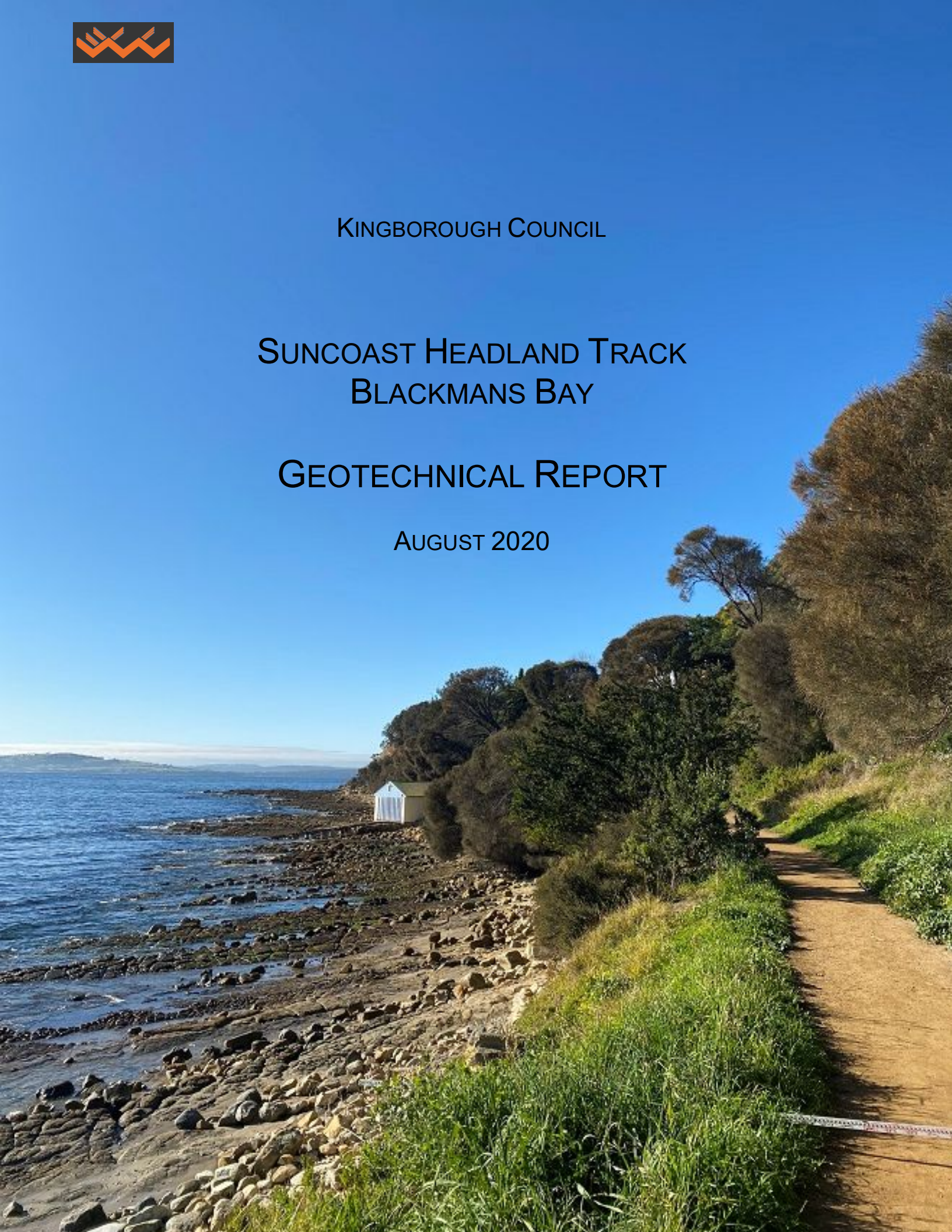
KINGBOROUGH COUNCIL

SUNCOAST HEADLAND TRACK
BLACKMANS BAY

GEOTECHNICAL REPORT

AUGUST 2020



Cover image

View looking east along part of the Suncoast Headland Track, which starts at the southern end of Blackmans Bay Beach. This report concerns geotechnical conditions along about 170m of track, from the end of the beach to the boat shed in the middle distance.
Photo: 10 August 2020

Refer to this report as

Cromer, W. C. (2020). *Geotechnical Report, Suncoast Headland Track, Blackmans Bay.* Unpublished report for Kingborough Council by William C. Cromer Pty Ltd, 30 August 2020. 35 pages.

1 INTRODUCTION

1.1 Background

William C Cromer Pty Ltd was commissioned by Kingborough Council to investigate geotechnical conditions along about 170m of the Suncoast Headland Track at the southern end of Blackmans Bay Beach (cover photo and Attachment 1).

The track is a popular walkway. Recently, a walker fell from it onto the foreshore. A fence along all or part of the outer side of the track is now being considered by Council to mitigate the risk of further falls.

The seaward side of the track embankment, entirely composed of uncontrolled fill, is being actively eroded by wave action. A sandstone block seawall has been destroyed. The erosion towards the eastern end of the track is now encroaching to within less than a metre of the walkway and in places creating unstable subvertical banks up to about 3m high.

This report addresses:

- whether the seaward side of the eroding fill embankment is strong enough to support a fence, and what type of fence might be suitable, and whether track realignment is required,
- mitigating coastal erosion, and
- risks to track users arising from observed and potential geotechnical hazards

1.2 Scope, dates, and personnel

An initial site inspection of the 170m long track was conducted with Mr. David Pitt (Supervisor of Parks and Reserves at Kingborough Council) on 3 August 2020. Follow-up investigations included:

- a desk top review of published geological and related maps, and
- site inspections on 10 and 12 August 2020, the former including mapping and photography of the foreshore and track, and accompanied by field assistant Mr. Richard Mackintosh.

1.3 Previous geotechnical investigations

As far as can be established, no previous geotechnical investigations deal specifically with the section of the Suncoast Headland Track described in this report.

1.3.1 Cromer (1999)

This brief report[1] to Kingborough Council commented on public safety at the Blackmans Bay Blowhole and recommended minor changes to fencing and drainage.

[1]Cromer, W. C. (1999). *Blackmans Bay Blowhole – Geotechnical Inspection.* Unpublished report to Kingborough Council by Environmental & Technical Services Pty. Ltd., 4 May 1999.

1.3.2 Leaman (2001)

A 2001 report[2] by David Leaman described geological conditions along Ocean Esplanade, probably as part of a Council landscaping and reconstruction plan for the area. The report included site sketches of the Blowhole Area, the foreshore between Pearsall Avenue and Hazell Street, the southern end of Ocean Esplanade (including the cul-de-sac), and the shore platform and cliffs east of the existing boatshed. About 30m of the Suncoast Headland Track was included in the last-mentioned sketch, but with no accompanying comments.

1.3.3 Cromer (2020)

This report[3] identified geotechnical hazards in the vicinity of the blowhole, estimated risks to life arising from them, and made recommendations to manage some of the risks.

1.4 Presentation of data

Text is kept to a minimum in this report. Results are mainly summarised in diagrams, and in the series of site photographs in Attachment 2 where distances ("chainages") in metres along the track (in 10m increments up to 170m) are measured from the end of the concrete pathway off the cul-de-sac at the southern end of the beach (Plate 1 in Attachment 2).

Attachment 3 presents event trees which estimate quantitative risks to life for an individual pedestrian most at risk on or below the 170m section of track and exposed to various geotechnical hazards.

2 RESULTS

2.1 Geology

2.1.1 Published geology

The published geology of the Blackmans Bay area (Attachment 1) shows that apart from beach sand, Permian-age sedimentary rocks underlie all of Flowerpot Point and the rising ground to the west.

2.1.2 Observed geology

Bedrock geology

Site observations in the vicinity of the track support the published bedrock geology. Excellent exposures of unweathered interbedded fractured sandstone and siltstone dipping 5 – 10^0 WSW (and inferred to be Permian in age) are exposed on the foreshore east of approximate chainage 90m.

[2] Leaman, D. E. (2001). *Geological Considerations Ocean Esplanade, Blackmans Bay*. Unpublished report by Leaman Geophysics for Kingborough Council, July 2001.

[3] Cromer, W. C. (2020). *Geotechnical Report, Blackmans Bay Blowhole and Environs.* Unpublished report for Kingborough Council by William C. Cromer Pty. Ltd., 12 January 2020.

Similar but weathered sedimentary rocks are locally exposed in cuttings on the landward side of the track, mostly eastwards from about chainage 120m. Some of the siltstone beds are extremely weathered and exhibit soil properties.

