PRDW
Consulting Port and Coastal Engineers

# AFR240103 WILDERNESS ERF 90 ROCK REVETMENT

## Coastal Protection Assessment

Specialist Report

AFR240103-RP-GA-001

19 February 2025

Sharples Environmental Services cc (SES)
South Africa

PRDW
Consulting Port and Coastal Engineers

# AFR240103 WILDERNESS ERF 90 ROCK REVETMENT

## Coastal Protection Assessment

Specialist Report

AFR240103-RP-GA-001-R0.docx

19 February 2025

| REVISION | DATE | EXECUTED | CHECK | APPROVED | CLIENT | DESCRIPTION / COMMENTS |
|---|---|---|---|---|---|---|
| 0 | 19-02-2025 | ARW | AHH | ARW | | Assessment Report |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

(A) Interdisciplinary coordination (B) For approval (C,D,E…) Modifications (0) Approved (1,2,3…) Scope modification (N) Void

TÜVRheinland CERTIFIED Management System ISO 9001:2015 www.tuv.com ID 9105074573

SABS ISO 9001

Sharples Environmental Services cc (SES)
South Africa

SES Sharples Est 1998 Environmental Services

## EXECUTIVE SUMMARY

This is a specialist coastal engineer's report in support of a section 24G impact assessment application for a retrospective environmental authorisation for an existing rock revetment constructed in October 2003. The report addresses the feasibility of the rock revetment in protecting Erf 90 from coastal waves and tidal surges; what should have been done to protect Erf 90 from coastal waves and tidal surges; alternative measures that could have been implemented to protect Erf 90 from coastal waves and tidal surges; and a professional opinion on the best outcome/solution regarding the protection of Erf 90 from coastal waves and tidal surges.

a. Findings
    i. The existing structure is well constructed, remains functional and capable of withstanding extreme storm events.
    ii. The revetment is not causing any detrimental impact on the surrounding beach area apart from the visual exposure of the armour rock.
    iii. The structure protects the existing dune vegetation, the house on erf 90, the adjacent property on erf 91 and the car park seawall.
b. Recommendations
    i. It is recommended that the structure be retained as it represents a net positive benefit to erven 90 and 91 and the public car park without causing a detrimental impact on the beach.
    ii. In the light of projected climate change effects on the overall beach area in future, it is recommended that the structure be covered with sand and revegetated with dune building plantings with a view to improving the resilience of the beach to large storm events. This action should, if possible, be extended to the car park seawall as well.

PRDW
Consulting Port and Coastal Engineers

## CONTENT



## TABLES



## FIGURES

# AFR240103 WILDERNESS ERF 90 ROCK REVETMENT

## Coastal Protection Assessment

Specialist Report

## 1. INTRODUCTION

In 2003 the Pallister Trust, the owner of the property, installed a rock revetment to protect the house at Erf 90, Sands Road, Wilderness. The Pallister Trust has recently been issued a Notice of Intent to Issue: A Coastal Protection Notice in Terms of Section 59 of the National Environmental Management: Integrated Coastal Management Act 24 of 2008 (NEM: ICMA); and/or A Repair or Removal Notice in Terms of Section 60 of the NEM: ICMA in Respect of Unlawful Encroachment Within the Coastal Zone at Erf 90, Wilderness, Western Cape Province, by the Department of Forestry, Fisheries and the Environment.

Sharples Environmental Services cc (SES) has been appointed as the independent Environmental Assessment Practitioner (EAP) to undertake a Section 24G impact assessment for a retrospective application for Environmental Authorisation. PRDW was appointed to provide a professional opinion from an experienced coastal engineer on the suitability of the rock revetment constructed in 2003.

This report is divided into 5 sections. Section 1 provides introductory remarks, whilst section 2 provides a general description of the relevant site characteristics, as technical context, for the work. The existing revetment, as built, is evaluated in section 3 with a view to its current state and ability to perform is its intended function during future storm events. Consideration is also given to whether this structure has a detrimental effect on the existing beach stability. Alternative measures that could have been implemented are discussed and evaluated in section 4, with findings and recommendations given section 5.

