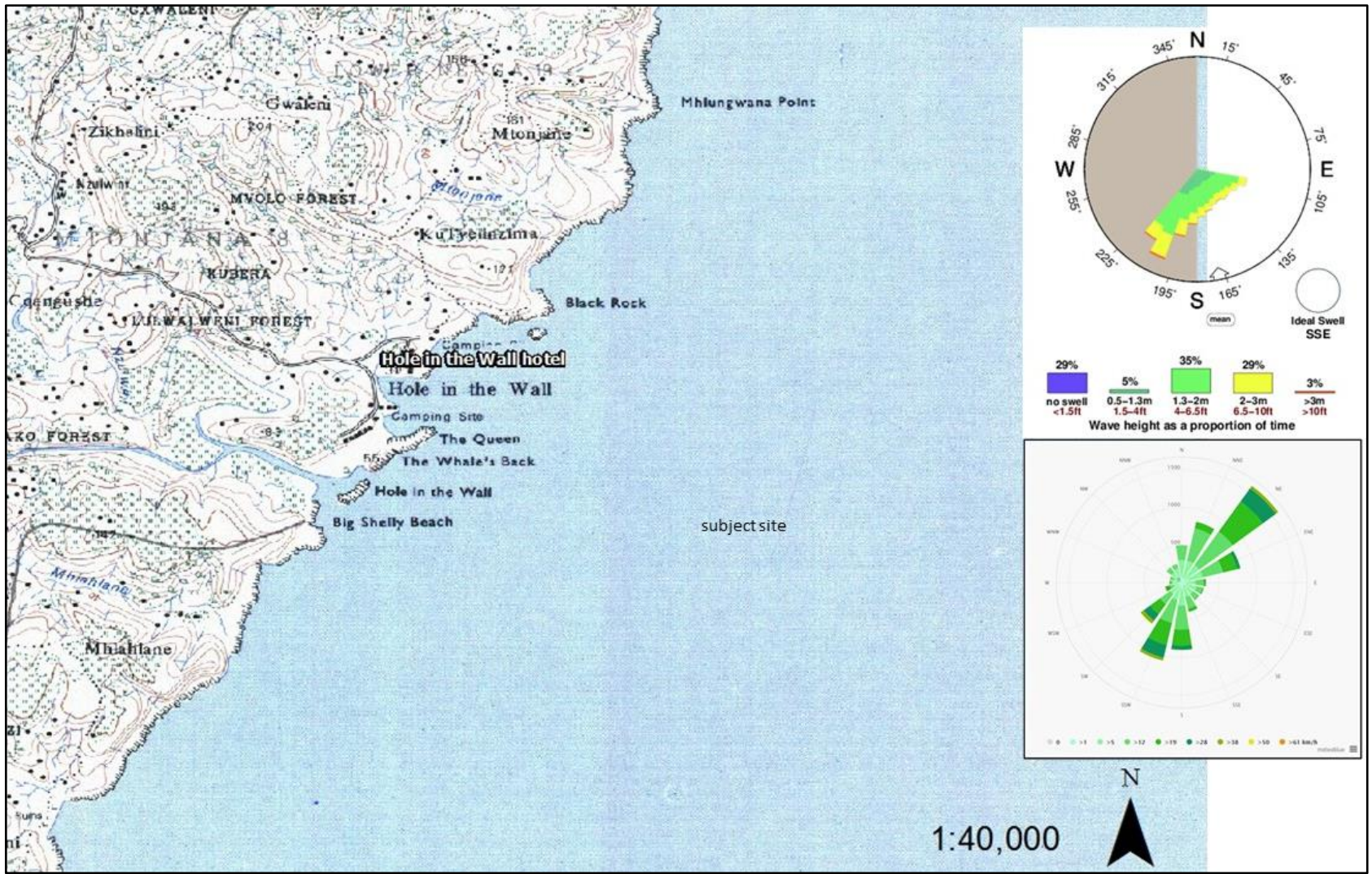


Figure 17. Topographic map showing the Hole in the Wall subject site, with associated wave and wind roses.



**Figure 18.** Aerial imagery indicating features at Hole in the Wall, in particular sediment by pass and beach environment.



**Figure 19.** Image of the Hole in the Wall site showing estuary and wooded flood terrace in foreground.



**Figure 20.** Image showing sand bypass, located to the north of the Hole in the Wall site.

The wetland feature serves to support psammoseral vegetation in this area through improved plant – water availability, and in part, may assist in checking the advancement and remobilisation of the sand bypass. The wetland is noted to fill after rains and often inundate portions of the adjacent forest system, a situation which should be borne in mind when formal paths and or boardwalks are to be constructed.