Beach sand

Beach sand abuts the base of the eroding embankment and extends northwesterly from about chainage 90 – 100m.

Uncontrolled fill

Uncontrolled[4] fill comprising mostly soil (sand, silt, clay) and rock fragments (well-graded sandstone and siltstone up to boulder size) is exposed along most of the 170m of track studied. It is dry, of variable texture, mostly loose to medium dense, and of variable (mostly low) strength.

During track construction, fill was placed along the outer edge of the track along its full length (0 – 170m). To about chainage 40m or so, it is not clear whether the track has been cut in and rests on original soil and/or bedrock, but after about 40m, it is inferred that the track is built largely on fill (Figure 1).

2.2 Coastal erosion and damaged seawall

Marine erosion of the track embankment is most active east of approximate chainage 100m, where sections of the embankment are subvertical and locally overhanging (various Plates in Attachment 2), with several very small landslides (slumps).

Remnants of a mortared sandstone block seawall are scattered near high water mark almost the full length of the track (Figure 2).

2.3 Geotechnical hazards

Geotechnical hazards on both the cut and fill embankments on the landward and seaward sides respectively of the track include rockfalls and landsliding – all of them very small scale (Figure 2). Most occur after about chainages 40m – 60m.

There are numerous individual rock falls onto the foreshore rock platform from the fill embankment. Several very small scale landslides (including slumps) are also present.

Rockfalls on the higher side of the track are locally present from small cliff-like exposures past about chainage 130m. A very small landslide occurs between about chainages 105 – 115m (Figure 3).

The types of observed and potential slope instability hazards adjacent to the track past about chainage 130m are schematically shown in Figure 4.

[4] "Uncontrolled" means the fill was not compacted in layers when placed.

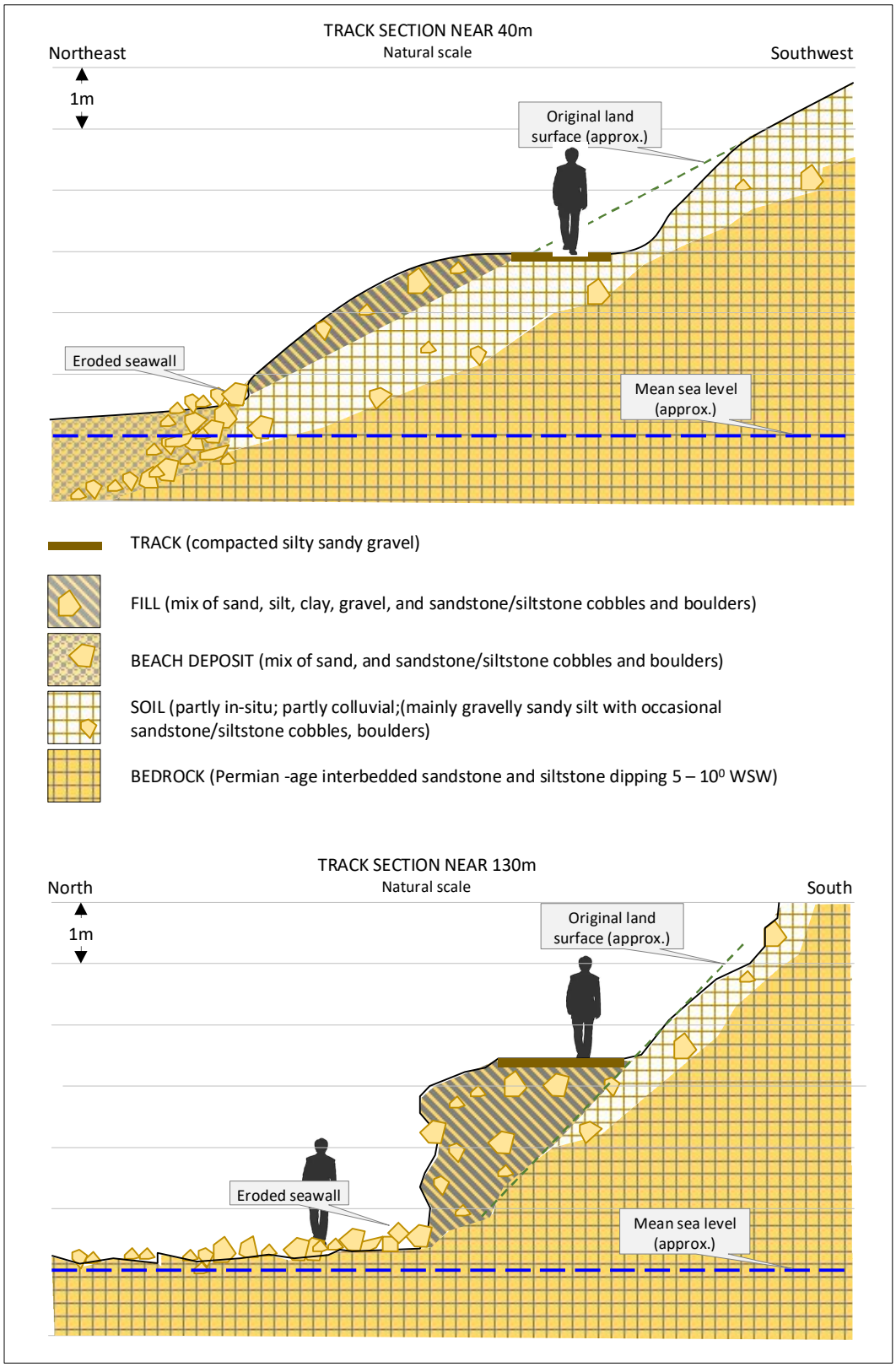


Figure 1. Interpreted geological cross sections at natural scale through the Suncoast Headland Track near chainages 40m and 130m.

Figure 2. The mortared sandstone seawall originally protected almost the full 170m of track described in this report. It contains sandstone blocks ranging in length from about 0.2 – 0.6m, and about 0.25m wide and high (approx. 20 – 100kg). Wave action has destroyed almost of it. The staff is 5m high.

Figure 3. A very small landslide in soil has occurred between approximate chainages 105 – 115m. Sandstone and siltstone bedrock dipping 5 – 10^0 WSW is exposed on the shore platform in the foreground, and in the light-coloured cutting to the left of the landslide.
Drone image by Bill Cromer 10 August 2020.