## 2. SITE CHARACTERISATION

### 2.1 General description

Erf 90 Wilderness is a beach front property located on the coastal foredune. The house was built in 1933 and being older than 60 years, has heritage value for the area. (see Figure 2.1)

*Figure 2-1 The House during construction (1933)*

## 2.2 Regional setting

The property is located on the western reaches of the Wilderness coastline between the Kaaimans river mouth and the Touws River estuary. (See Figure 2.2)


*Figure 2-2 Regional setting*

The immediate area is characterized by a sandy beach environment with landside development on the coastal foredunes, an extensive beach area with the Leentjiesklip reef outcropping on the lower beach profile and a dynamic high energy surf in the nearshore area. (see Figure 2.3)

*Figure 2-3 Beach area at low tide (22 January 2025)*

The beach area is considered a high value recreational zone with various beach amenities, car parking, life savers facilities and braai areas. Private properties adjoin these facilities on both sides.

## 2.3 Coastal form

The site is located on a typical sandy beach formation consisting of foredunes, a medium grain size sandy beach and a high energy surf zone. This coastal form extends some 350 metres eastwards where it intersects with a typical rocky shoreline which stretches some 400 metres to the sand filled estuary of the Kaaimans river mouth. Westwards, the sandy beach form extends 1200 metres to the Touws river estuary and thereafter to high ancient dunes backing onto a sandy beach which overlies calcarenite beach rock formations.

## 2.4 Coastal processes

The coastal morphology associated with the site under consideration is defined by the natural processes affecting the greater coastal zone from the Kaaimans river estuary to several kilometres of beach to the east. Developments on the foredune system over the last 80 years has reduced the amount of sand in storage which in turn has resulted in a more vulnerable shoreline to large episodic storm events. Under normal conditions it remains in a dynamic equilibrium between sand availability, wave energy distribution and prevailing sea levels. An analysis of the coastal erosion since the year 2000 (DE Africa (2023)) shows no net erosion. (see Figure 2.4)

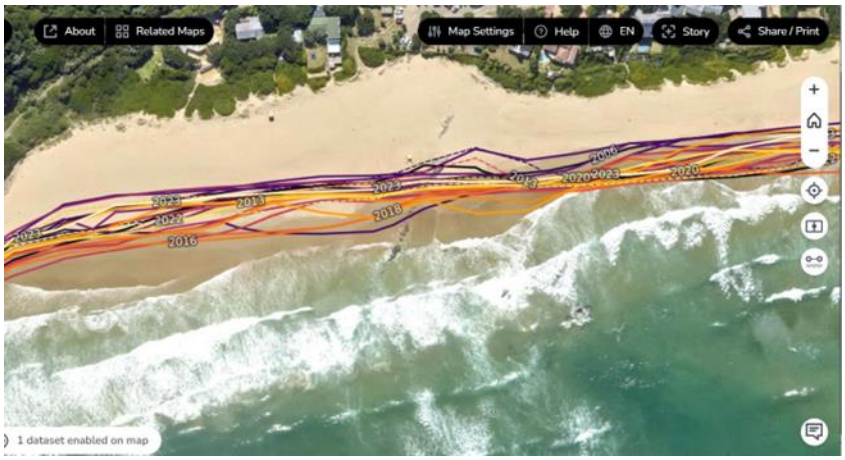



*Figure 2-4 DE Africa mean sea level analysis (2023)*

An assessment of coastline vulnerability undertaken by CSIR (2023) indicates a high risk of erosion to the east of the site. This is associated with the low lying car park, stormwater outfalls and the presence of a vertical seawall. (see Figure 2.5)


*Figure 2-5 CSIR (2023) Greenbook coastal vulnerability assessment*

## 2.5 Future climate change

It is expected that global climate will affect the conditions prevailing at the site over the next 100 years. This is likely to affect the beach and dune system in the following manner:

- By 2100 extreme wave conditions are expected to increase by some 5% with a southward rotation of the south westerly swell of approximately 5%.
- The extent of sea level rise is dependent on the future emission reductions achieved globally. If a mid-level scenario (upper confidence level) is selected for 2060 an increase in sea level of 0.4 m is forecast whilst for 2100 an increase of 0.8 m is forecast. (see figure 2.6 below). Increased sea levels in future will result in more erosion of the beach dune system.

