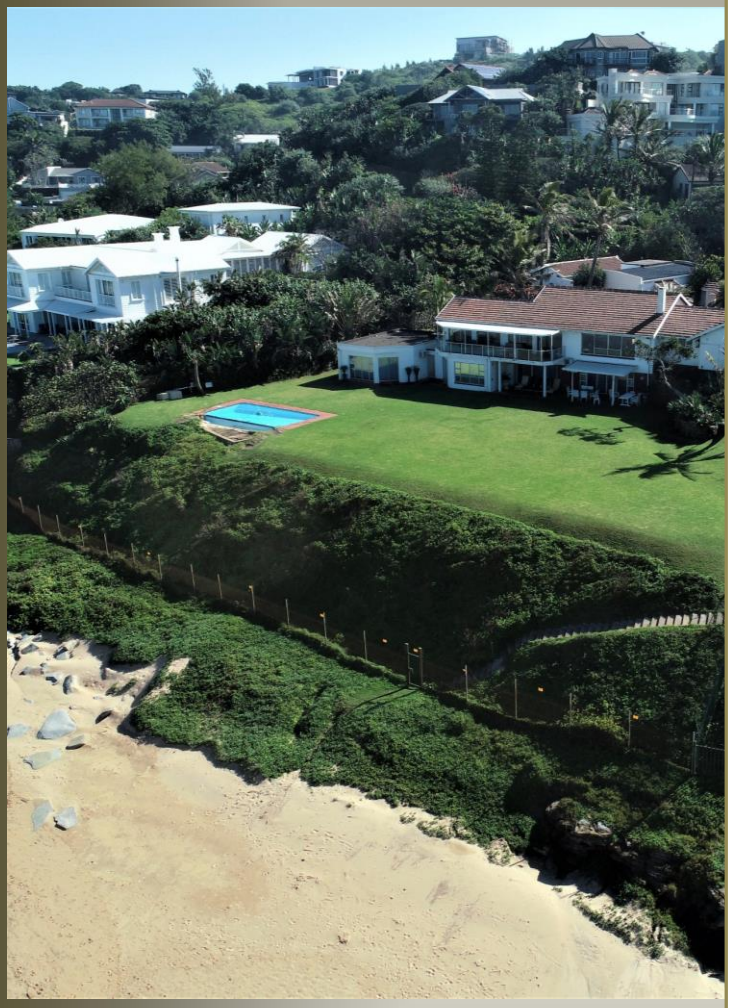

ECOLOGICAL IMPACT ASSESSMENT

CONSTRUCTION OF RESIDENTIAL DWELLINGS AT 99 COLWYN DRIVE, SHEFFIELD BEACH, KWADUKUZA

(REM OF PTN 292 OF LOT 61 NO 1521)

Compiled by:
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SDP Ecological and Environmental Services

Compiled on behalf of:
Confluence Strategic Development (Pty) Ltd.

Date of compilation:
July 2021 (reviewed September 2021)

ECOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED RESIDENTIAL DEVELOPMENTS AT 99 COLWYN DRIVE, SHEFFIELD BEACH, KWADUKUZA

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Front page image	Aerial photograph of 99 Colwyn (Provided by Map Architecture).

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Glossary of Terms and Abbreviations

Associes	Groupings of species, particularly plants commonly found to occur together
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,
Hs	Significant wave height
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

23 July 2021

PARTICULARS OF AUTHORS/ECOLOGISTS

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DATE OF BIRTH 7 September 1966 **PLACE OF BIRTH**: Glasgow, Scotland.
MEMBERSHIP OF PROFESSIONAL BODIES: South African Council of Natural Scientific Professionals No. 400093/06 – Professional Ecologist; Southern African Association of Aquatic Scientists

KEY COMPETENCIES AND EXPERIENCE

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.

SELECTED RELEVANT PROJECT EXPERIENCE

Ecological investigations for numerous renewable energy projects, including "Kalbult", "Dreunberg", "jUWI", "Kenhardt Pv1 - 6", "Solar Capital 2 and 3" and "Lindes".
Ecological investigations Tongaat and Illovo Desalination Plants : CSIR –(2013 - 2016)
Ecological investigations and Rehabilitation Planning : Sodwana Bay :iSimanagaliso 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)

PUBLICATIONS

Over a dozen scientific publications, numerous popular articles and contributions to books and documentaries in local and international journals

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MEMBERSHIP OF PROFESSIONAL BODIES: South African Council of Natural Scientific Professionals No. 130557 – Environmental Science (Candidate Natural Scientist).

KEY COMPETENCIES AND EXPERIENCE

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

Confluence Strategic Development Pty Ltd have appointed SDP Ecological and Environmental Services to undertake an Aquatic Biodiversity and Marine Impact Assessment on a residential property located at 99 Colwyn Drive, Sheffield Beach. Presently a residential homestead is established upon the property, a singular erf (Rem of Lot 292 of Lot 61 No 1521 Sheffield Beach), and it is the applicant's intention to subdivide the property, demolish the existing dwelling and construct two new residential dwellings.

Site reconnaissance revealed that the property in question is highly transformed and reflects a built homestead and tended garden environment. The site is elevated to above 10m amsl and does not fall within the sand sharing system. Apart from the establishment of a wooden walkway to the beach, it is evident that the proposed development will elicit little impact on the coastal, sand sharing environment of the area. Notably some recommendations relating to inter alia sewerage disposal and access have been presented in this report.

STATEMENT

The study site at 99 Colwyn Drive (Rem of Lot 292 of Lot 61 No 1521 Sheffield Beach) has been shown to be a highly transformed environment with little to no intrusion into the coastal sand sharing system. Subject to the implementation of some minor layout and management conditions it is recommended that the authorities should sanction the proposed development.

1. INTRODUCTION & BACKGROUND INFORMATION

Rem of Lot 292 of Lot 61 No 1521 Sheffield Beach, the property at 99 Colwyn Drive (29°28'40.53"S / 31°15'48.32"E), is an existing residential property encompassing a single homestead and associated structures that lies adjacent to the shoreline. Mr Michael Starr, the present owner of 99 Colwyn Drive, has recently engaged in the subdivision of the property, whereafter the southern portion encompassing some 2100m^2 is to be transferred to Mr. Robert Emmanuel. The balance of the property, some 1904m^2 in extent, will be retained by Mr Starr. Both Messrs Emmanuel and Starr wish to demolish the existing structures on the properties and establish new, separate dwellings. Confluence Strategic Development (Pty) Ltd are the appointed environmental assessment practitioners (EAP) conducting a Basic Assessment, in terms of the National Environmental Management Act, for the establishment of the said homes on the subdivided properties. As a component of the Environmental Authorisation application, SDP Ecological and Environmental Services have been commissioned to conduct an ecological assessment on the subject property, with specific consideration of the impacts on beach and dune dynamics, aquatic environments, and biodiversity.