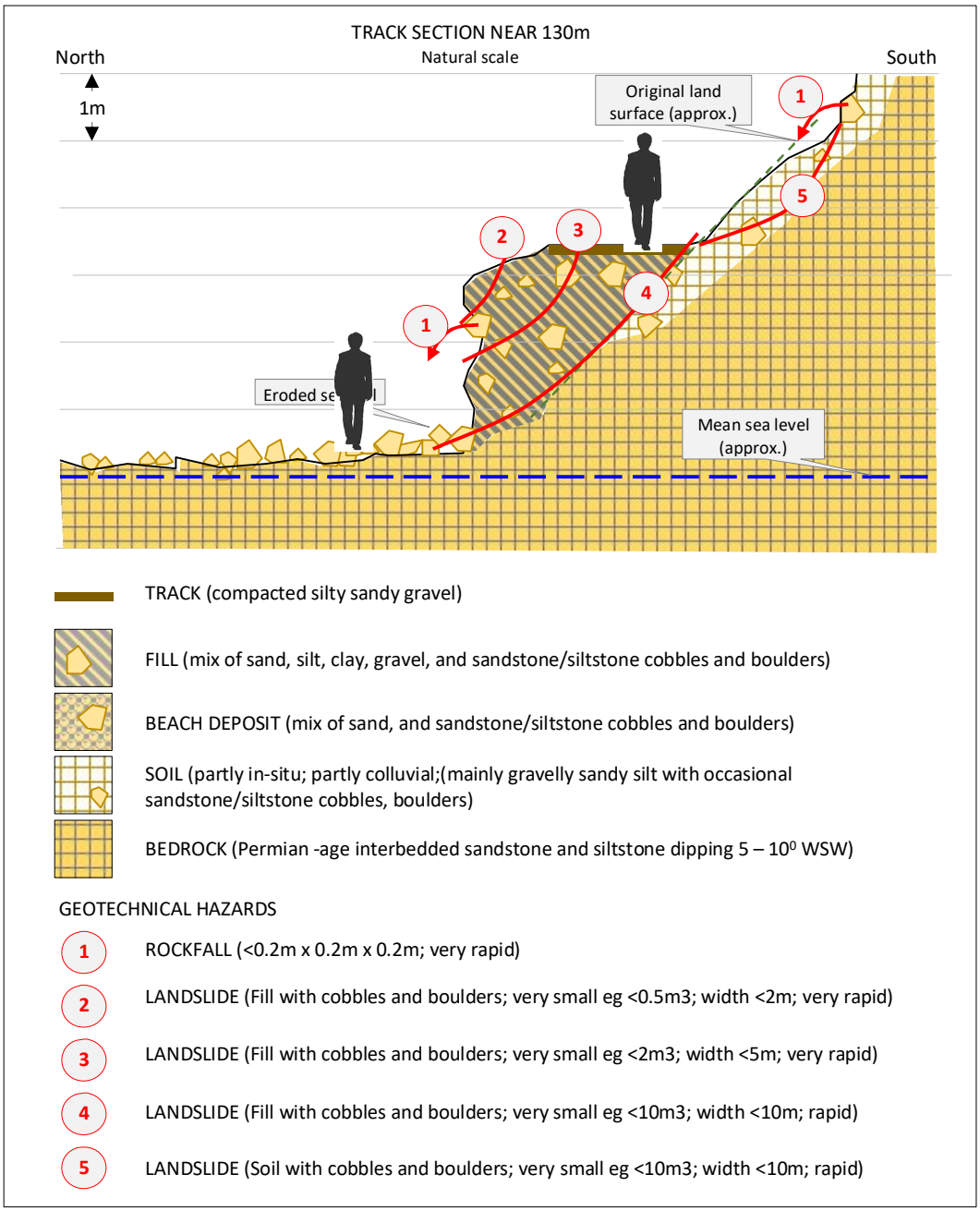


Figure 4. Potential and observed slope instability hazards 1 – 5 on the Suncoast Headland Track after approximate chainage 130m.

2.4 Track width and distance to lip of embankment

2.4.1 Track width

Used track width[5] remains fairly constant in the 1.2 – 1.5m range to about chainage 70m. Between chainage 70m and 140m, used width is in the 1.0 – 1.3m range (locally 1.7m). From about chainage 140m to 170m, it narrows to about 0.6 – 0.7m (Figure 5).

[5] This is the width trampled by feet. It tends to extend landwards to the edge of the gravel, but on the seawards side a strip up to 0.3m wide dips slightly downwards and is rarely used.

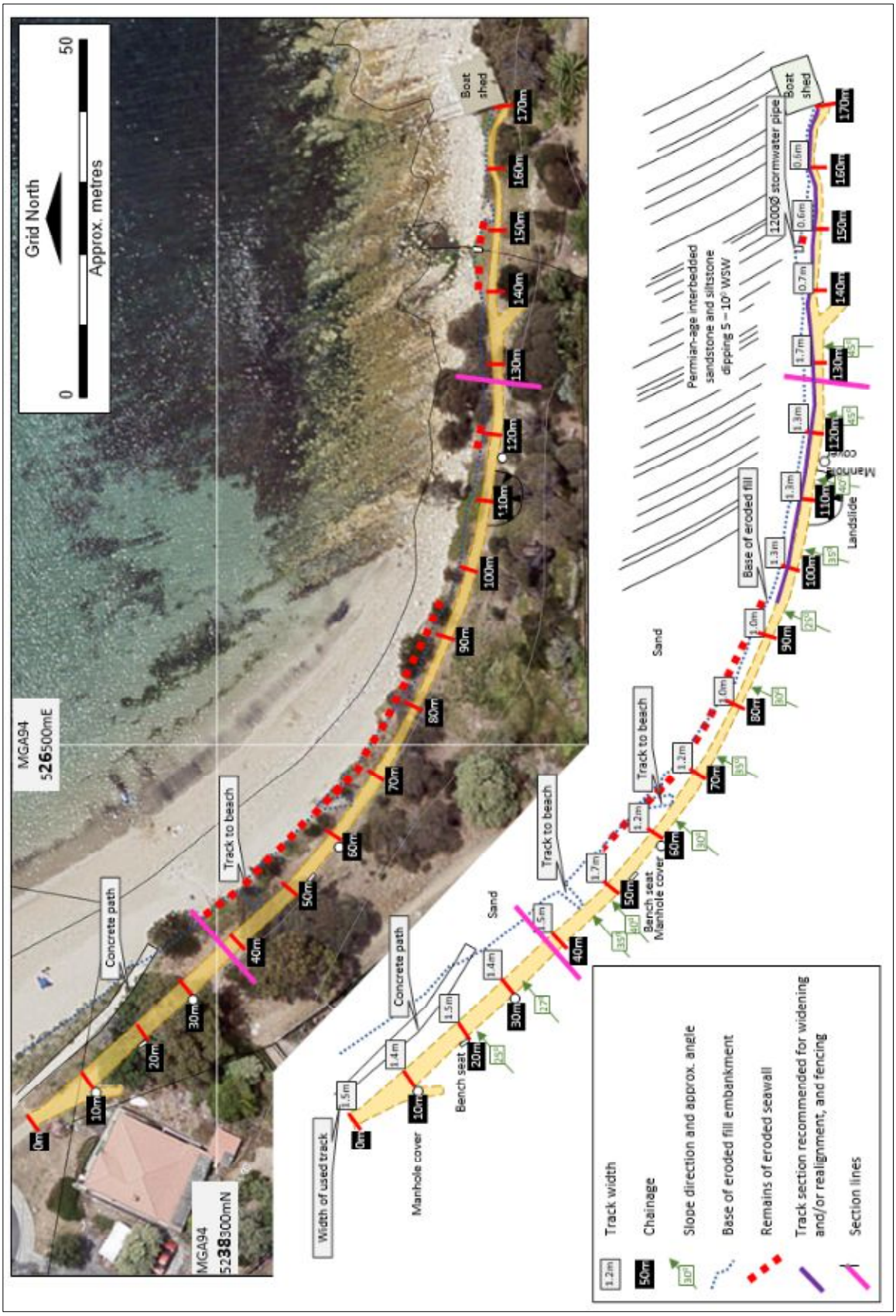


Figure 5. Track chainages and widths, landward slope angles, locations of cross sections in Figure 1, remains of seawall, and suggested track widening and/or realignment and fencing

2.4.2 Distance to embankment lip

Up to about chainage 60m, there is no embankment lip (upper diagram in Figure 1). Elsewhere, distance to the lip ranges from about 0.5 – 1.5m (several Plates in Attachment 2, and Figure 5).

3 DISCUSSION

3.1 Geotechnical risks for track and foreshore users

Attachment 3 employs event trees to estimate risks to life for track and foreshore users with respect to the five geotechnical hazards identified or inferred in Figure 4.

Council as regulator should determine whether the estimated risks to life are acceptable, tolerable or unacceptable. Some guidance in this regard is provided in Attachment 3.

3.2 Seaward embankment fill of variable (mainly low) strength

Visual inspection of the seaward embankment fill indicates it is of variable but mainly low strength, and in places is not strong enough to support fence posts along the outer edge of the track. Furthermore, the presence of buried cobbles and boulders in the fill will make it difficult to excavate for the posts, and continued coastal erosion will increase the likelihood of the geotechnical hazards depicted in Figure 4.

3.3 Fencing and track design

3.3.1 Fence location and length

It is suggested that because of relatively gentle seaward embankment slopes, fencing to mitigate the risk of falls is unnecessary from 0m to about 95m (Figure 5). This distance may be varied by Council.

Fencing should be considered over the remaining distance to the boatshed – from about 95m to 170m.

3.3.2 Fence type

Fencing is typically a timber rail and post design in accordance with AS2156:2. However, because of the locally low fill strength on the outer edge of the track, it is suggested that posts should be galvanised steel welded to horizontal beams extending out from the landward side of the track and anchored in concrete, and buried in the track (Figure 6).

3.3.3 Fence setback from lip of embankment

If the fence posts are securely anchored at point 3 in Figure 6, the fence may be located within about 0.3 – 0.5m of the lip of the embankment. However, from about chainage 140m to 170m, where the embankment is subvertical, this distance should be increased to one metre. This will necessitate minor track realignment (Plates 24, 26 and 28 in Attachment 2)

3.3.3 Track class

The Suncoast Headland Track is classified as Track Class 3 in terms of AS2156 – 2001 *Walking Tracks Part 2: Infrastructure Design.*

3.3.4 Track width

Track width should everywhere be at least 0.9m. Council may elect to increase this, and indeed sections which already exceed this width should be maintained.