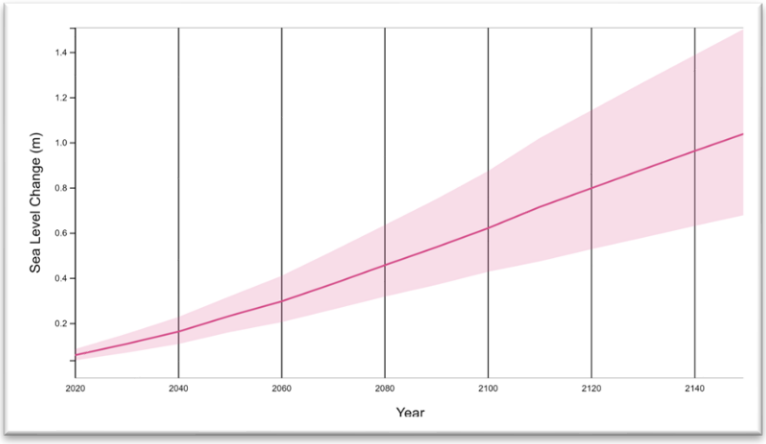



*Figure 2-6 Projected Sea Level Rise for SSP2-4.5 scenario*

The impact of climate change is expected therefore to lead to more severe conditions at the site. This will be experienced as greater levels erosion of the dune system during large scale storm events. The entire system however will tend towards an equilibrium and post storm recovery.

## 3. THE EXISTING SHORELINE PROTECTION

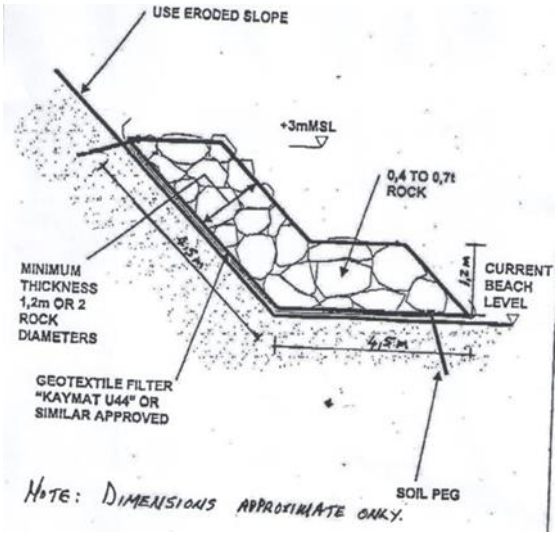
Erf 90 is presented in figure 3.1 below. The cadastral boundaries are illustrated in red.


*Figure 3-1 Property cadastral boundaries*

Since its construction in 1933 the property has been subjected to episodic erosion events due to a combination of high wave and sea level conditions. Pallister (2024) documents various measures that were implemented over the last 80 years, the most recent being in 2003. It is this structure that forms the current shore protection and thus forms the focus of this assessment. In this regard, consideration is given to the following issues:

- What is the current condition of the structure?
- What is the impact of the structure on the surrounding beach stability?

The Trustees have provided a typical section of the revetment that was constructed by the civil contractor on a design and build basis.