It follows that the establishment of infrastructure within the subject area are at risk, over a short to medium term from several factors. Such factors include the engulfment by sands, as mobilisation of the sand sharing system arises and flooding occurs from both the Mpako River (or combined storm surge event) and the pan formation, which lies within the flood terrace. These factors are considered in Section 6.

## **6. ANALYSIS OF IMPACTS & MANAGEMENT RECOMMENDATIONS**

### **6.1. Coffee Bay - Main Beach**

The most significant features proposed for the Coffee Bay Main Beach are the parking areas, ablution facilities, viewing decks and the boardwalk or beach access routes. A previous version of this report submitted in February 2021 recommended that infrastructure be established at the most distal point from the Nenga estuary to reduce the risk that such infrastructure poses to the eco-morphological state of the dune and beach environment. It was highlighted that this would have a concomitant reduction in risk to such infrastructure from the effects of coastal processes (See Figure 21). In addition, the following aspects and recommendations were discussed:

1. Parking facilities should effectively avoid the wetland environments within the dune slack or heel of the dune. Parking areas are best accommodated to the north of the subject area or on the opposite side of the roadway.
2. The beach access and boardwalk facilities should align with the dune crest and sand sharing system. In effect all structures should lie leeward of the dune crest, while the shore parallel structures proposed should guide visitors to the north towards the more stable and level stoss face, where alighting onto the back beach should be encouraged (Figure 21).
3. The lifeguard tower should either be incorporated into the proposed boardwalk or a more informal, beach-based facilities (e.g. high chair), should be placed onto the back beach.

4. The traverse of much of the frontal dune by beach visitors should be actively dissuaded. While often a difficult task, such actions will preserve the present structure of the dune. Sand winning of the beach sediments is a noted problem on this beach and aggravates transgression.

Figure 21 below, presents a recommended layout discussed in the report submitted in February. In response to the above recommendations, the layout of infrastructure has been revised and is shown in Appendix A2. Notably, the parking facilities effectively avoid the wetland environment. In addition, the formalised walkway is positioned with the dune crest and will function to discourage the traverse of beach visitors across the frontal dune. However, some vegetation clearance is anticipated for the establishment of the new ablution facilities.



**Figure 21.** Aerial image of Coffee Bay Main Beach showing recommended arrangement of boardwalk in relation to sand sharing system (February 2021).

## **6.2 Hole in the Wall**

Infrastructure proposed for the Hole in the Wall site may generally be considered to be of low impact, comprising primarily of existing footpaths, poly-timber viewing decks and rest areas. As highlighted in the February report, a cautious approach should, however, be taken in the planning and establishment of these features, which should include the following:

1. The walkway should be maintained as an informal structure within the lower flood terrace of the Mpako estuary, in order to avoid the effects of significant floods. This may take the form of raised wooden walkways or similar, but should be suitably placed, effectively avoiding close proximity to wetland and estuarine environments, as well as the flood berm by staying at elevated points approximating 5m above the contour.
2. Two options are evident in the routing of the walkway from the north to the south (Figure 22). These options identify that the transgressive sand bypass system to the north may either be avoided, by maintaining the route at an elevated level along the upper bank. Or alternatively, may allow for a break in the boardwalk at the sand bypass and the general avoidance of any structure crossing this mobile environment. The route may be re-established where dune transgression is not occurring. Such approach will avoid the likelihood of increased transgression and possible engulfment of the structure.
3. The route of the walkway should give due consideration to the avoidance of the wetland environment and possible recognition of the extensive inundation of areas around the pan that is flooded from time to time (Figure 22).
4. Materials utilised in the construction of the boardwalks should be sourced locally, but in a mindful and sustainable manner. For example, when establishing cobbled surfaces, shingle found at site is preferable to using imported materials. In addition, the use of suitably treated timbers for boardwalks is preferable to the use of “timber – plastic” or recycled “fake wood” products, which should not be used where structures are susceptible to beach and coastal erosion. Poly-timber, as proposed for the walkways and infrastructure, is suitable for such refurbishments.

