COASTAL EROSION ASSESSMENT

at

BEACH ACCESS ROAD

BALGOWAN

for

YORKE PENINSULA COUNCIL

Project No: 16533
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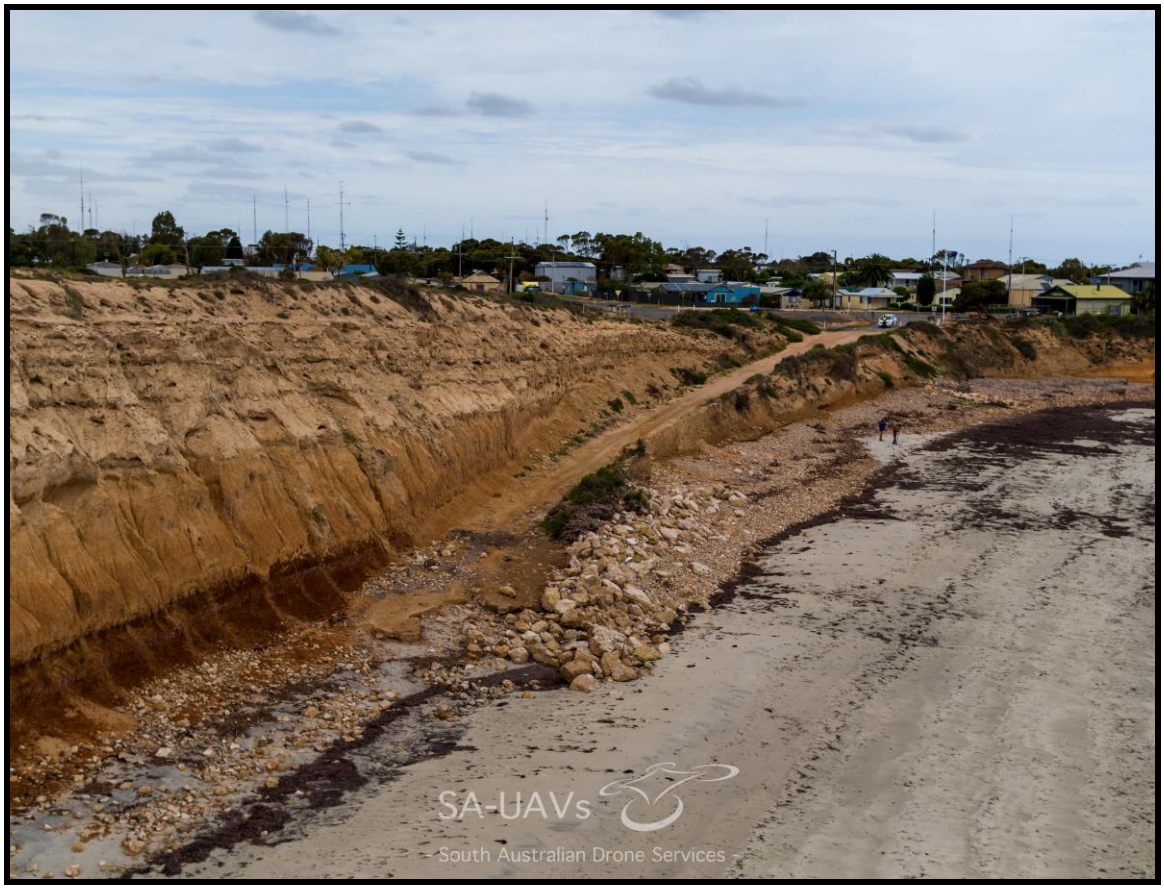
GENERAL

The beach access ramp at Balgowan is located north of the township. The ramp provides access on to the beach for recreational use. After recent storms, the ramp has become severely damaged as a result of erosion of the cliff adjacent. The access ramp has now been closed to vehicles.

Magryn and Associates were engaged by Yorke Peninsula Council to:

- Review a preliminary report by Mace Engineering.
- Inspect and assess the stability of the cliff seaward and landward of the beach access ramp.
- Design new beach access road and seawall revetment to protect the road from wave attack.
- Specify remedial work stabilize the cliff landward of the access road.
- Estimate the cost to undertake the works.