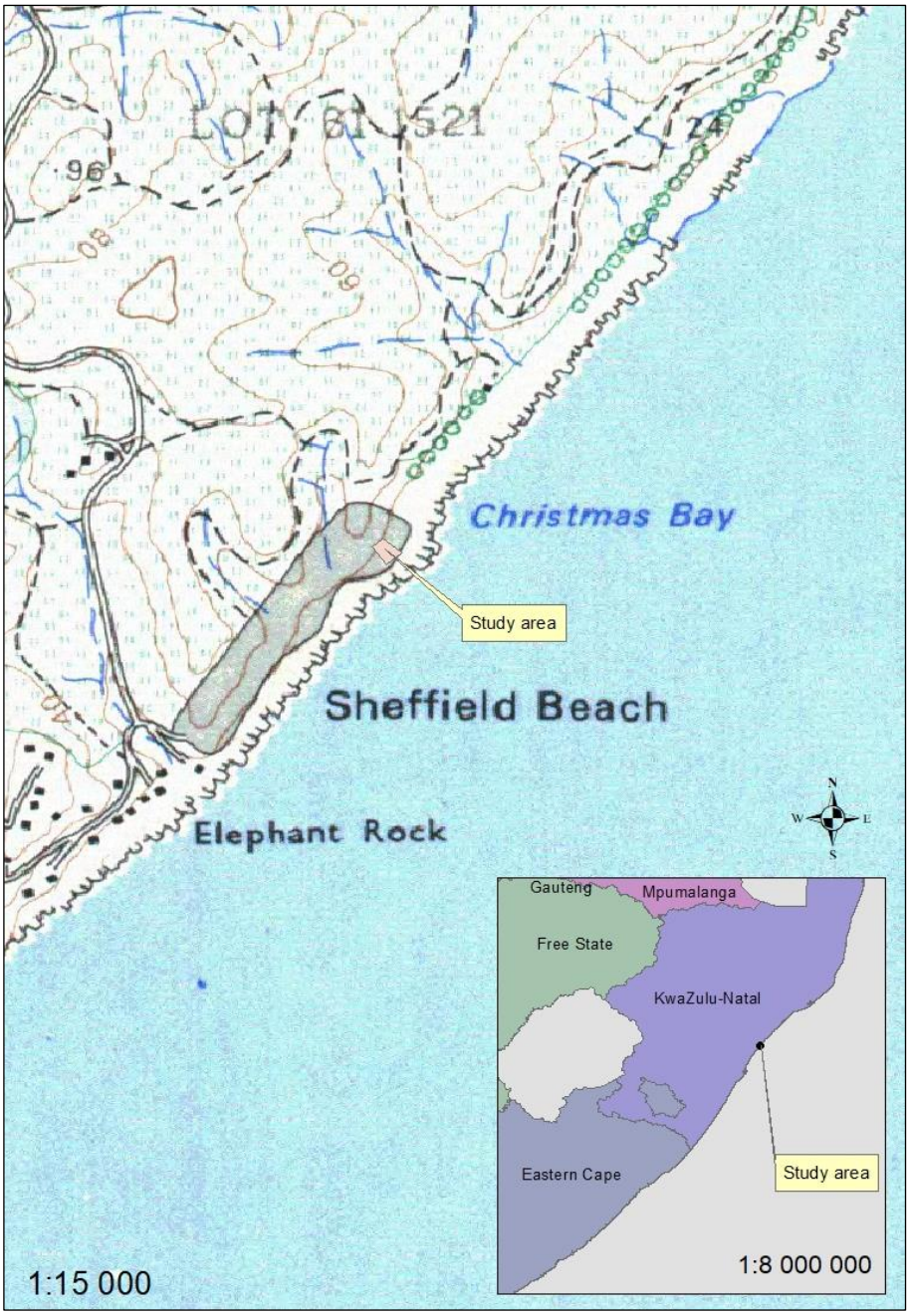


Figure 1. A map showing the study area from a regional and local perspective.

2. EXPECTATIONS AND LIMITATIONS

2.1. Project framework

This assessment has been carried out in terms of Government Gazette 43110 "Protocol for the specialist assessment and minimum reporting content requirements". This report considers:

- The coastal/terrestrial, eco-morphological factors associated with the site at a local and wider scale.

- The potential impacts of the proposed activities, within 100 m of the primary dune and beach and within 32 m of any watercourses.

- The identification of measures which may be applied to rehabilitate, mitigate, and manage these impacts.

- Rehabilitation or remediation of the dune form, where applicable.

- Identify and define terrestrial, wetland and aquatic areas that may be considered to be ecologically important or must be avoided during construction, maintenance and operations.

- The value and function of any aquatic or wetland environment identified on site, using the methods acceptable to authorities for their evaluation processes.

- The potential impacts of the proposed activities on the overall biodiversity of the site, which includes the impacts on vegetation dynamics.

2.2. Seasonality and site conditions

The field assessment was undertaken during May to June 2021, which aligns with the southern hemisphere autumn and winter period. Winter weather conditions in KwaZulu-Natal are associated with lower rainfall and cooling temperatures. The beach conditions in early autumn are generally inflated, but by winter are advancing towards a deflated state, with beach rotation within bays, typical of winter. Aerial imagery from various years, as well as imagery of the 2007 storm event (the highest recorded storm surge and wave run-up available) were used for comparative interpretation of beach states and erosion or deposition trends.

2.3. Limitations

Beach geomorphology is affected by several dynamic processes such as waves, tides and currents that act to shape the beach and dune environments. As such, a coastal impact assessment requires the

consideration of numerous, complex factors. Management measures have been suggested using the current available data and should be open to re-evaluation, as the coastline changes under varying scenarios.

2.4. Applicable legislation

The following legislation is understood to apply to the activities under consideration.

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 Activity 19A and 54 of Listing Notice 1 and Activity 23 of Listing Notice 3, which state –

Listing Notice 1, Section 19A

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
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.

Listing Notice 1, Section 54

"The expansion of facilities—
(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—
(e) [buildings where the building is expanded by 50 square metres or more; or]
[(f)] infrastructure or structures where the development footprint is expanded by 50 square metres or more,
but excluding—
(bb) where such expansion occurs within an urban area."

Listing Notice 3, Section 23

"The expansion of—

(x) buildings where the building is expanded by 10 square metres or more in size;

(xii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;]

i) dams or weirs where the dam or weir is expanded by 10 square metres or more; or

(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;

where such [development] expansion occurs—

(a) within a watercourse;

(b) in front of a development setback adopted in the prescribed manner; or

(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.

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.

National Forest Act (1998)

Where there is the "cutting, removal or disturbance" of designated forest or protected trees as determined, an application in terms of S 7 of the National Forest Act is required.

The National Water Act (36 of 1998)

This act serves to regulate law relating to water resources. S 21 of the Act determines the manner in which activities in and around water resources are conducted.

3. METHOD AND APPROACH TO EVALUATION OF IMPACTS

As per the requirements of Government Gazette 43110 "Protocol for the specialist assessment and minimum reporting content requirements", consideration of The Department of Environment, Forestry and Fisheries' screening tool (https://screening.environment.gov.za), indicates the subject site to be of

a "low aquatic biodiversity sensitivity" (Figure 2). The same tool indicates the subject site to have a "high terrestrial biodiversity sensitivity" (Figure 3) and a "medium plant species sensitivity" (Figure 4). As such, an ecological assessment of the coastal environment was undertaken using the method and approaches discussed below.

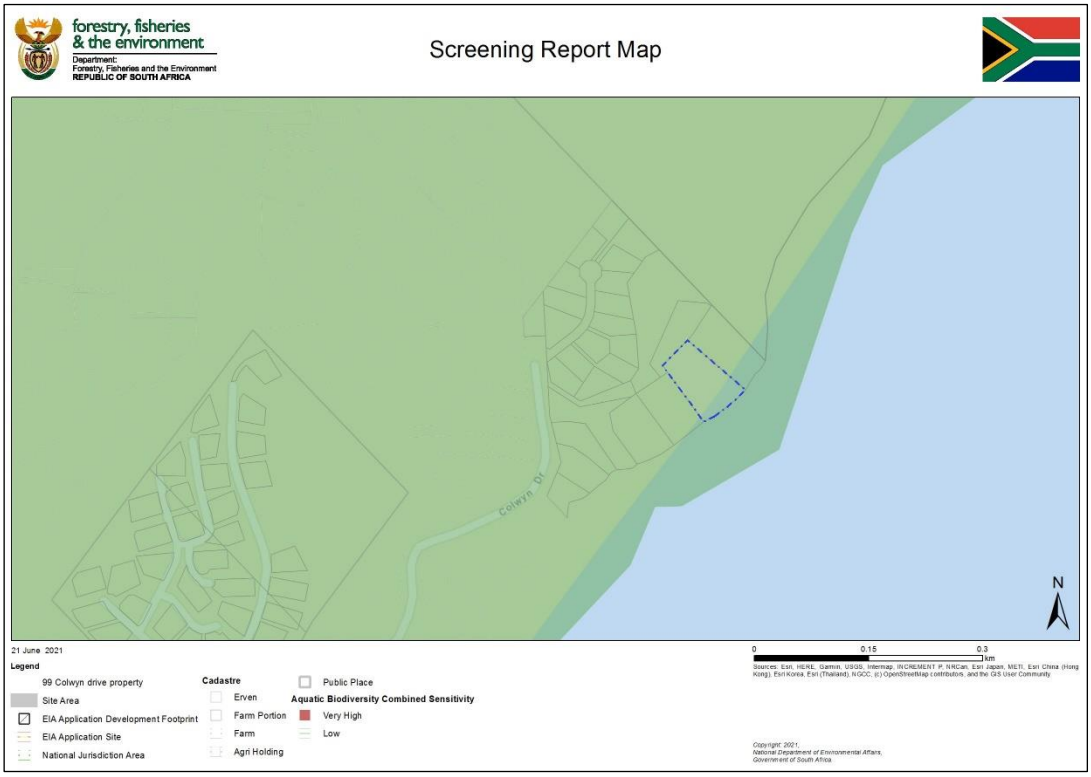


Figure 2. Screening report map of the study site showing predicted aquatic species sensitivity (Department of Environment, Forestry and Fisheries 2021).