3.4 Coastal defence to mitigate erosion

3.4.1 Need for coastal defence

No detailed historical study has been done of the rate of erosion of the foreshore along the length of track studied. However, it is clear that marine erosion is focussed on the eastern end of the track.

Erosion will continue and eventually destroy sections of the track.

3.4.2 Gabion wall for coastal defence

Numerous types of coastal defences are available for the site. It is beyond the Brief of this report to canvass each one. Instead, partly with aesthetics in mind, it is suggested than a gabion wall of on- an off-site sandstone be erected, as schematically shown in Figure 6. Constructed with high strength stainless steel cages nominally 3m long and 0.6m square, and tied ends and tops with similar stainless steel, these will weigh more than a tonne each and should be strong enough to withstand marine erosion. A wall nominally 1.2m (2 gabions) high with a horizontal base into or onto sandstone bedrock should be sufficient, and an extra row or more can be added in future to counter predicted sea level rise.

A single gabion of this design lies on the rock platform at the boatshed, and appears to have withstood marine action well. (Figure 7).

3.4.3 Length of the gabion wall

The gabion wall should extend from 0m to 170m, replacing the former sandstone block wall.

From 0m to about 30 – 40m, the wall could comprise one row of gabions. Where the eroding, subvertical embankment is more than about 2.5m high, a three-tiered gabion wall might be considered.

3.4.4 Completing the gabion wall

A suggested completed gabion wall backed by erosion-resistant spalls against the eroding embankment is shown in Figure 6. Other designs will also be suitable.

4 RECOMMENDATIONS

The following recommendations are made

1. Fencing similar to the design in Figure 6 should be erected between about chainages 95m and 170m.
2. A sandstone-filled gabion wall similar to that depicted in Figure 6 should be considered as a marine defence for the eroding embankment and threatened walkway.
3. Minor track realignment is suggested in Plates 24, 26 and 28 in Attachment 2.
4. A barrier (eg vertical steel rods at 0.2m spacings) should be placed at the open end of the 1200Ø concrete stormwater pipe at chainage 147m to prevent access up it.

W.C. Cromer

Principal

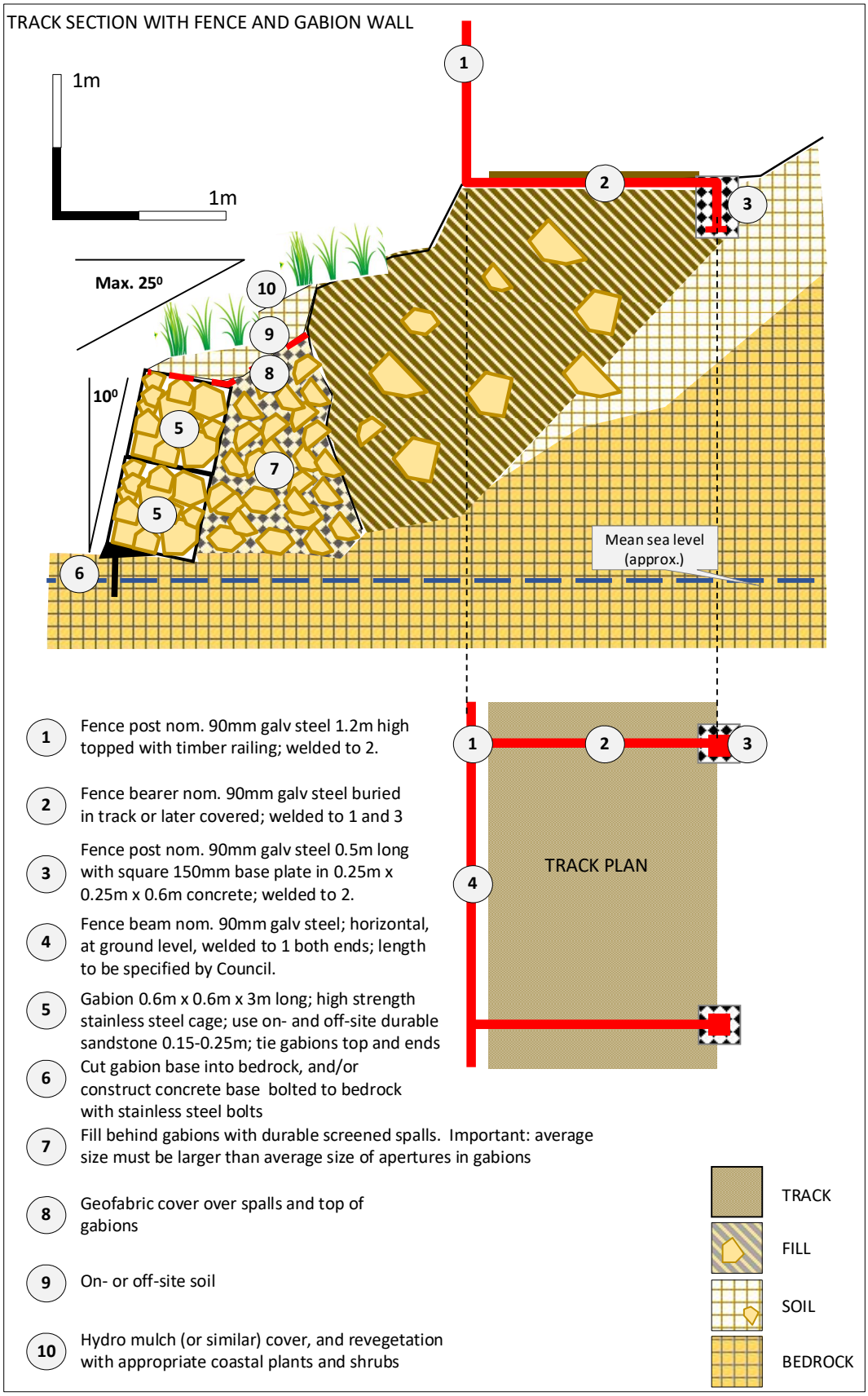


Figure 6. Suggested design for a fence (which avoids posts in low-strength and eroding fill) from about chainage 95 – 170m along the Suncoast Headland Track. Also shown is a suggested design for a spall-backed gabion wall as a form of coastal defence from chainage 0 – 170m.

Figure 7. A 3m long gabion of on-site sandstone blocks encased in a high-strength stainless steel cage has survived intact on the rock platform at the boatshed near chainage 170m. Similar gabions are suggested as an aesthetically acceptable coastal defence from chainage 0 – 170m to mitigate embankment erosion.

Attachment 1

(2 pages)

Location map and geology of Suncoast Headland Track showing section of track studied in this report

Source: www.thelist.tas.gov.au


MGA94
526500mE
Geology
Calver, C. R. (2007) (compiler). Digital geological atlas 1:25,000 Series. *Blackmans Bay*. Mineral Resources Tasmania.
Key to colours
Blue = Permian sedimentary rocks; Green = Triassic sedimentary rocks; Orange = Jurassic dolerite; Yellow = Quaternary beach sand
Section of track studied (170m)
Suncoast Headland Track
MGA94
5238000mN
Grid North
0
250
Approx. metres

Attachment 2
(15 pages)
Site photographs

The staff is graduated into red- and black-numbered segments each one metre long. The numbers are decimetres.