EXISTING DETAILS

The existing ramp runs parallel to the cliff and slopes down towards the north east, at a slope of between 1:20 to 1:30. The ramp is unsealed and is approximately 115m long. The width of the roadway is generally approximately 4m, with a verge either side between the road and the cliff. The road is wider at the top to approximately 7m, and narrower near the lower section where it has collapsed, to approximately 2.5m.

WATER LEVELS AT SITE

Water levels at site, as referenced from the Tide Tables for South Australian Ports published by Flinders Ports are:

	AHD
Highest Astronomical Tide	+ 0.89
Mean Sea Level	- 0.18
Lowest Astronomical Tide	- 1.07

The 1 in 100 year Average Return Interval (ARI) High Water level for the area is approximately 1.99m AHD.

These levels have been adjusted relative to Australian Height Datum (AHD).

The 1 in 100 year ARI High Water Level is the average highest water level which would occur once in a one hundred year period, or the level which has a probability of exceedance of 1% in any one year. It is determined from water level records by The National Tidal Facility of the Bureau of Meteorology.

These levels are in AHD, which is the same datum as the site levels shown on the attached survey by Mosel Steed Surveyors.

In addition to this, sea level rise at the site is expected to be 0.3m to 2050 and up to an additional 0.7m to 2100. These are additional to the figures above.

ROCK/CLAY LAYER LEVELS

A geotechnical investigation was conducted to determine the depth to a solid stratum that will resist erosion, to found the base of the rock wall on. A suitable base is hard clay or rock. The depth of this layer was determined along the beach by driving a steel post into the ground until a solid layer was reached. The depth below existing ground level to a solid layer was found to be approximately 0.5-0.8m (beneath a top layer of loose gravel). This depth will need to be verified by the contractor during excavation.

CURRENT EROSION OF CLIFF FACE

The following photos show the access road, cliff face and the extent of the erosion damage (at time of inspection, 14th December 2016).