Figure 22 below, shows the recommendations proposed in the February report. In response to the recommendations suggested in February 2021, the client has opted to change the boardwalk to a low-impact foot path which will aim to follow existing pathways (Appendix A3). Notably, this footpath will avoid the wetland environment. The client has also removed the proposed viewing deck at the promontory commonly known as “The Whale’s Back”. In addition, low impact poly-timber will be utilised throughout the refurbishments.





**Figure 22.** Aerial image showing routes of walkways and other features at Hole in the Wall (February 2021).

### **6.3. Analysis of Impacts**

The proposed layout has been updated to accommodate environmental input. However, in reviewing the coastal facilities proposed for Coffee Bay Main Beach and Hole in the Wall from a coastal ecological perspective, it is evident that some impacts are still anticipated at each site. These impacts are discussed below.

#### **6.3.1. Analysis of impacts at Coffee Bay Main Beach**

It is clear that at Coffee Bay Main Beach, the proposed development is likely to see the following changes and impacts arising:

1. Possible alteration of the sub surface hydrology on account of changes in the wet dune slack lying to the lee of the secondary dune.
2. Excavation, on a minor scale, associated with the construction of formalised poly-timber walkways and related infrastructure leading to disruption and change in dune edaphics.
3. Clearance of vegetation due to the establishment of structures.
4. Alteration of the wind and sediment transport regime on frontal dune features.
5. General indirect impacts on beach and dune eco-morphology associated with the movement of pedestrian traffic to and from the beach.

#### **6.3.2. Analysis of impacts at Hole in the Wall**

The impacts associated with the proposed developments at Hole in the Wall are similar in form to those forecast for Coffee Bay Main Beach and include the following:

1. Possible changes to the sand sharing system and sediment transport, in particular around the identified dune or sediment bypass system.
2. Minor excavation and change in flood terrace and beach-estuary interface altering edaphics at a localised level.
3. Minor alteration of the extreme flood regime around and on account of built structures, in particular boardwalks and related infrastructure.

4. The clearance or disturbance of vegetation, particularly within the lower dune forest and flood plain habitat.

The abovementioned impacts can be summarised as :

- The disruption to geomorphological drivers and features within the supra tidal zone at each site.
- Disruption of the sand sharing system associated with the coastline in question; and
- The level of disturbance affecting the prevailing biological habitats.

Table 1 below summarises the nature and form of impacts using the above summary, that may arise on the three factors identified above. These impacts are evaluated to identify their significance and the status of the impact, using the following parameters.

1. **Spatial Extent:** Denotes the affected area, - site, local, regional or national
2. **Duration:** The period of time over which the impact will be noted. This may be “long term (greater than the duration of project), moderate or medium term (occurs during the lifetime of the project) or “short term” (less than the lifetime of the project and primarily during the implementation stage of the project).
3. **Intensity:** An order of magnitude. Negligible (inconsequential or no impact), low (small alteration of natural systems, patterns, or processes), medium (noticeable alteration of natural systems, patterns, or processes), high (severe alteration of natural systems, patterns, or processes).  
**Frequency:** a description of any repetitive, continuous, or time-linked characteristics of the impact. Once Off, Intermittent; Periodic; Continuous
4. **Probability:** The likelihood of the impact occurring as a result of the project being undertaken. Such probability may be “high”, “moderate” or “low”.
5. **Irreplaceability:** Resource loss caused by impacts. This may be “high” (the project will destroy unique resources that cannot be replaced), “moderate” (the project will destroy resources, which can be replaced with effort), “low” (the project will destroy resources, which are easily replaceable).
6. **Reversibility:** The ability of the impacted environment to return/be returned to its pre-impacted state. Non-reversible, low reversibility, moderate reversibility of impacts, or high reversibility of impacts
7. **Significance:** The nature of the impact in respect to the status quo (i.e. alteration of status quo). Such levels of severity may be “high”, “moderate” or “low”.

8. **Confidence:** An indication of the level of surety that the impacts or the parameters identified will occur.

From Table 1, it is clear that the proposed development of infrastructure at Coffee Bay Main Beach is anticipated to have at least a “moderate to low level” of impact, with inherent change in the drivers associated with the system as well as the direct alteration of the system. However, with the implementation of a judicious approach to the establishment of infrastructure at Hole in the Wall, the associated impacts are considered to be generally “low to moderate” in significance. Mitigation and avoidance measures can be implemented to reduce such impacts.

**Table 1.** Review of ecological impacts arising from the construction of tourist facilities in Coffee Bay and Hole in the Wall.