Plate 2
CUT
FILL
1.4m
10m


Plate 3
CUT
FILL
1.5m
20m


Plate 4
CUT
30m
1.4m
FILL


Plate 5
CUT
1.5m
40m
FILL

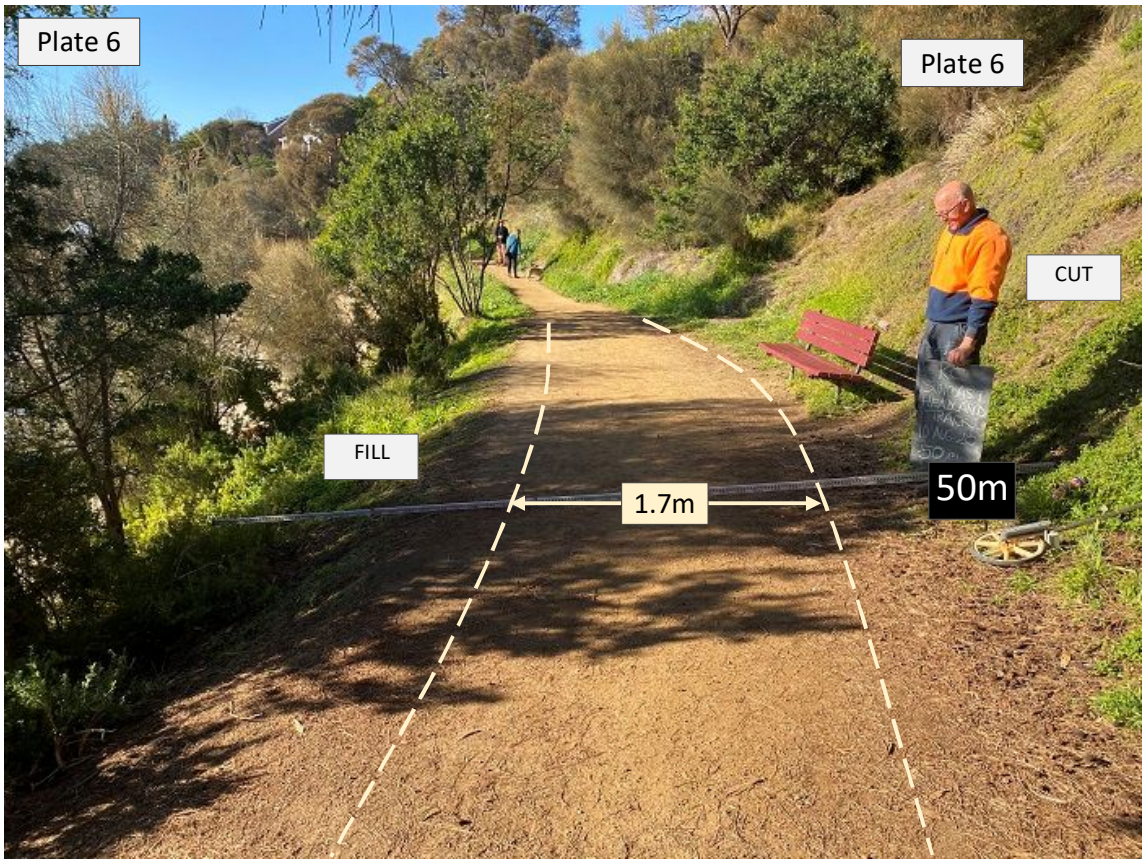


Plate 6
Plate 6
CUT
FILL
1.7m
50m

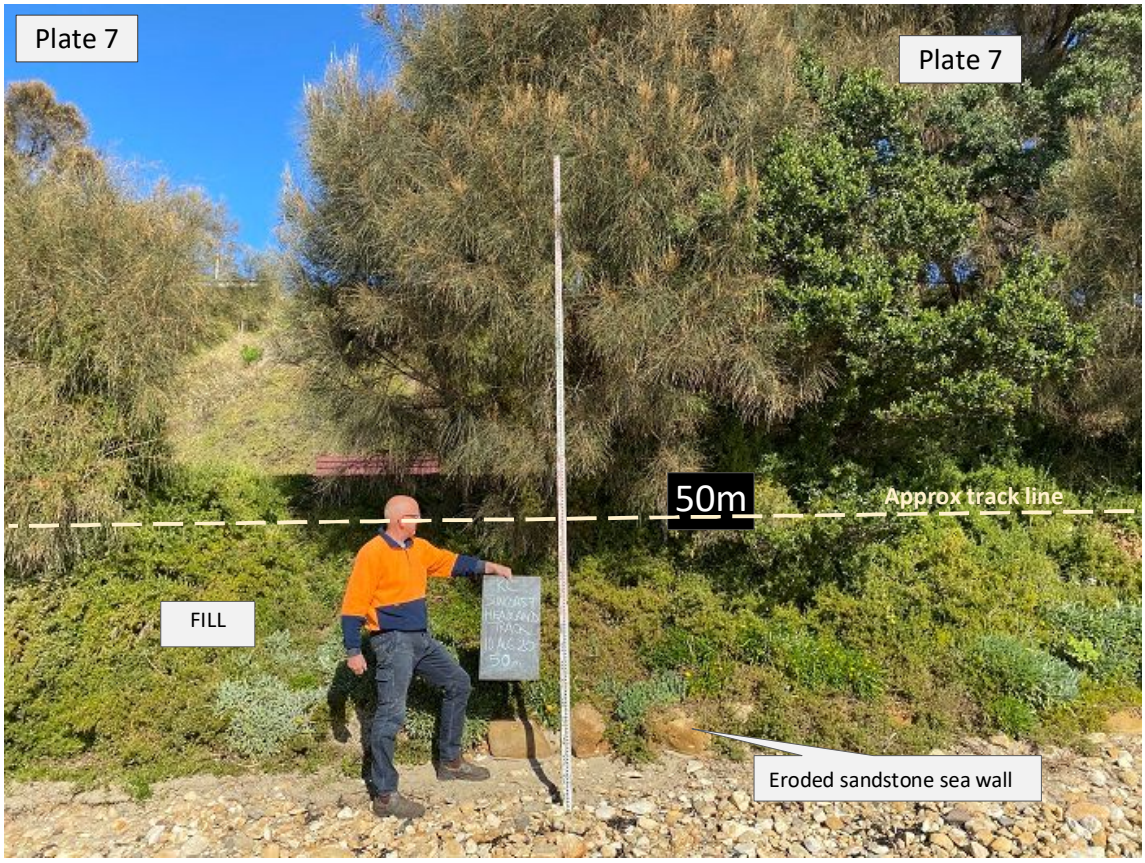


Plate 7
Plate 7
50m
Approx track line
FILL
Eroded sandstone sea wall


Plate 8
CUT
60m
1.2m
FILL

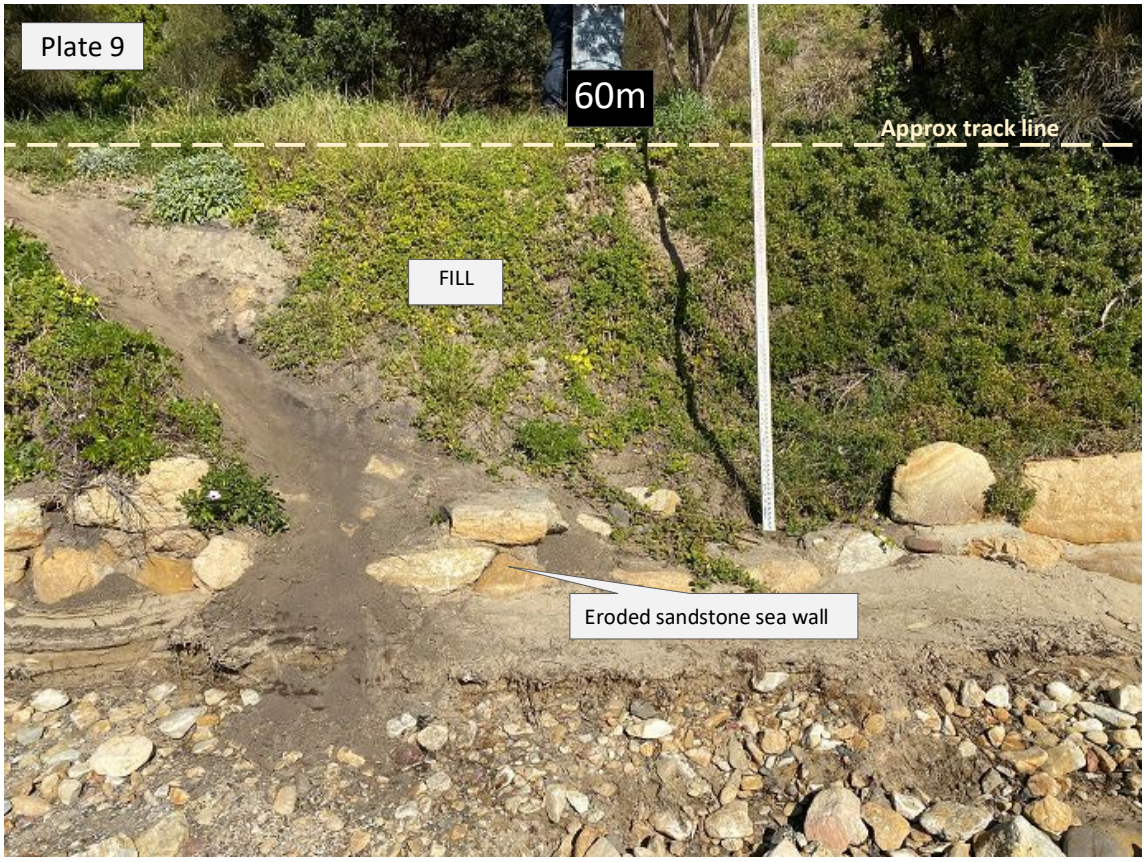


Plate 9
60m
Approx track line
FILL
Eroded sandstone sea wall


Plate 10
CUT
FILL
1.2m
70m

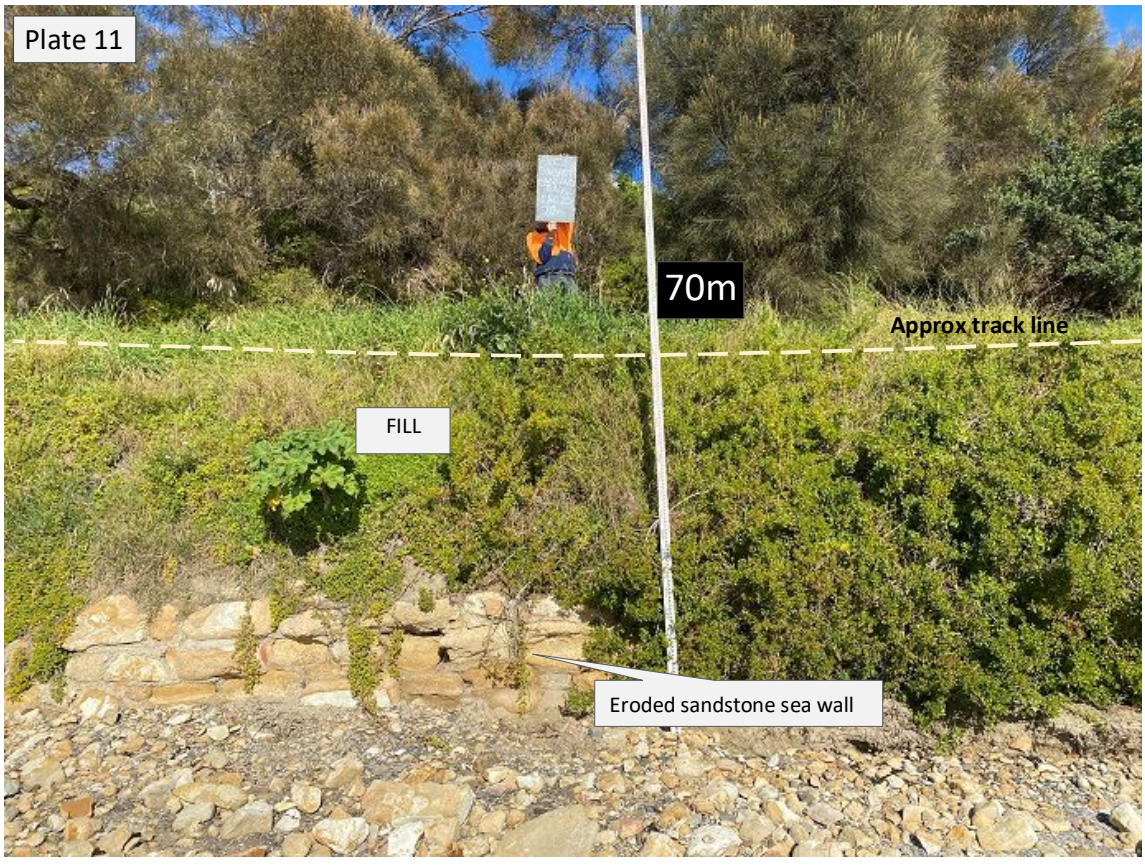


Plate 11
70m
Approx track line
FILL
Eroded sandstone sea wall


Plate 12
CUT
80m
1.0m
FILL


Plate 13
80m
Approx track line
FILL
Eroded sandstone sea wall