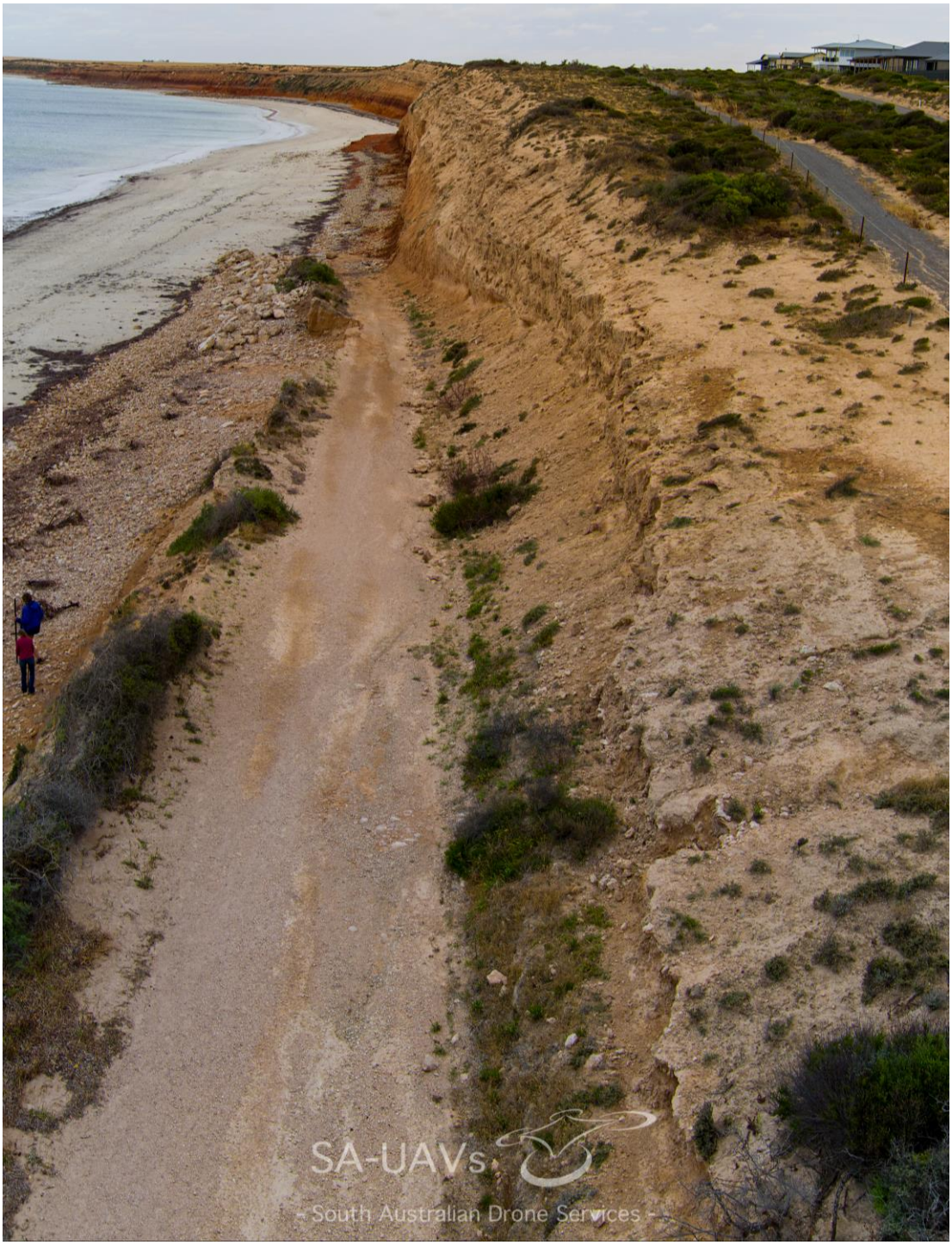


Figure 1- Existing cliff is unstable east of the road.

Figure 2- Existing cliff west of the road is unstable.
It is collapsed and undercut in some sections.