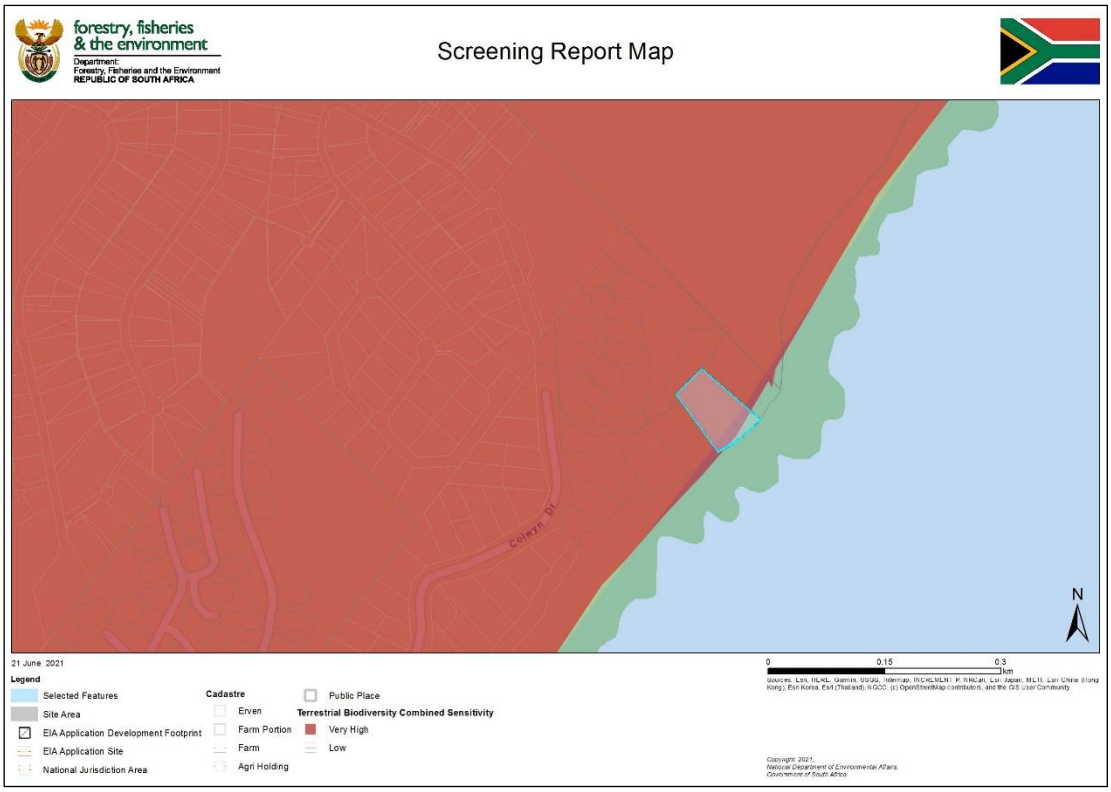


Figure 3. Screening report map of the study site showing predicted terrestrial species sensitivity (Department of Environment, Forestry and Fisheries 2021).

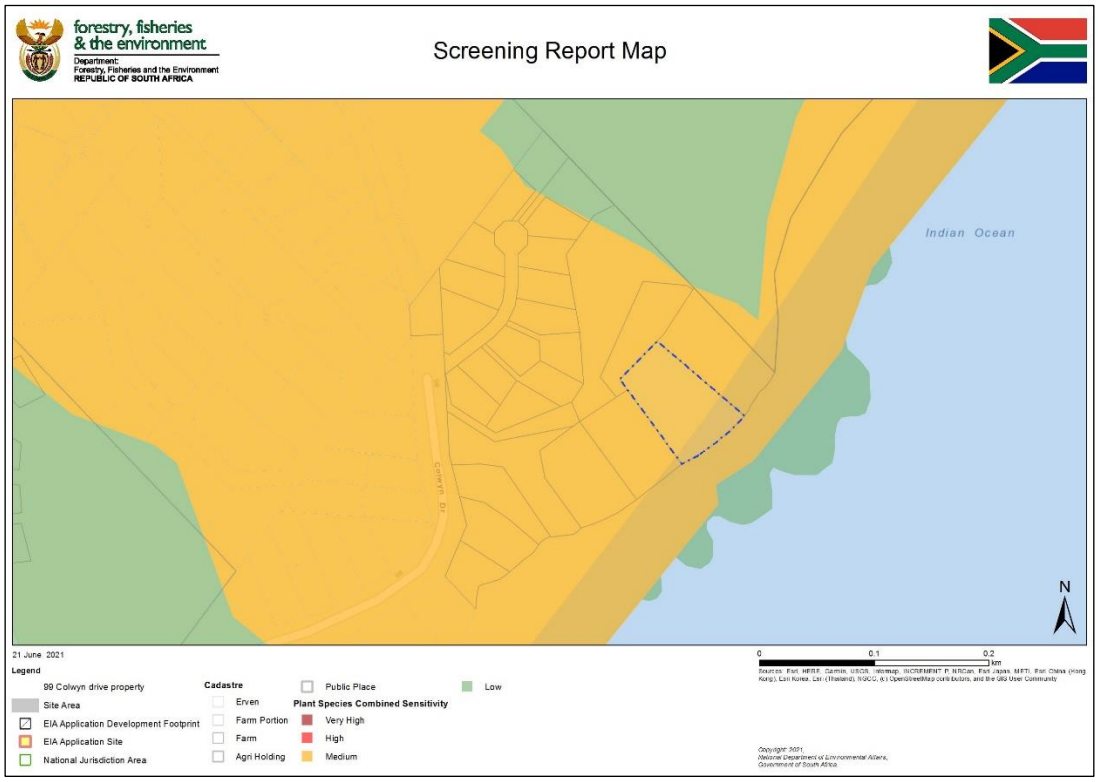


Figure 4. Screening report map of the study site showing predicted plant species sensitivity (Department of Environment, Forestry and Fisheries 2021).

3.1 Desktop review

A desktop review of literature and related pertinent information relating to the site was undertaken, primarily with consideration of historical trends along the shoreline and dune cordon. Such desktop investigations included:

- Review of aerial photography sourced from ESRI using ARC 10.3 GIS (Geographic Information System) and Google Earth.

- Review of historical imagery sourced from the Surveyor General's Office.

- Review of pertinent literature relating to the site and surrounds was undertaken to assist with the evaluation and to support the outcomes of the analyses.

3.2 Study area and site reconnaissance

The subject property is approximately 4000m^2 in extent, with a beach frontage of approximately 60m. Site reconnaissance was undertaken on the 6th of May and 22nd of June 2021, whereby:

- The property and adjacent shoreline were traversed on foot.

- The nature of the prevailing vegetation type was assessed, which included consideration of habitat form and structure across sites.

- Consideration was given to the nature and form of the beach and dune environment, with identification / delineation of the sand sharing system. This determination was undertaken using geomorphological evidence of marine inundation and erosion, nature of prevailing vegetation and other evidence.

- Identification and delineation of various botanical associations within the frontal dune communities and backshore was undertaken.

- Other factors associated with the site were considered (i.e., elevation, topography, etc.) using comparison of the prevailing site state and the abovementioned historical information.

- Specific features of the beach and dune environments were identified and logged using a Garmin Montana V GPS (Figure 5).

Figure 5. Features noted during site reconnaissance (source: Google Earth 2021).

4. SITE IN REGIONAL PERSPECTIVE

Beach and dune environments are continuously changing and shaped by wave, wind and sediment transport within the sand sharing system (Psuty 1994). The sand sharing system is the underlying process, whereby marine sediments are shared between the offshore surf bar and the dune cordon. The system is dynamic and is driven by wave and wind energy, with biological components, primarily vegetation, adapted to living within the harsh environment, characteristic of such systems. Vegetation acts to ameliorate such dynamism.

The sand sharing system, including the sub tidal, intertidal, the beach and dune system components, can be considered to be, over any given temporal period, in a state of equilibrium (Figure 6). It follows that disturbance to this equilibrium results in a shift, with concomitant effects on the system. Such effects may lead to the erosion of beaches, engulfment of vegetation and generally undesirable effects upon the coastline. Such consequences may have serious direct, indirect and cumulative effects upon ecological, social and economic environments.

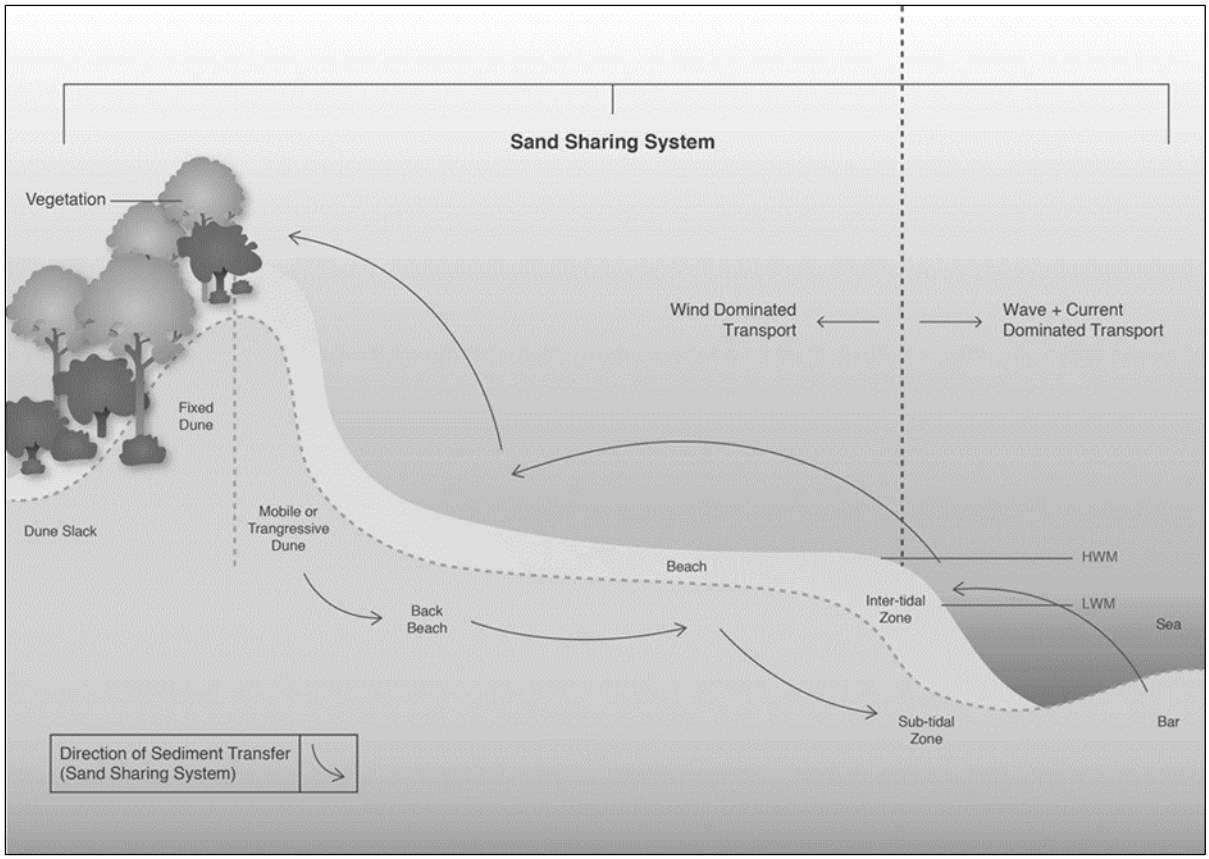


Figure 7. Graphic image showing a sand sharing system and associated processes.