The revetment design as proposed by the contractor is expected to have a capacity to protect the slope at high water spring tide subject to breaking waves up to 2 m wave height, which would typify an extreme event. The design includes a geotextile filter which is required to ensure that sand is not removed from inside the revetment, however the vegetation above the +3 m MSL level would be available to feed the beach during a major storm. Post construction in October 2003, the revetment was buried underneath beach sand. (see Figure 3.2)

*Figure 3-2 Post construction of the revetment in 2003*

The photograph above illustrates the as built condition of the revetment. Attention is drawn to the large boulders in the foreground. These rocks indicate the level of sand depletion in the back beach area and represents the foundation level of the revetment as indicated on the cross section above.

*Figure 3-3 The toe of the foredune slope above the rock revetment (October 2004)*

The photograph above shows the top of the revetment in October 2004 still covered in sand. An inspection of the revetment on site in January 2025 shows the revetment revealed, after the largest recorded storm event to date, in September 2023. An assessment, based on what is visible on the surface, indicates that good quality rock has been used for the construction and that the revetment is largely intact. Generally, the rock size appears to be larger than the 0.4–0.7 t rock indicated on the drawing. Our estimate would be closer to 0.5 t–2.0 t, on average. Although it was not possible to see the geotextile layer, we have no reason to believe that this is not still intact. A year after the last major storm event the beach has largely recovered on the bottom and mid sections. Our overall assessment is that the revetment is in good condition and will continue to function as an effective protective barrier during the next storm event.

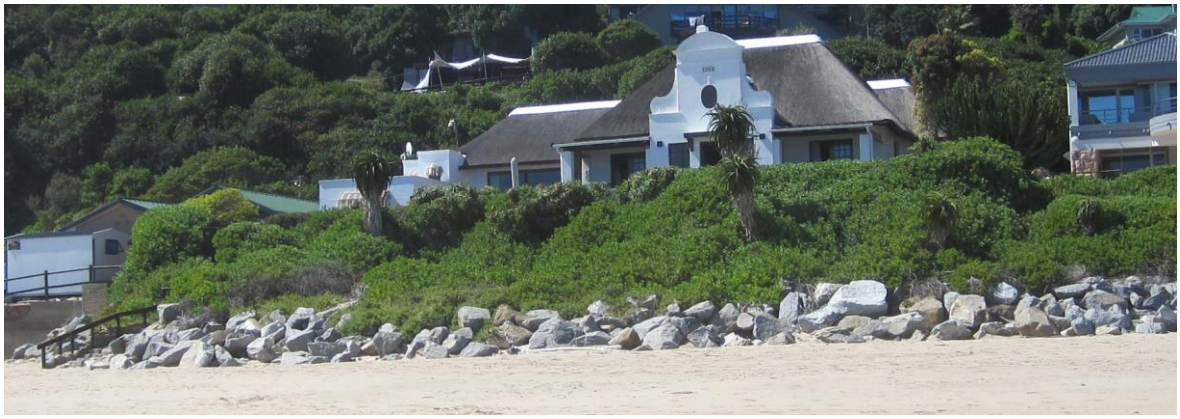


*Figure 3-4 The rock revetment (January 2025)*

When considering any sandy beach dune stabilization system, it is important to evaluate its potential impact on the overall beach stability. Whilst the revetment is designed to protect the toe of the foredune under extreme storm conditions it should not prevent the build-up of sand on the middle and back beach areas and should allow for the natural vegetation to re-establish itself post the event. Both these conditions appear to have been met by the structure. Apart from protecting Erf 90, this revetment forms a hard point (similar Leentjiesklip) which protects the car park seawall and adjacent properties to the east, without any detrimental effects of the overall beach system.

# 4. ALTERNATIVE OPTIONS

This section of the report deals with the technical options that could be considered, and their implications, should some form of remediation be considered.

## 4.1 Removal of revetment

The removal of the revetment will expose the historical protection works, timber gabions, vertical concrete brick wall and the vegetated slope to erosion during large storm events. If unmitigated it will result in the loss of the foredune and ultimately threaten the house. In addition to the impact on erf 90, the interfaces between the car park and erf 90 will be eroded as the foredune recedes. The same will occur between erf 90 and erf 91 where erosion will extend behind the western flank of the existing revetment.