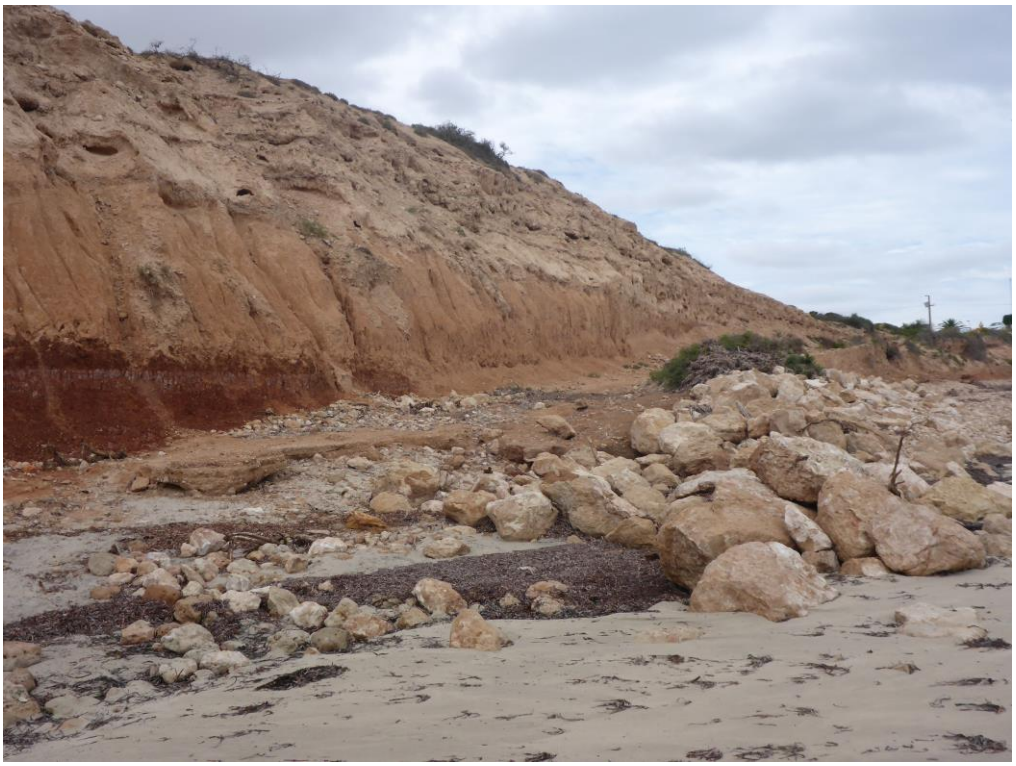


Figure 3- View of the bottom of the existing access ramp.
Some sand and rock protection has washed away.

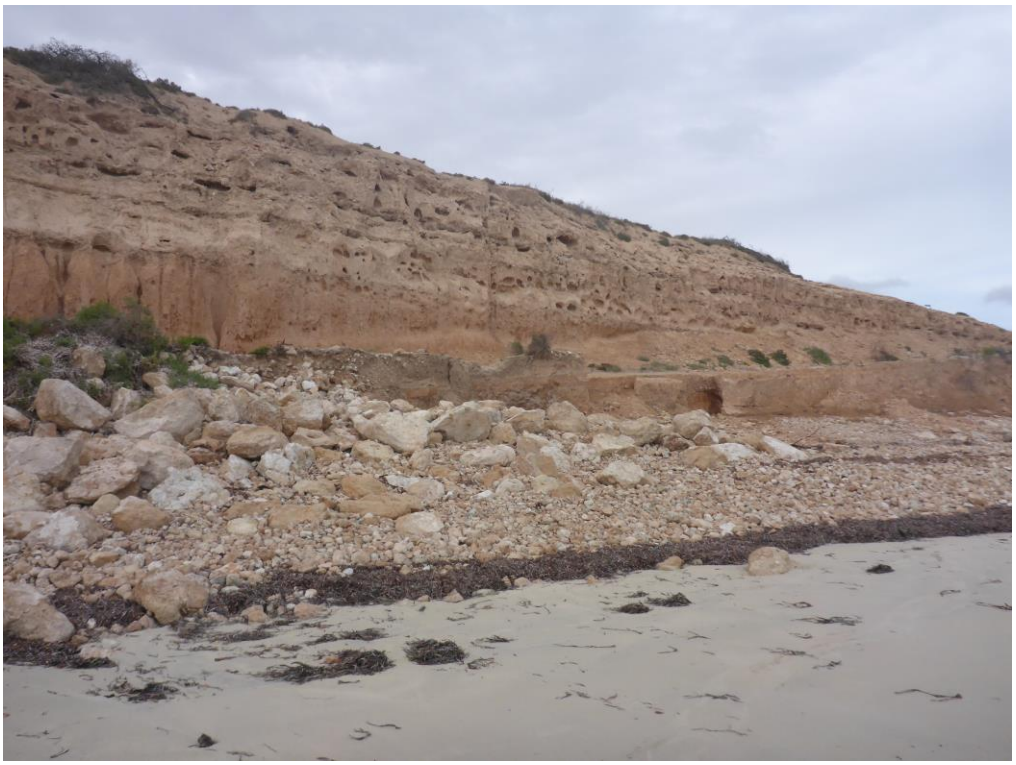


Figure 4- View of the bottom of the existing access ramp.