It follows that the most effective "test" in evaluating the impact of human induced activities on a coastline, is to consider where and how, such activities may affect the sand sharing system. This test forms the basis for consideration in this review and evaluation of the construction activities that are proposed for 99 Colwyn Drive.

The subject site lies within Sheffield Beach, a residential suburb within the KwaDukuza Municipality (see Figure 1 above). Sheffield Beach is a relatively recently developed, urban settlement with its first formal structures being established during the early 1900s. Much of the natural terrestrial components of the sand sharing system have become stabilised or highly transformed, altering the dynamism within the sand sharing system.

The coastline in and around Sheffield Beach comprises of a number of rocky promontories and "pocket beaches" covered by a generally thin veneer of sand (Figure 7). The supra tidal coastal environment varies from steep cliffs to low elevation and relatively "young" sand dunes that are backed by older (+/- 10000 yrs BP) paleo dunes and earthen cliff. The KwaDukuza coastline is generally exposed and is subject to the effects of the prevailing wave and wind regimen which determines the extent of the sand sharing system (Figure 7). Unlike the Durban coastline to the south, the KwaDukuza coastline has a

more extreme wave climate, lacking the shelter from high wave energies offered by the crenulated bay in which Durban is positioned, while also lacking the extended shallow shelf that serves to dissipate much of the incoming wave energy along the Durban shoreline. Comparatively, Durban's bathymetry indicates that the -20m bathymetric contour lies approximately 1000m from the shore, while along the Ballito and Sheffield Beach coastline, the same contour is approximately 80m from the shore. This situation means that wave energy is dissipated through breaking waves far closer to the beach and as such, the sand sharing system is more dynamic and energised in Sheffield than is the case in Durban. In shore reef also serves to focus wave energy at points across the beach and dune cordon (Figure 7).

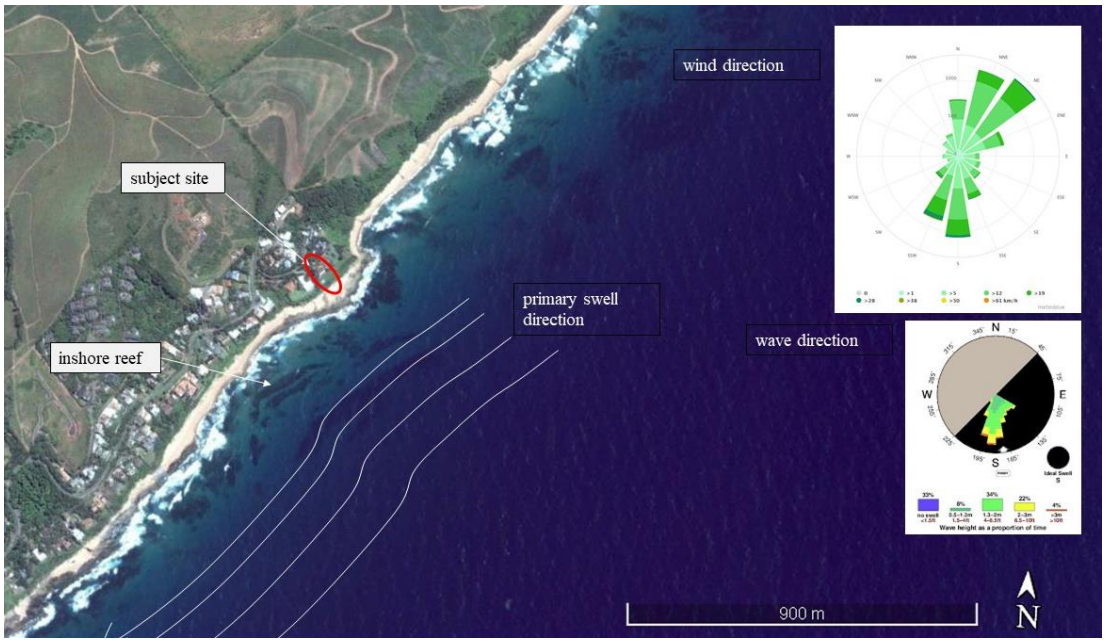


Figure 7. Sub regional perspective of site showing meteorological and marine aspects.

The prevailing wave conditions along the KwaDukuza coastline are presented in Figures 8 and 9 which indicate the peak wave period and maximum wave height with exceedances for the various seasons, respectively. Period and wave height are synonymous with maximum run up of waves. These graphs indicate that 90% of the wave periods recorded along the KZN coastline are less than 15s, which can be considered a moderate groundswell, while 90% of all wave heights recorded are less than 4m for all seasons. It follows that under most conditions, waves are of low to moderate energy. Extreme conditions, where waves exceed 18s periods or heights of greater than 6m, have been recorded but are a very rare, occurring only 1% of the time.

This information is useful in evaluating the highest run up encountered along a coastline. While methods such as the Bruun Rule and Oregon Model may be applied to determine run up levels, these models are generally considered "weak" (Cooper 2008) as they do not account for numerous physical factors inherent in the eco-morphological state of the sand sharing system. A better method of evaluating run up and wave inundation in relation to shorelines has been proposed by Corbella and

Stretch (2012), where use is made of the exceedance level of the 2007 marine storm event, which was the highest event recorded along the coastline, where historical information can be accessed. A 1954 storm event is suggested to have been of a similar magnitude, however no data related to this event is available.

Corbella and Stretch (2012) have considered the wave height data and the wave period data for the period 1991 to 2010 and identified that 2007 saw a peak in Hmax (wave height), Hs max (upper 30% of maximum wave heights recorded) and peak wave period (Figure 10). Using this data Corbella and Stretch (2012) identified that the 2007 marine storm event had a 32-year return period. They, however, recognise that the probability of the extreme Hs and T associated with this storm, coincide with the highest astronomical tides or extreme tides associated with the LNC, as well as extended storm duration, which must be factored into such predictions.

From this information, it can be concluded that the highest recorded wave run up associated with the 2007 storm event is a reliable indicator of the extent of wave inundation and can be a determinant in the defining of the sand sharing system. The results of this method are presented below in respect of 99 Colwyn Drive.