Plate 14
CUT
90m
1.0m
FILL


Plate 15
90m
Approx track line
FILL
Eroded sandstone sea wall


Plate 16
100m
1.3m

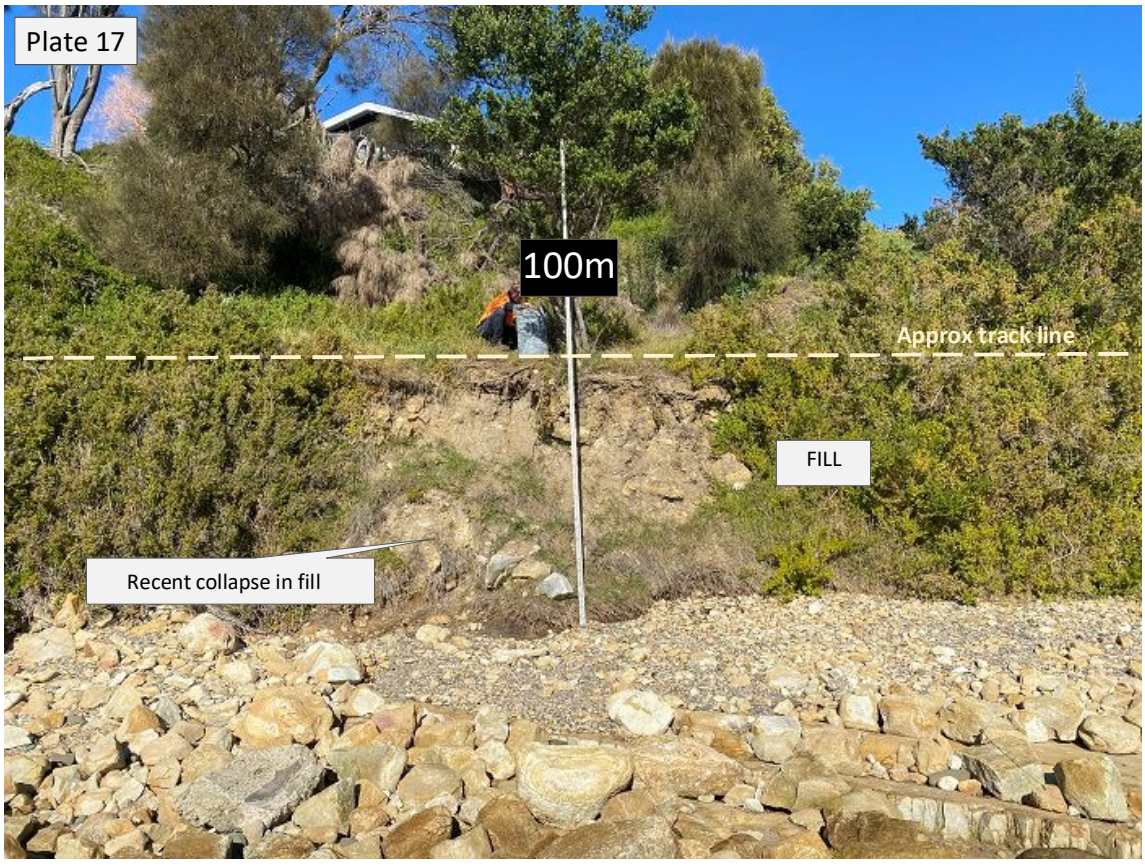


Plate 17
100m
Approx track line
FILL
Recent collapse in fill


Plate 18
110m
1.3m

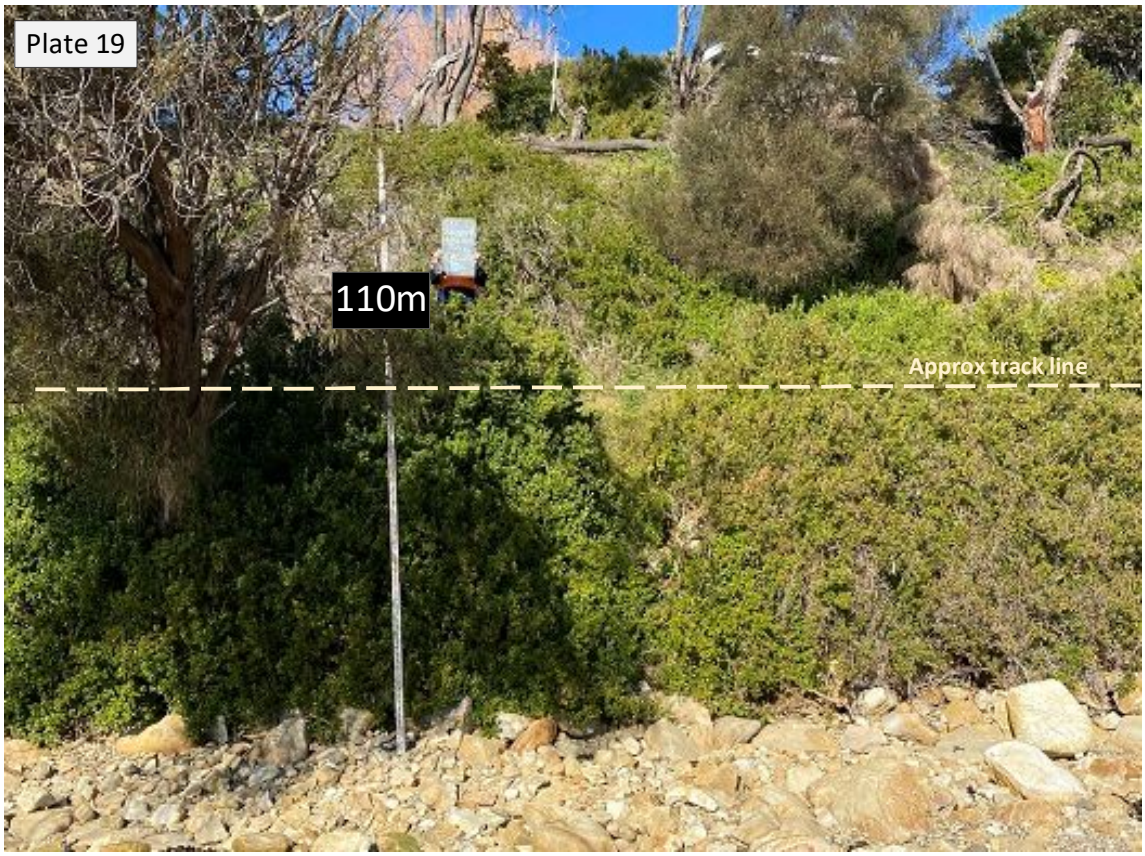


Plate 19
110m
Approx track line


Plate 20
120m
1.3m


Plate 21
120m
Approx track line


Plate 22
KC
SUNCOAST
HEADLAND
TRACK
10 AUG 20
130m
130m
1.7m


Plate 23
130m
Approx track line


Plate 24
KC
SUNCOAST
HEADLAND
TRACK
10 AUG 20
140 m
140m
0.7m
Suggested track
realignment and widening


Plate 25
140m
Approx track line

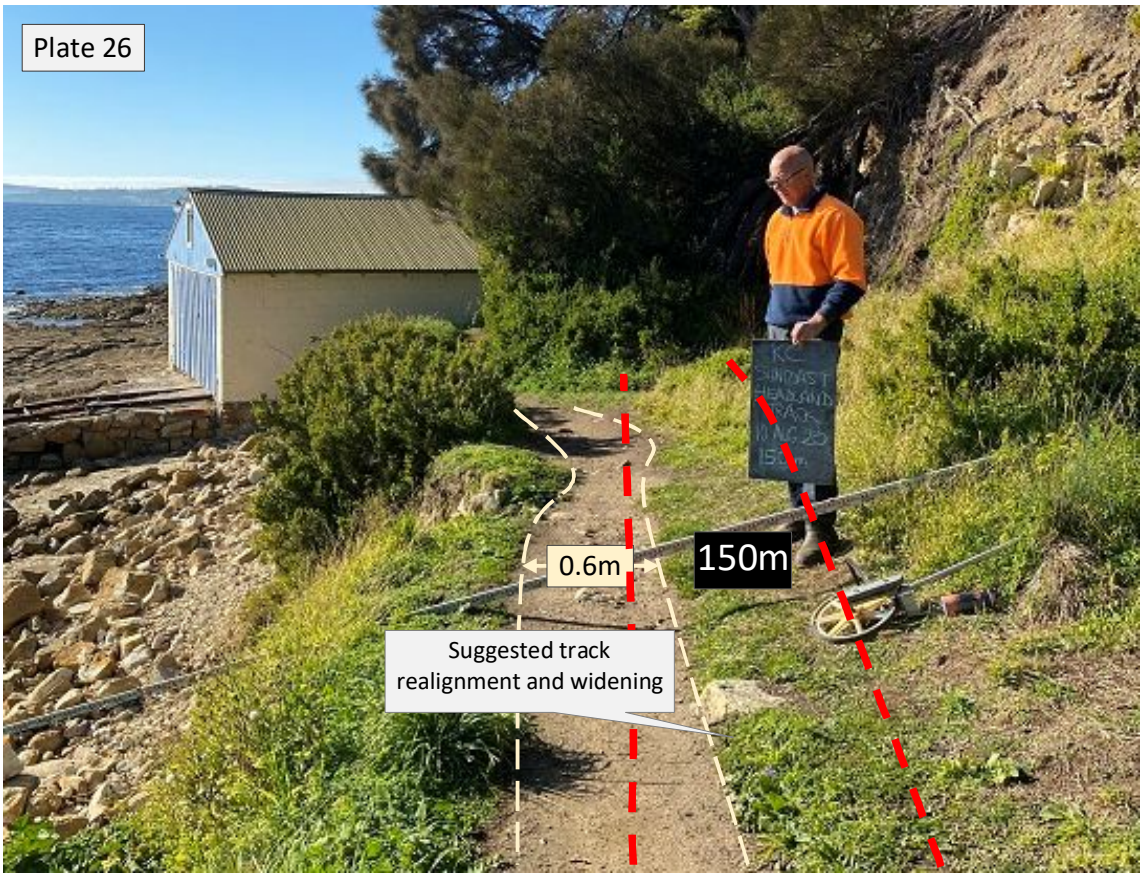


Plate 26
0.6m
150m
Suggested track realignment and widening


Plate 27
150m
Approx track line


Plate 28
160m
0.6m
Suggested track realignment and widening


Plate 29
160m
Approx track line

Attachment 3

(4 pages)

Geotechnical hazards and risk to life estimations for track and foreshore users

Risk to life is more important than risk to property along the investigated part of the Suncoast Headland Track..

Five geotechnical hazards have been identified on the track[6]. Their occurrence is more likely after about chainage 90m, and they include rockfalls and very small landslides as schematically depicted and characterised in Figure 3.1.