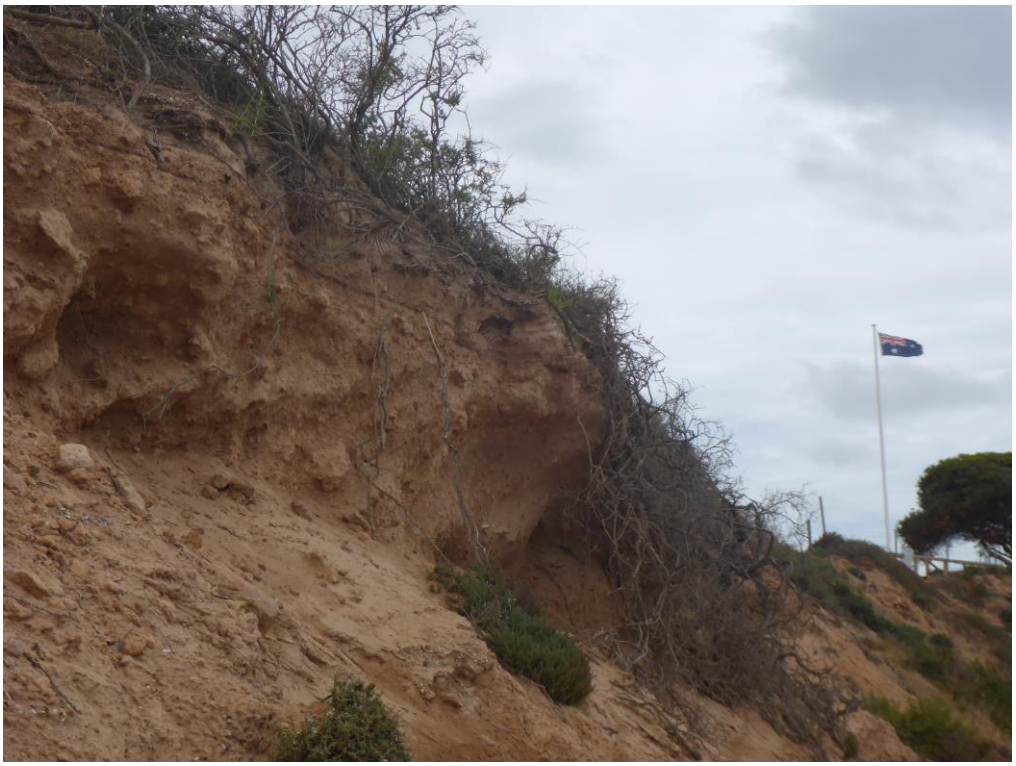


Figure 5- Undercut sections of cliff west of access ramp.