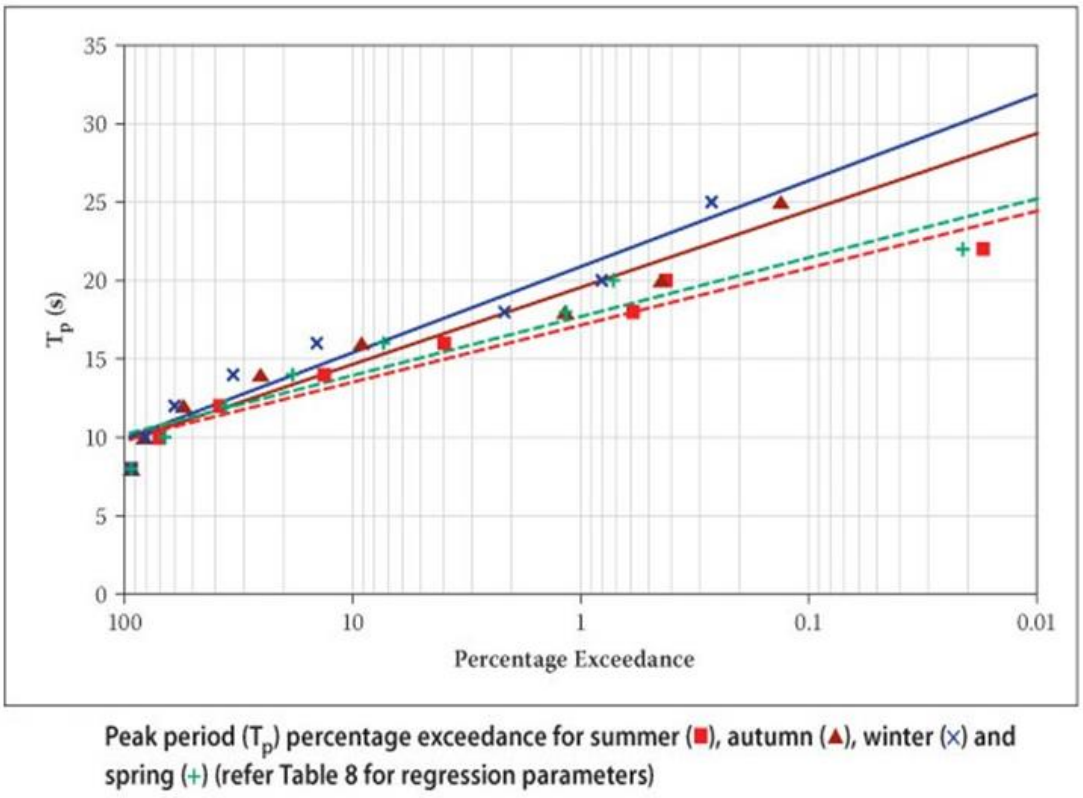
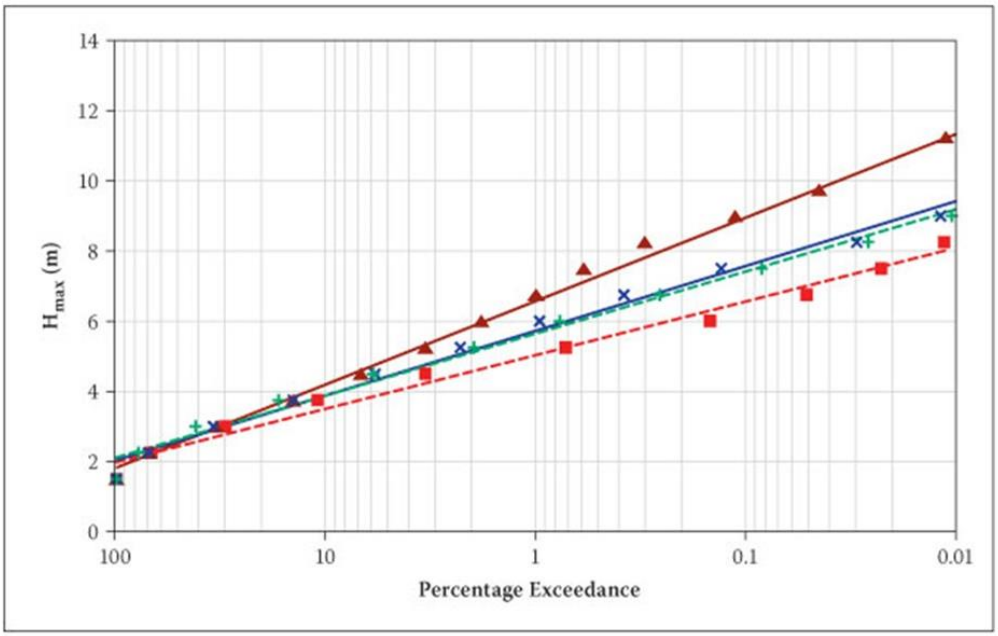
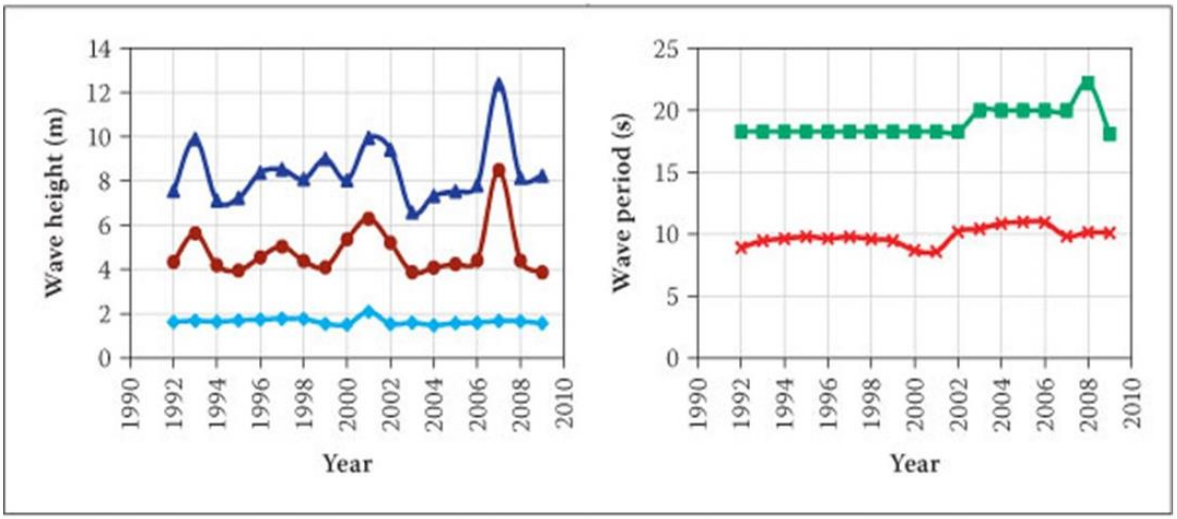


Figure 8. A graph showing the peak wave period for the KwaDukuza coastline.



Maximum wave height (H_{max}) percentage exceedance for summer (■), autumn (▲), winter (×) and spring (+) (refer Table 7 for regression parameters)

Figure 9. A graph showing the maximum wave height recorded for each season for the KwaDukuza coastline.



H_{max} (▲), Hs_{max} (●), average Hs (◆), maximum peak wave period (■) and average peak wave period (x) for the entire data set

Figure 10. Wave data recorded over a 20-year period, which shows the wave height and wave period experienced during the 2007 extreme weather event.

Given the above, factoring with an accepted annual sea level rise of between 1.23mm (NOAA) and 3.2mm (Mather 2009) an approximate maximum increase of 0.8m can be expected over the ensuing 25

years. Developments along this coastline should therefore employ sea defence or set back and buffer of at least 1m to prevent damage during future storm events.

From a terrestrial perspective, the study site falls within two biomes: KwaZulu-Natal Coastal Belt Grassland and Subtropical Seashore vegetation (Mucina and Rutherford 2006) (Figure 11). These vegetation types are considered "Critically Endangered" and "Least Threatened", respectively (SANBI 2018). KwaZulu-Natal Coastal Belt is described as a highly dissected undulating coastal plain environment, which was historically covered by subtropical coastal forest (Mucina and Rutherford 2006). As much as 50% of this vegetation type has been transformed for cultivation, urbanisation, and infrastructure.

The study area also falls on Subtropical Seashore vegetation which is characterised by recent/young coastal sandy sediments which form beaches and dunes that support herbaceous and dwarf-shrubby vegetation (Mucina and Rutherford 2006). Dominant species common to this vegetation type include *Scaevola plumieri, Phylohydrax carnosa, Gazania rigens* and *Canavalia rosea.*

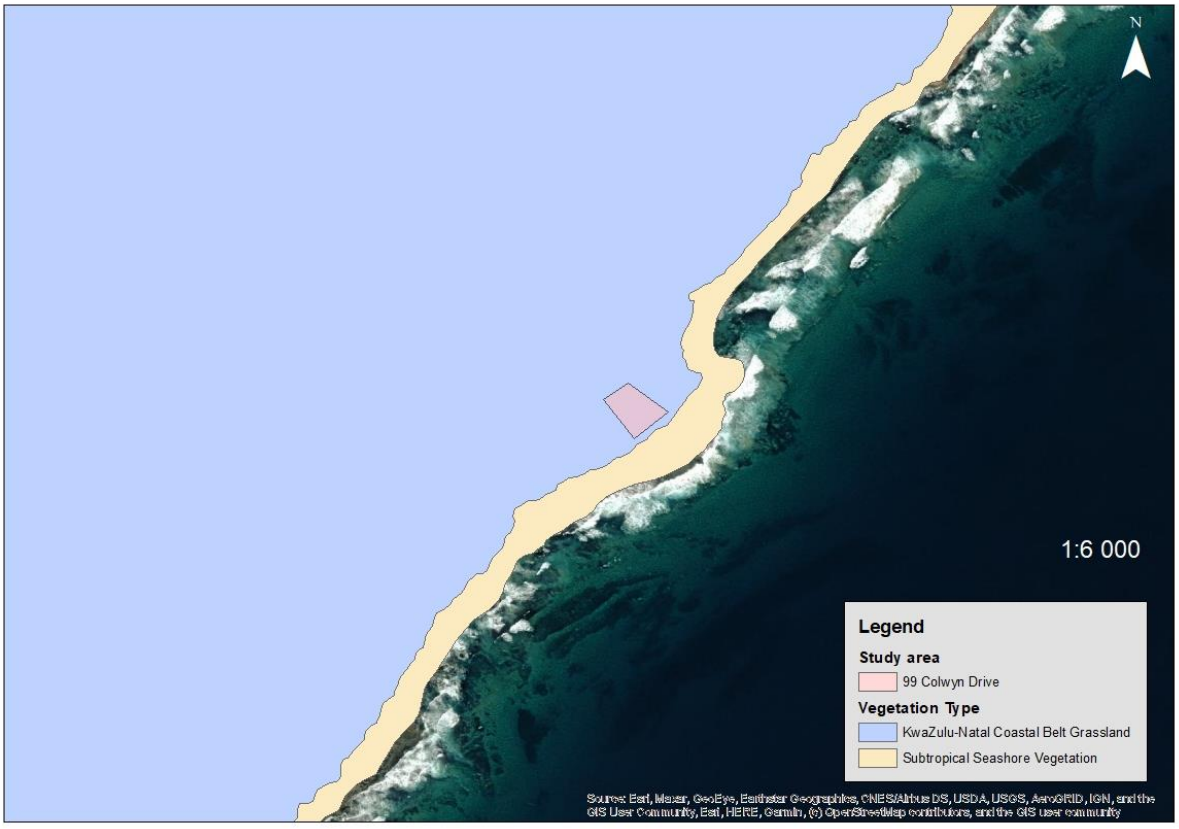


Figure 11. Map showing site in relation to prevailing vegetation forms (source: SANBI 2018).