IMPACT	Spatial extent	Duration	Intensity	Frequency	Probability	Irreplaceability	Reversibility	Significance	Status	Confidence	Mitigation
<b>COFFEE BAY - MAIN BEACH</b>											
Alteration of drivers of coastal process, (e.g., wind and wave)	Local	Long term	Medium	Intermittent	High	Low	reversible	Moderate	Moderate impact	High	Structures anticipated to alter wind regime through obstruction giving rise to changes in sediment transport and deposition, with possible erosion at other points. Maintaining structures on crest and heel of dune will mitigate impacts
Interruption of sediment transport regime	Local	Long term	Medium to low	Continuous	High	Low	reversible	Moderate	Moderate to low impact	High	On account of placement of structures, sediment transport will be disrupted, altering depositional aspects on dune stoss face and crest, while also stabilizing dune and altering sediment discharge to beach and surrounds. Maintaining structures on crest and heel of dune will mitigate impacts.
Alteration of habitat/eco-morphology	Local	Long term	Low	Once off	High	Medium	Reversible	Moderate	Low Impact	High	Vegetation, particularly on crest and heel of dune will be subject to excavation and clearance. Such clearance may change habitat form in and around affected portion of dune (e.g. wind clipping). Proposed that where disturbance arises, horticultural interventions to stabilize dune may be practiced.

<b>HOLE IN THE WALL</b>											
<b>Alteration of drivers of coastal process, (e.g., wind and wave)</b>	Local	Long term	Medium	Intermittent	Moderate	Low	reversible	Low	Low Impact	High	Structures anticipated to alter wind regime through obstruction around sand bypass, giving rise in changes in sediment transport. Avoiding the building of structures across sand by pass or diverting infrastructure around sand by pass will mitigate impacts.
	Local	Long term	Medium	Continuous	Moderate	Low	reversible	Low	Low Impact	High	On account of placement of structures, sediment transport will be disrupted, particularly in respect of fluvial transport associated with flood regime. Notably the sand bypass system has been affected by stabilization interventions. The clearance of <i>C. equisetifolia</i> will perhaps improve sediment transport but should be implemented judiciously. Avoidance of beach environment near estuary also required to maintain ephemeral dune structures.
	Local	Long term	Low	Once off	Low	Medium	reversible	Medium	Low Impact	High	Vegetation within flood terrace and secondary vegetation associated with sand bypass may be removed or affected by proposed development. Limited clearance is however envisaged and present use of area for recreational purposes has given rise to existing change in habitat within subject area. Prudent approach to clearance of vegetation should be practiced.

## 7. CONCLUSION & MANAGEMENT INTERVENTIONS

The proposed development of coastal infrastructure at Coffee Bay and Hole in the Wall will have significant socio-economic and economic benefits for the region. In addition, the proposed developments also offer both remedial and mitigatory measures from an environmental perspective, serving to manage pedestrian foot traffic at these sites, which at present is causing a general decline in the integrity of habitat and ecological function.

It follows that the proposed developments should be supported from an ecological perspective, subject to the implementation of the identified management and mitigation measures. Such measures can broadly be summarised to include:

1. At Coffee Bay Main Beach, the southern extent of the boardwalks should be checked and access for visitors from the boardwalk to the beach should be concentrated to the north of the embayment, as proposed in Appendix A2.
2. At Coffee Bay Main Beach, the ablution block must be set back by at least three metres from the dune heel. Surface run-off should be concentrated into the heel of the dune to provide a water supply to dune vegetation.
3. Due consideration should be given to the wet dune slack, leeward of the dune at Coffee Bay Main Beach, to maintain sub surface hydrology. The wetland environment must be avoided when upgrading and establishing facilities.
4. At Hole in the Wall, the footpath should avoid the identified sand bypass system, and in general, limited infrastructure should be placed on the flood terrace associated with the Mpako River.
5. At Hole in the Wall Hotel, the boat launch should extend below the practical HWM as shown in Appendix A4. This ramp should be reinforced using concrete, or alternatively some form of flexile ramp.