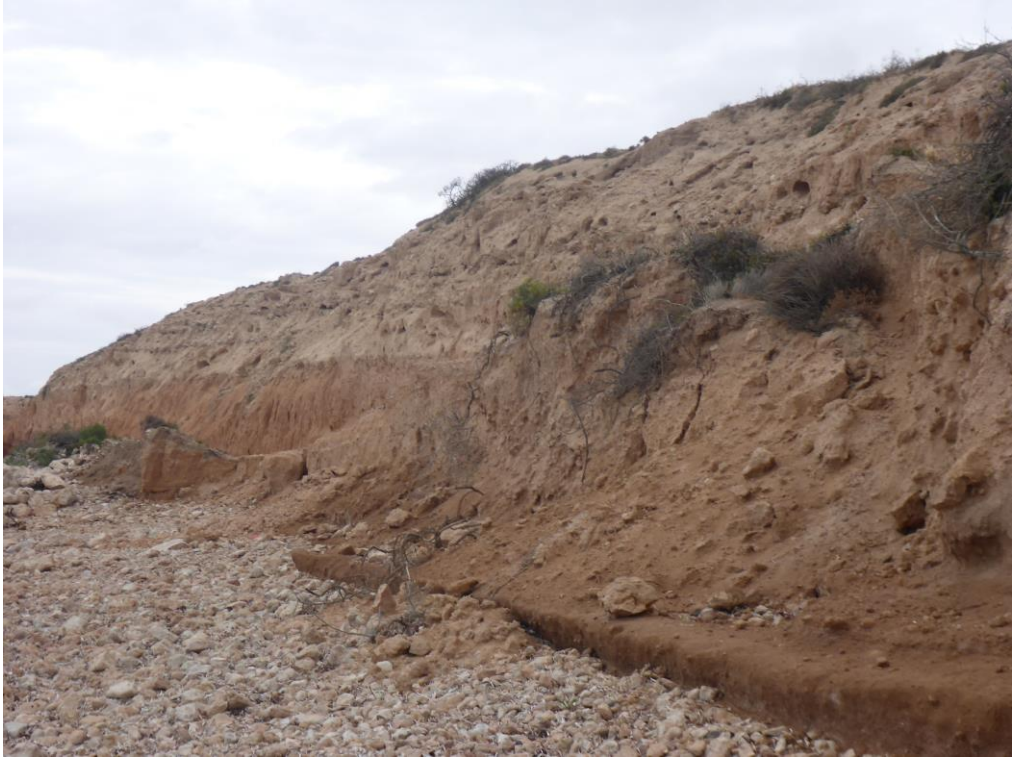


Figure 6- Severely eroded cliff west of access ramp, loose collapsing sand.

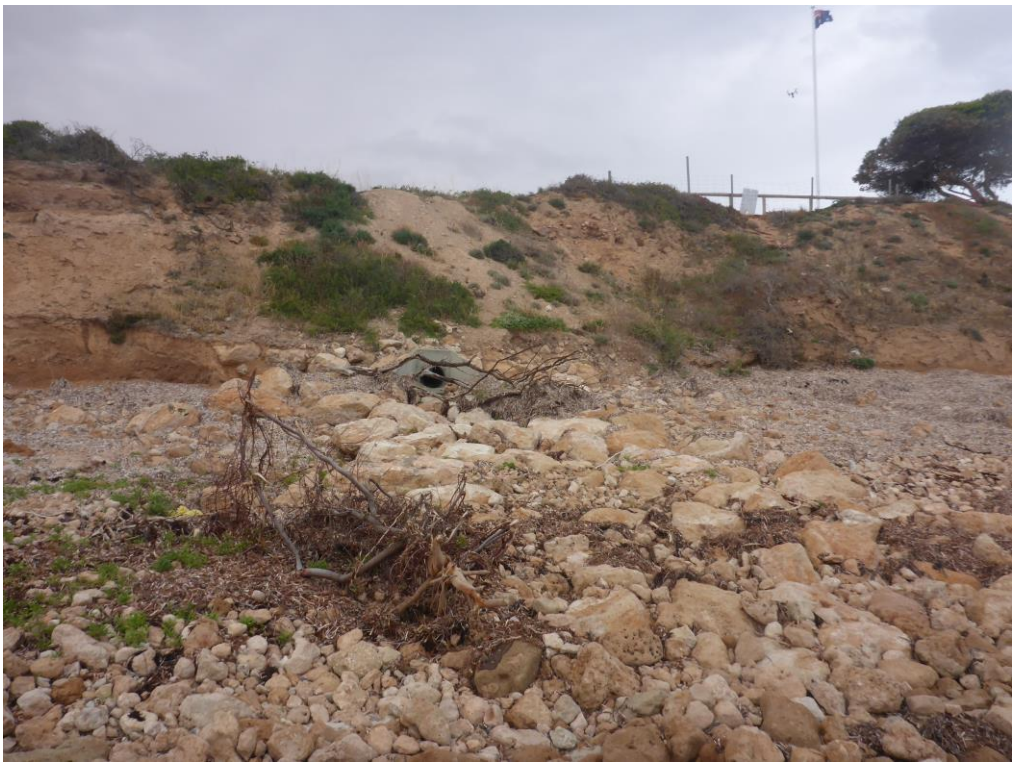


Figure 7- Existing stormwater outlet and rock protection at base of cliff, southern end of access road.

The cliff face west of the access road is generally uncompacted sand. The sand is mostly unvegetated and is loose and collapsing. The cliff face is generally steeper than 1:1.5 slope.

The cliff face east of the access road is generally uncompacted sand, collapsing in the lower half. The top of the cliff is unvegetated in some sections (refer figure 1). The cliff face is near vertical in the middle. It is critical that these sections are protected from further erosion of the cliff.

The beach in front of the cliff is generally flat and shows a slope of 1 in 20 generally. The beach is sand with gravel over.