The Provincial Conservation Authority has identified regions in KwaZulu-Natal considered to be of critical importance from a conservation perspective, having some areas designated as "CBA

Irreplaceable", "CBA Ecological Support Areas" and "CBA Optimal areas" (see SANBI CBA Technical Guidelines for more information). This study area is identified as a region of critical biodiversity importance, as portions of the site are considered "CBA Irreplaceable" (Figure 12). These are areas considered to be in sound ecological condition and are irreplaceable in respect of Provincial biodiversity targets. As such, critical biodiversity areas should be carefully considered in terms of environmental impacts associated with anthropogenic activities. In terms of coastal CBA data, the study area also falls within an "Ecological Support Area" (Figure 13).

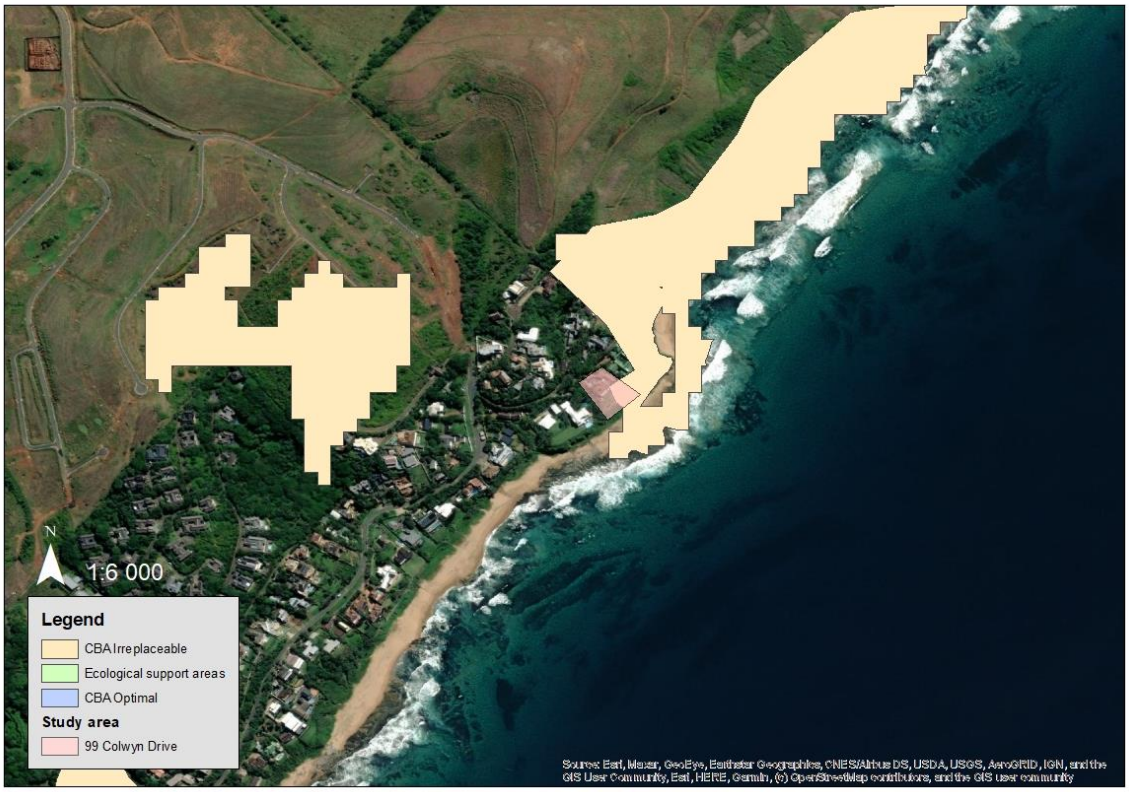


Figure 12. The extent of terrestrial CBA zones in the vicinity of 99 Colwyn Drive, Sheffield Beach.

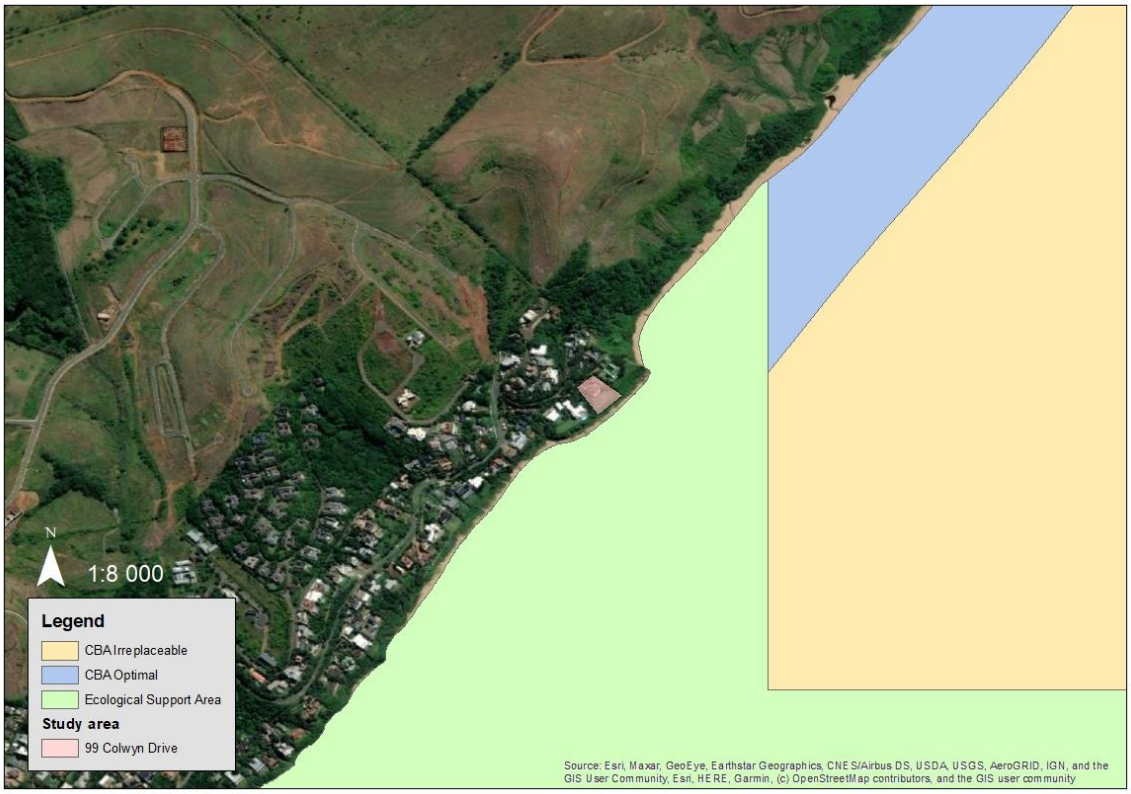


Figure 13. The extent of coastal CBA zones in the vicinity of 99 Colwyn Drive, Sheffield Beach.

According to the Coast KZN database, the study site falls within a long-term (100 year) risk category and is under "Moderate Risk" in terms of the Coastal Vulnerability Index (http://www.coastkzn.co.za/) (Figure 14). Sites considered moderate risk are those that have medium risk in terms of erosion, sea level rise and extreme events (Palmer *et al.* 2011).