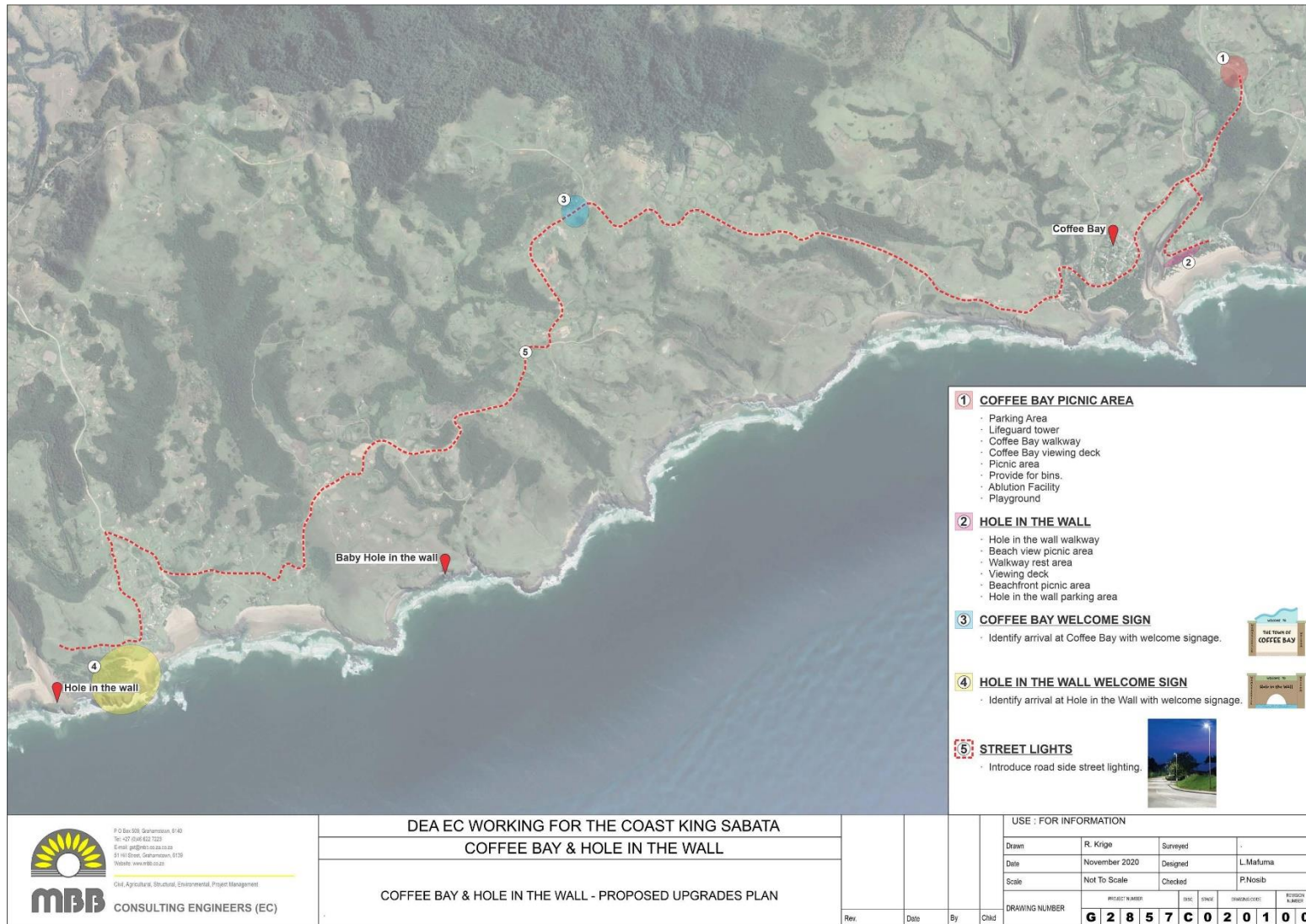
It follows that the proposed planning and positioning of infrastructure, as shown in Appendices A2 and A3, have carefully considered environmental input. Poly-timber has been selected as a low-impact construction material. In addition, the facilities and walkways have been carefully positioned to avoid high impacts on the sand-sharing system. As such, it is contended that the proposed activities at Coffee Bay and Hole in the Wall, if implemented with the conditions and recommendations presented in this report, will give rise to moderate to low ecological repercussions on the subject area.

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**APPENDIX A1 – Proposed refurbishments for Coffee Bay and Hole in the Wall**



**APPENDIX A2 – The proposed refurbishments for Coffee Bay (revised February 2022)**



# APPENDIX A3 – The proposed refurbishments for Hole in the Wall (revised February 2022)



**APPENDIX A4 – The practical high-water mark adjacent to the Hole in the Wall hotel (Google Earth, 2022)**



**APPENDIX A5 – The estimated Estuarine Functional Zone (EFZ) at Coffee Bay (Google Earth, 2022)**