DISCUSSION- CAUSE OF EROSION ON SITE

The erosion on the cliff face west of the access road is of two different types. The erosion below approximately 4m AHD is from wave action. This can be seen in the collapsed and undercut road.

The tide levels in the area reach to 0.89m AHD at Highest Astronomical Tide, which is below the bottom edge of the cliff face at the top of the beach. Hence, wave action will only reach the cliff base in times of severe storm action, when the water level is artificially raised and waves are superimposed onto this higher water level.

It should also be noted that the site is west facing and is exposed to large storm surges from the south and west. Swell waves entering from the south through the mouth of Spencer Gulf may refract towards the east to impact the site.

The majority of the beach itself is covered in a layer of loose gravel over sand. This has potential to erode further, lowering the level of the beach. Based on the geotechnical investigation, we have allowed for 0.5-0.8m of erosion of the beach. We have taken this erosion into account when considering the maximum wave height at the base of the cliff.

The top of the rock revetment wall has been set to a level of 4.4m AHD. This level has been calculated based on a 1 in 100 year ARI high water level of 1.99m AHD (taken at Wallaroo, 45km north of Balgowan), and the following factors:

- Maximum water depth at the toe of the seawall of 2.1m, accounting for 0.3m sea level rise and 0.8m erosion of the beach.
- Maximum wave height above still water level (at the toe of the rock wall) of 1m, accounting for wave set up (0.3m). These waves are depth limited.
- Maximum wave run up of 2.05m above the still water level.

The still water level when accounting for sea level rise is 2.3m AHD. The maximum wave run up is 2.05m above still water level, giving 4.35m.

The erosion of the cliff above 4.4m AHD (predominantly east of the access ramp) is from slumping sand, de-vegetation and wind effects. These upper sections of cliff are too steep to revegetate naturally.

Cliff erosion can often be exacerbated by inadequate stormwater management over the top edge of the cliff. The effectiveness of the existing stormwater outlet that discharges stormwater from the carpark over is unknown.

RECOMMENDED WORKS

The following remedial works are proposed (refer to dwg. 16533-1 to 4):

1. Edge the base of the cliff in rock protection up to 4.4m AHD to prevent wave erosion. This is undertaken by:
   - Remove and dispose of existing erosion protection (rocks) at base of cliff, as required.
   - Excavate to hard clay or bedrock, to found toe of rock wall.
   - Batter the slope to grade 1:1.5.
   - Installation of geofabric to prevent washout of sand under/behind the wall
   - Installation of smaller secondary armour rock
   - Installation of larger primary armour rock to resist wave attack.

This rock armour has been designed to resist wave attack of waves up to 1m high (above still water level) and a water level of 1.99m AHD. The waves in this instance are depth limited. We have allowed for 1.1m of wave run-up, to prevent waves overtopping the rock armour and causing erosion. The top of the rock wall has been set to 4.4m AHD. Details of the rock armour are shown on our drawing 16533-3.

If sea level rises to the levels predicted to 2100, it will be possible to place additional geofabric, secondary armour and primary armour over the top of the wall when necessary.

2. Stabilize the cliff face (in areas as shown in dwg. 16533-2-4) as follows:
   - Batter the top of the cliff and add new compacted fill where required, to achieve a cliff slope of 1:1.5 or flatter.
   - Add top soil to devegetated areas and over new fill.
   - seed the areas which have been top soiled and/or devoid of vegetation.
   - Install a double thickness layer of Geofabrics Jute Mesh over the areas of slope which have had top soil added and/or are devoid of vegetation. Install Jute Mesh with propriety galvanised metal pins 30mm x 300mm x 4mm Ø, at the rate of 5 pins/m^2 ensuring that all laps of Jute are fully pinned
   - Water to promote germination and plant growth. Tend to plants as required.

Refer to Magryn drawings for further details on the above.

For Magryn & Associates Pty Ltd

Will Souter
B.Eng

Attachments: - Magryn drawing 16533-1 to 4, including base survey by Mosel Steed Surveyors.
- - Geofabrics Jute Mesh & Pinning installation sheets