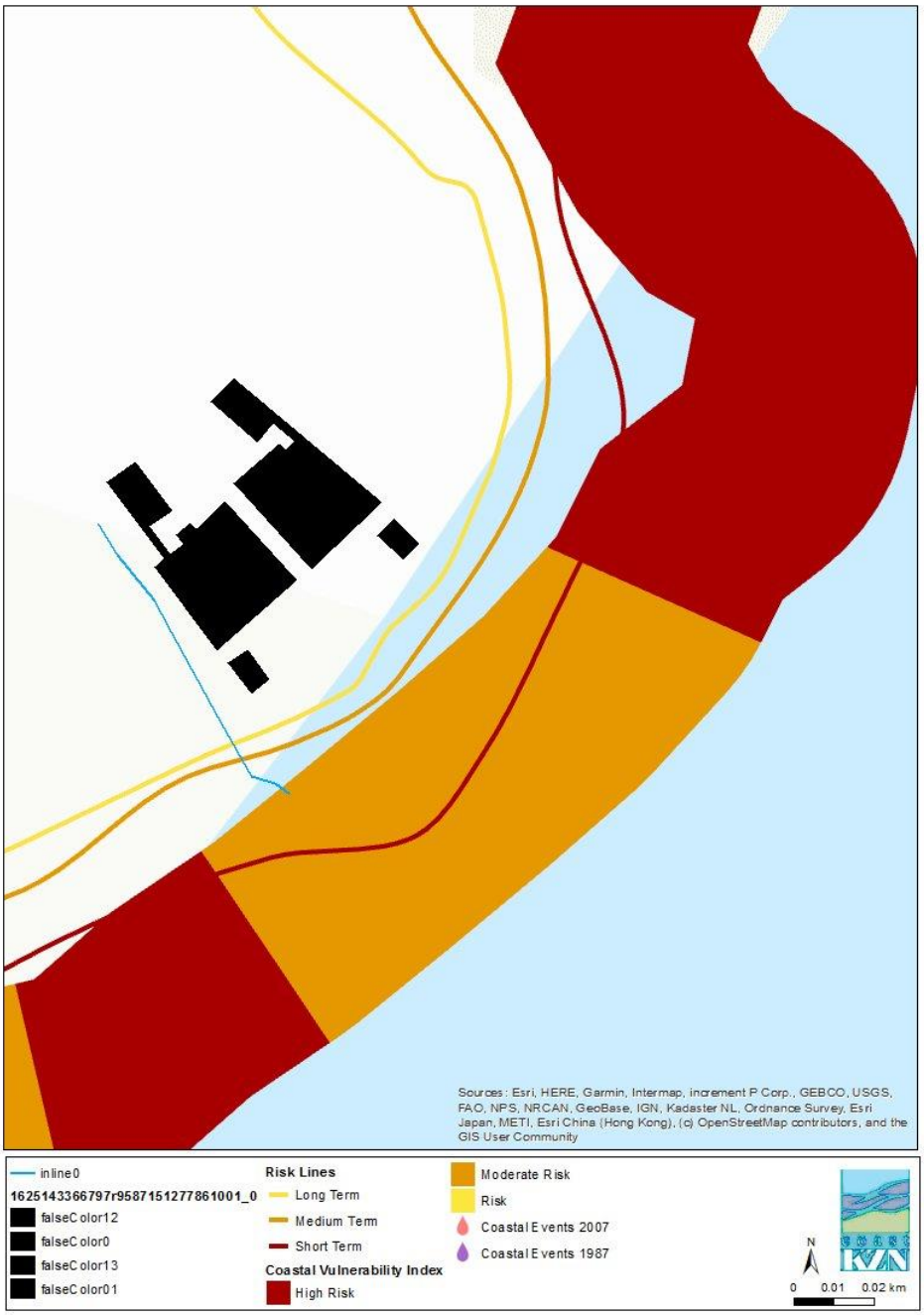


Figure 14. Results from the Coast KZN database (http://www.coastkzn.co.za/) showing the risk lines and coastal vulnerability index associated with the study area.

5. SITE SPECIFIC EVALUATION

The study site forms one of the 30 homesteads that are located at Christmas Bay, seaward of Colwyn Drive, with its south-eastern cadastral boundary lying on the dune or backshore of the beach at

Sheffield. The mother property is some 4000m^2 in area and lies upon a steep, secondary dune and cliff form, at the northern extent of Christmas Bay which lies some 10 to 12m above the beach (Figure 15).

Christmas Bay is a rocky bay encapsulated by two rock promontories and significant inshore reef. The thin veneer of beach sediment forms a narrow sediment bypass which is underlain by a mixed sandstone and dolerite pavement, which in turn is backed by a sandstone cliff form with occasional granitic intrusions. The reef and promontories serve to focus wave energy onto the shoreline, particularly those swells emerging from the south. Most swell emerging from the north is dissipated by the northern promontory, effectively promoting the bay as a depositional zone, while strong southerly swells tend to erode the beach and inshore environment. As such, the southerly swells associated with the site are responsible for shoreline erosion and where significant storm surge accompanies tides and storm events, wave run ups can be extreme. The 2007 marine storm event is considered the highest marine inundation experienced over approximately 40 years (Smith *et al.* 2009). This event saw significant wave run up along most of the KZN coastline, including Christmas Bay. Using this information, as well as interpolated contour data, it is clear that the wave run up associated with the 2007 storm approximated 10m above mean sea level (Figure 16). Such evaluation supports the Provincial policy promoting the limitation of development to above 10m amsl. As such, it is notable that all structures within the subject property positioned above 10m amsl were not affected by erosion, while the concrete stairway to the beach, which evidently lies below 10m was heavily damaged.

Notably, the subject site is underlain by a highly fractured sandstone geology, which offers some resistance to strong wave forcing, however seepage as well as percussion induced fracturing of the cliff face by high waves may give rise to chronic, but low-level erosion of the cliff. It follows that structures within the subject site should be set back from the identified 10m contour. Access to the beach form evidently must extend to a point on the beach (+/- 4m amsl) and as such, this structure should be composed of woody or other organic materials and of limited extent and volume.

The beach form lying immediately below the property is primarily a boulder strewn hummock dune formation, with the earthen – rocky cliff form leading to the subject sites being composed of early seral dune vegetation, including *Gazania rigens* and *Carpobrotus dimidiatus*. A fence lies along a platform at approximately 4 – 6m amsl and marks the seaward property cadastral (Figure 16).

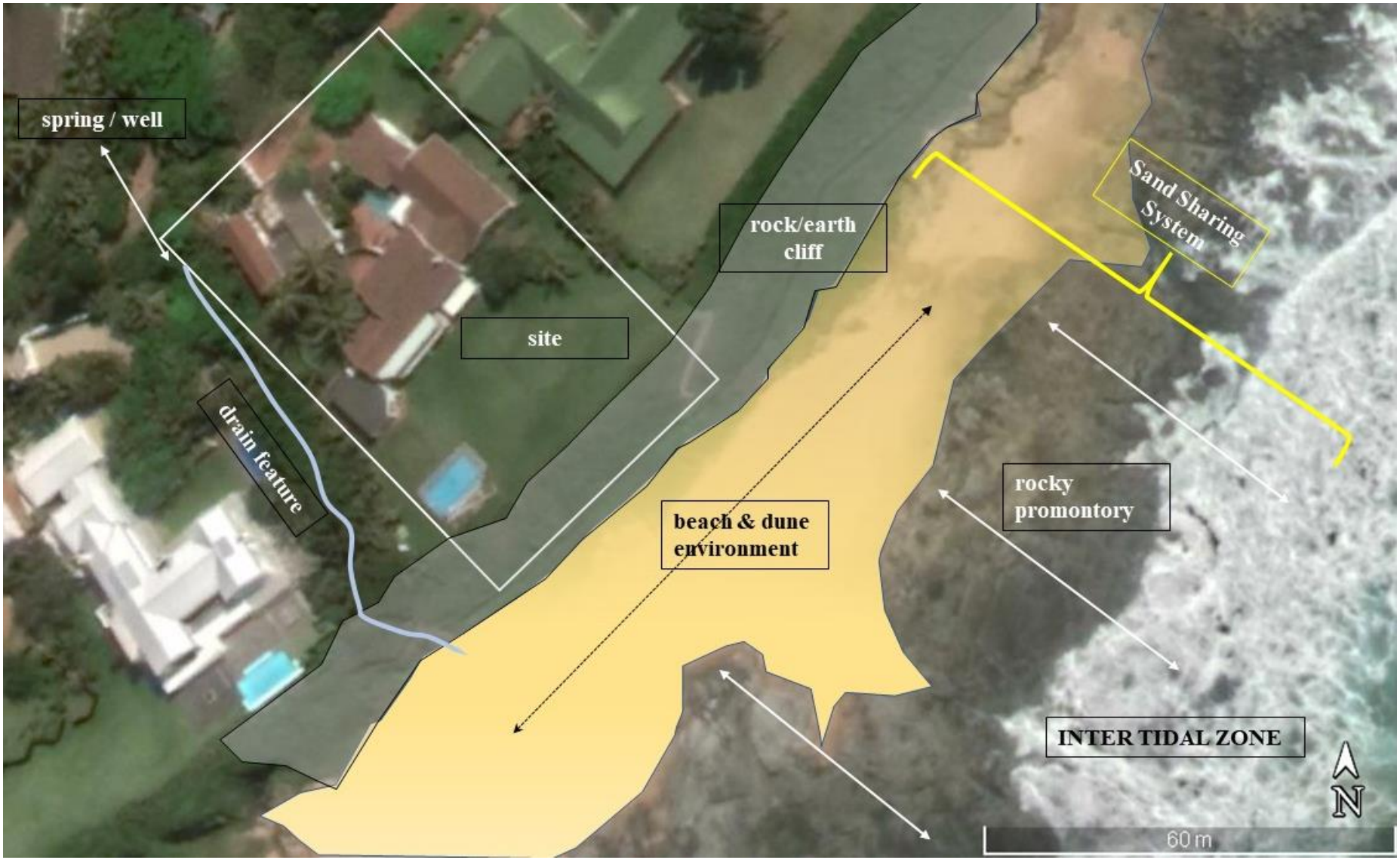


Figure 15. Image showing site in relation to various coastal features.

Figure 16. Image showing site in 2007 following significant storm erosion (above) and recent imagery – 2020, showing site and 10m contour, in orange (below).

Figure 17. Image showing frontal dune and security fence and approximate point of establishment of the new wooden walkway.

It is proposed that a new access point to the beach will be established across this dune form to replace the existing damaged stairway and allow independent, but collated access for both properties to the beach once subdivision has been approved.