## 4.2 Construction of a new revetment within the property boundary

The construction of a new revetment within the boundary of erf 90 would require the temporary removal of the existing foredune and its vegetation, the excavation of the toe of the slope to the previously eroded beach level (approx. 0 msl) and the construction of a new slope which would terminate about a metre from the house foundations. The upper slopes (above + 5 m msl) could be vegetated, but the lower slopes would remain a rock revetment. This option is expected to require significant capital investment and time to permit and construct.

## 4.3 Construction of a new vertical wall within the property boundary

An alternative to the revetment would be to install a vertical sheet pile retaining wall along the boundary similar to that in the car park area. The toe of the structure would need to be located significantly deeper than the revetment options due the greater degree of back beach erosion that would occur during a large storm. Further consideration would need to be given to the reflected wave from this wall which would focus wave energy on the car park. The benefit of this option would be the retention of the garden but at significant capital cost.

## 4.4 Re-establishment of dune on the existing revetment

A soft engineering option would be to re-establish the foredune in front and over the top of the existing revetment. This would entail rebuilding the foredune using suitable beach sand and establishing appropriate vegetation. The revetment would maintain its protective function during storm events but would also fulfil the sand storage function of the foredune which could supply the beach during extreme event. Maintenance would be required after large storm events but the overall resilience of the beach to storm events would be improved. It is recommended that the same approach be implemented in front of the car park vertical wall.

## 4.5 Do nothing

The revetment has been in place for more than 20 years, the structure is in good condition and is functional as protection for the vegetated foredune which in turn secures the house against extreme storm events. The beach has not been detrimentally affected by its presence in the back beach area in spite of the foredune material not being readily available. It is within this context that consideration could be given maintaining the status quo.

- A summary of the option assessment is provided in table (4.1) below:

*Table 4-1 summary of the option assessment*

| Options | Cost | General assessment |
|---|---|---|
| **Removal** | Low cost | Increased risk to vegetated slope, existing house and adjacent properties |
| **New revetment at boundary** | High cost | Loss of erf 90 garden and visual impact on lower slope revetment |
| **Vertical wall at boundary** | Very high cost | Visual impact, increased back beach erosion and wave focussing on car park |
| **Rebuild foredunes** | Low cost | Enhancement of beach stability and reduction of visual impact |
| **Do nothing** | No cost | Visual impact of revetment and maintenance of the status quo |

# 5. FINDINGS AND RECOMMENDATIONS

We have visited the site, met with the environmental practitioner and reviewed all the available information from the trustees. We have considered the environmental context within which the site is located, its associated coastal processes and the possible future implications of global climate change. Accordingly, we can make the following findings and recommendations.

## 5.1 Findings

- The existing structure is well constructed, remains functional and capable of withstanding extreme storm events.
- The revetment is not causing any detrimental impact on the surrounding beach area apart from the visual exposure of the armour rock.
- The structure protects the existing dune vegetation, the house on erf 90, the adjacent property on erf 91 and the car park seawall.

## 5.2 Recommendations

- It is recommended that the structure be retained as it represents a net positive benefit to erven 90 and 91 and the public car park without causing any detrimental impact on the beach.
- In the light of projected climate change effects on the overall beach area in future, it is recommended that the structure be covered with sand and revegetated with dune building plantings with a view to improving the resilience of the beach to large storm events. This action should, if possible, be extended to the car park seawall as well.

## 6. REFERENCES


1. Pallister (2024) The history of our family's endeavours to protect the property and house (situated on Erf 90, Wilderness, Western Cape) from the sea over the period 1933 to date (September 2024).
2. DE Africa (2023) https://maps.digitalearth.africa/#share=s-vUeuUItS28F1Nmxs7T9rCz4SzYp
3. CSIR (2023) Green book https://riskprofiles.greenbook.co.za/

PRDW
Consulting Port and Coastal Engineers



For contact or more information, find us at

**prdw.com**