As indicated above, the subject property is primarily a gardenscape, showing only limited psammoseral or coastal/ dune habitat (Figure 18). The vegetated component of the site comprises of tended lawns with occasional woody species, such as *Ficus lutea* and *Strelitzia nicolaii*. Other occasional species associated with the site include *Carissa macrocarpa, Aloe thraskii* and *Chrysanthemoides monilifera* which have in most instances been incorporated into the horticultural regime. Two species of conservation interest and significance noted on site include *Mimusops caffra* and *Hibiscus tiliaceus*. The former are two individual specimens while the latter is found within an association that primarily arises on the neighbouring property and is associated with a minor drainage feature.

The drainage feature lying on the adjacent property is associated with a borehole / well that serves a number of properties in and around Christmas Bay. As such, this feature has arisen through the excavation and containment of a surface seep associated with a sandstone fracture. Anecdotally, it is understood that the "well" has been in place for some decades and formed the primary water resource for homes in the area since the 1940s. The associated drain directs water that overflows from the well

towards the dune face and flows across the neighbouring property, see Figure 15 above. *H. tiliaceus* has been planted in and along this drain to promote stability.

Figure 18. Image across subject site, showing structure to be demolished and lawn where septic tanks are to be situated.

As an existing homestead, constructed a number of decades ago, it is evident that services including sewerage, are presently catered for with the site. The present sewerage disposal system is through a percolative, septic tank system, with two tanks being positioned within the front lawn as per Figure 18. It is thought a third septic tank may also be located on the south-western portion of the property. Subject to geotechnical evaluation, it is proposed that this method of disposal should be sanctioned with the two new individual homes being established with individual septic tanks serving each home. A suitable evapo-transpiration area approximating between 22 and 44m^2 should be set aside, depending upon the number of units and ablution facilities in each dwelling. If the evapo-transpiration area is deemed insufficient, the client should consider either:

1) Installing a conservancy tank on site which is regularly emptied by a contractor for disposal off site at a licensed treatment works; or
2) Installing a 75mm diameter HDPE pipeline along Colwyn Drive to connect to the existing Siza Water reticulation system positioned at Christmas Bay car park.

In general, the property can be described as an urban homestead, with little in the way of natural coastal habitat being evident around the proposed structural footprints and as such is a "highly transformed" environment.

6. IMPACTS & RECOMMENDATIONS

6.1 Analysis of Impacts

As discussed above, the nature and significance of negative impacts arising from the proposed developments can be evaluated against the status quo upon the site or the nature of the prevailing environment. Broadly, impacts on the coastal environment can be considered to be affecting:

a. The sand sharing system including sub tidal to dune habitats or in some cases, rock and earthen cliff.
b. The terrestrial environment along the landward extent of the shoreline.

In the case of the proposed development, it is clear that anticipated negative impacts or externalities arising from the development that require redress or mitigation have already been imposed upon the site. In addition, it is clear that present and proposed structures lying at an elevated and distal position from the shoreline, lie well beyond the sand sharing system and those areas of highest wave run up, while the balance of the property has been largely transformed. It follows that a primary objective from this evaluation and assessment would be to align the proposed development with current thinking and concepts in terms of coastal management and mitigate or ameliorate issues that have arisen over the preceding decades.

Table 1 below, summarises the potential impacts that may arise from of the proposed activities on the ecology of the site. These impacts are evaluated to identify their significance and the status of impact.

From Table 1, and as the study site is located within a transformed portion of coastline, the significance of these impacts is identified as being *low* to *very low*. However, in the long term a generally latent alteration of the proximal plant community structure within the frontal dune and more distal cliff form may occur, particularly as the broader hydrology changes. Such changes will be brought about by both changes in the availability of water as well as its chemistry. This may generally be imperceptible but may alter biotic factors on account of changes in the availability of (in particular) groundwater and seeps, as well as possibly, water chemistry. While plant communities may alter to accommodate such change, invertebrates, in particular, such as coastal amphipods and isopods (Crustacea), noted from the seeps in this region will also be affected accordingly (Culver *et al.* 2012), with possible impacts on such communities.

Table 1. Review of ecological impacts arising from the proposed activities at 99 Colwyn Drive.

IMPACT	Spatial extent	Duration	Probability	Significance	Status	Confidence	Comment & Mitigation
Interruption of sediment transport regime	Local	Long term	Very low	Very low	Very low	High	No intrusion into the sand sharing system by built structures other than access stairway to beach. Minor sediment mobilisation at the point of excavation for the walkway through the dune may arise. Measures to stabilise and address sediment transport around walkway should arise to allow rapid return to state of equilibrium.
Change in the hydrology	Local	Long term	Very Low	Very low	Very low	High	Minor increase in hard panned surfaces and the establishment of additional septic tanks may serve to alter the surface and sub-surface flow of water. Septic tanks should be placed distantly from the stream and beach.
Change or loss of habitat	Local	Long term	High	Very low	Low	High	Low faunal and floral diversity present on the primary dune, although distal rock cliff shows some significant hygrophilous vegetation. Some transformation of a low level may arise on habitat associated with seeps – subject to sub surface geology. The establishment of the walkway will result in the loss of some vegetation; however, adjacent concrete structure will be removed. A stilted walkway will decrease the impact on vegetation and dune dynamics.
Change in coastal fauna and faunal ethos	Local	Long term	Low	Very low	Very low	High	Changes in hydrology and water chemistry as well as plant communities will lead to changes of, in particular invertebrate faunal communities and associated faunal ethos. Little mitigation is evident on account of such change.

Spatial Extent: Denotes the affected area, - site, local, regional or national.

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).

Probability: The likelihood of the impact occurring as a result of the project being undertaken. Such probability may be "high", "moderate" or "very low" and "low".

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".

Status: This refers to the overall impact determined from the above parameters. **Confidence**: An indication of the level of surety that the impacts or the parameters identified, will occur.

7.1. Mitigation and Management Recommendations

From the above, and in view of the present nature of the site, the most important aspects that require consideration in respect of the proposed dwellings are:

1. The placement of the septic tank systems.

   Subject to a more detailed geotechnical investigation, it is recommended that septic tanks are positioned distally from the identified stream and beach environments. Figure 20 identifies proposed points of establishment. These points will allow for suitable evapo transpiration areas to be established around the tanks, as well as allowing for increased percolation and subsurface flow through terrestrial edaphics and geology. It is important to avoid the placement of the tanks proximal to the seaward edge (cliff face) of the property. The option to modify the surface soils around the septic tanks, as well as ameliorate the edaphic and vegetative state around the tanks may be considered in order to improve the biochemical remediation of discharge.

2. Beach access.

   The subdivision of the property will evidently require singular accesses to the beach for each property. Presently the beach access to the property is a concrete structure that has been rendered derelict by high seas. It is proposed that:

   - The present concrete structure be removed, and the affected area is re-established to natural dune / cliff form.
   - A singular wooden (raised) access or stairway be established across coastal public property (Figure 19). This access will effectively alight proximal to the boulder strewn back beach. This would be an improvement in the present point of access on to the beach, which is effectively in and around a seep.
   - The area around the new stair way and access should be suitably vegetated to promote surface stability.

3. The placement of the proposed dwellings.

   No encroachment towards the identified “spring / well” identified on the neighbouring, southerly property should occur. New structures should remain within the footprint of existing structures adjacent to the building line. Measures, such as a cordon should be implemented during construction to ensure no encroachment towards the “spring” arises.

Figure 19. Aerial image indicating specific measures to be employed in respect of the proposed construction of homes at 99 Colwyn Drive. Note recommended evapo transpiration areas and alternative measures for disposal of sewerage to Christmas Bay.

4. Landscaping

It is recommended that landscaping within the property be confined to the cut platform, while the dune frontage and slopes be retained in a more natural form, with redress of evident alien vegetation that may arise on site. An "indigenous" and appropriate (coastal dune to dune species) planting palette should be employed on the property. It is recommended that the two *Mimusops caffra* specimens located on the western portion of the property (29°28'39.62"S / 31°15'47.59"E and 29°28'40.09"S / 31°15'48.12"E) are retained on the property. However, the third *Mimusops caffra* specimen present on the eastern portion of the property (29°28'40.25"S / 31°15'49.35"E) should be removed as it is effectively falling over. The removal or disturbance of any *M caffra* specimens will require a permit from the Department of Agriculture, Forestry and Fisheries.

5. Lighting

The use of external lighting should be confined to areas around the built structures. Specifically, spotlights directed onto the beach should be avoided.

7. CONCLUSION

The property at 99 Colwyn Drive, Sheffield Beach is an existing homestead comprising of residential structures. The property is to be subdivided and the existing structures demolished, and two independent, new structures are to be built. As an existing, transformed portion of coastline, an evaluation of the bio physical aspects of the site and its adjacent dune and coastal environment has indicated that such activity will elicit minimal environmental impacts, provided that suitable mitigation measures are imposed. Furthermore, the proposed redevelopment of the site offers an opportunity to address aspects presently evident on the site that do not align with contemporary coastal management practices.

It follows that subject to the measures indicated above, the impact of the proposed subdivision and building of homesteads on Rem of Ptn 292 of Sheffield Beach, is unlikely to elicit significant coastal or ecological impacts on the site and surrounds.

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Annexure A – Proposed Layout for House Emmanuel

Annexure B – Proposed Layout for House Starr