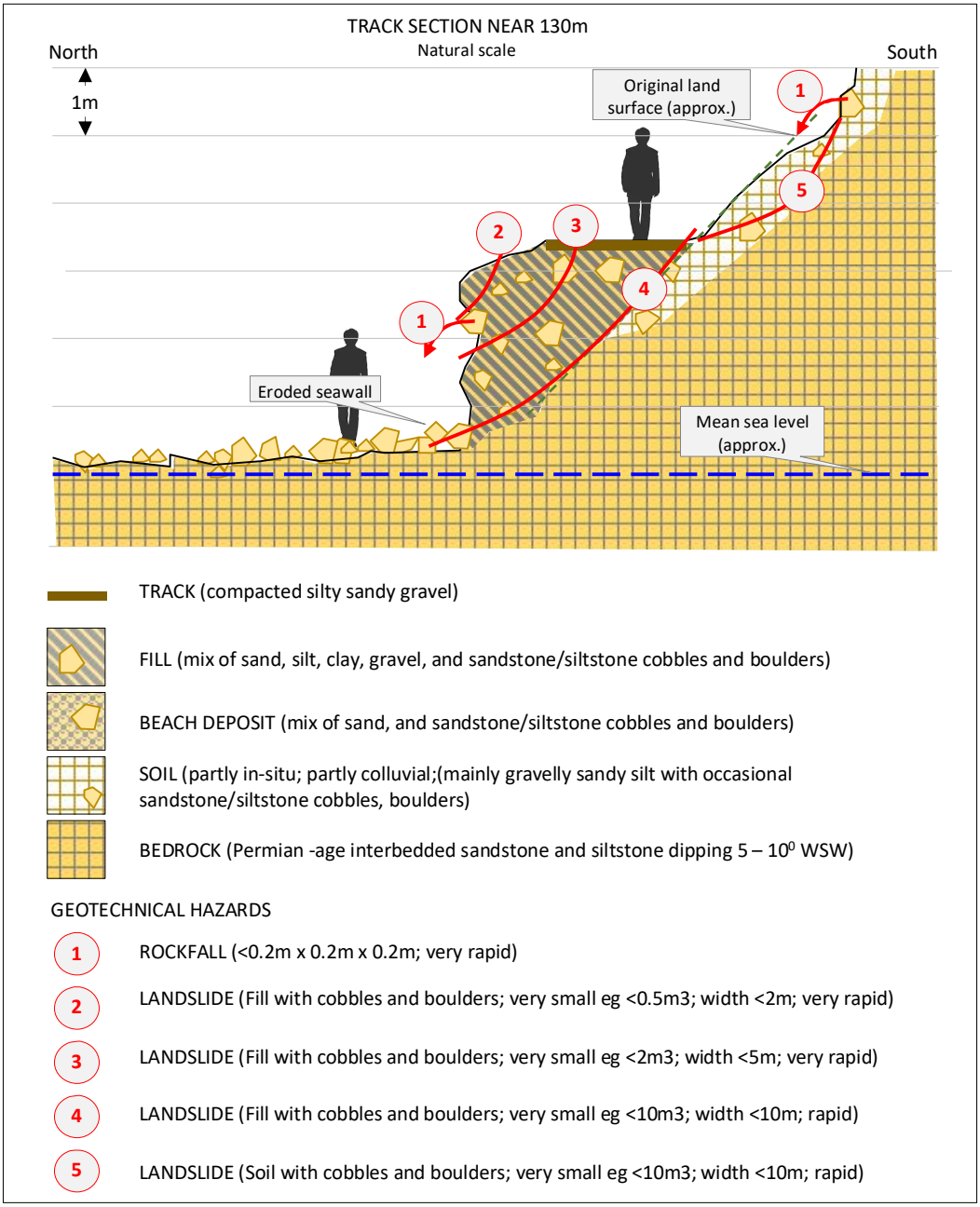


Figure 3.1. Schematic description and characterisation of geotechnical hazards identified after about chainage 90 on the Suncoast Headland Track

[6] Accidental falls onto the foreshore of people using the track are not technically geotechnical hazards, although they might be influenced by them.

Risk to life for the individual most at risk is estimated in event trees in Figures 3.3 and 3.4.

- Figure 3.3 estimates the risks from Scenarios 1 and 5 for an individual walking along the track between approximate chainages 90m and 170m, and
- Figure 3.4 estimates the risks for an individual from Scenarios 2, 3 and 4 on the rock platform at low tide between approximate chainages 90m and 170m.

The estimated risks to life are for existing conditions above and below the track.

Important notes in relation to Figures 3.3 and 3.4

The regulatory authority shall determine whether or not a risk to life is acceptable, tolerable or otherwise.

Guidance is provided in Figure 3.2 , the content of which is presented unamended from Section 8 of AGS (2007c). *Practice Notes Guidelines for Landslide Risk Management*. Australian Geomechanics Vol 42 No 1 March 2007

Table 1: AGS Suggested Tolerable loss of life individual risk.

Situation	Suggested Tolerable Loss of Life Risk for the person most at risk
Existing Slope (1) / Existing Development (2)	10^{-4} / annum
New Constructed Slope (3) / New Development (4) / Existing Landslide (5)	10^{-5} / annum

Notes:

1. "Existing Slopes" in this context are slopes that are not part of a recognizable landslide and have demonstrated non-failure performance over at least several seasons or events of extended adverse weather, usually being a period of at least 10 to 20 years.
2. "Existing Development" includes existing structures, and slopes that have been modified by cut and fill, that are not located on or part of a recognizable landslide and have demonstrated non-failure performance over at least several seasons or events of extended adverse weather, usually being a period of at least 10 to 20 years.
3. "New Constructed Slope" includes any change to existing slopes by cut or fill or changes to existing slopes by new stabilisation works (including replacement of existing retaining walls or replacement of existing stabilisation measures, such as rock bolts or catch fences).
4. "New Development" includes any new structure or change to an existing slope or structure. Where changes to an existing structure or slope result in any cut or fill of less than 1.0m vertical height from the toe to the crest and this change does not increase the risk, then the Existing Slope / Existing Structure criterion may be adopted. Where changes to an existing structure do not increase the building footprint or do not result in an overall change in footing loads, then the Existing Development criterion may be adopted.
5. "Existing Landslides" have been considered likely to require remedial works and hence would become a New Constructed Slope and require the lower risk. Even where remedial works are not required per se, it would be reasonable expectation of the public for a known landslide to be assessed to the lower risk category as a matter of "public safety".

Acceptable risks are usually considered to be one order of magnitude lower than the Tolerable Risks.

It is important to distinguish between "acceptable risks" and "tolerable risks".

Tolerable Risks are risks within a range that society can live with so as to secure certain benefits. It is a range of risk regarded as non-negligible and needing to be kept under review and reduced further if practicable.

Acceptable Risks are risks which everyone affected is prepared to accept. Action to further reduce such risk is usually not required unless reasonably practicable measures are available at low cost in terms of money, time and effort.

AGS suggests that for most development in existing urban area criteria based on Tolerable Risks levels are applicable because of the trade-off between the risks, the benefits of development and the cost of risk mitigation.

Figure 3.2 Guidance on risk to life criteria (AGS (2007c), Section 8 (Table 1 and its accompanying notes on pages 77 and 78)

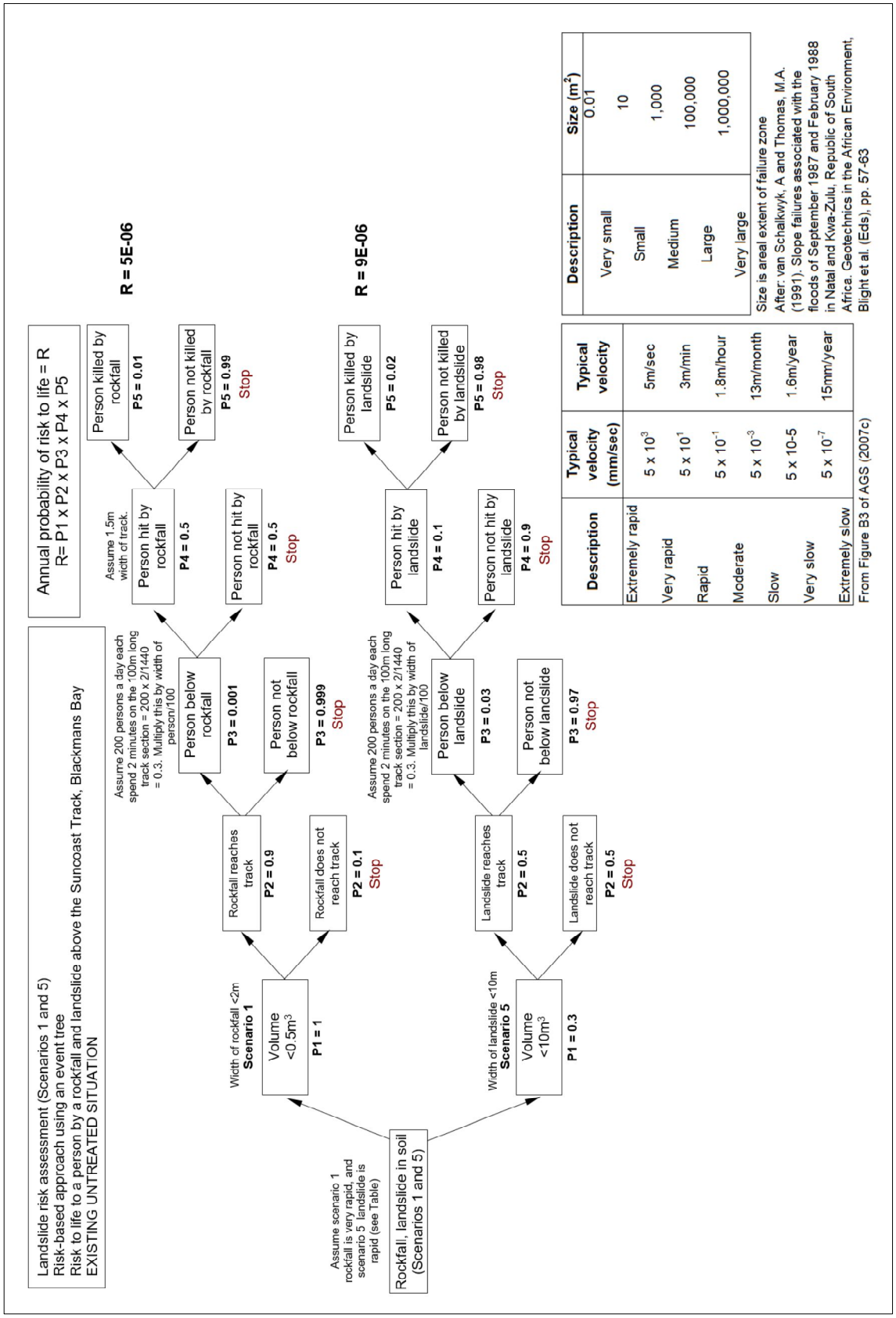


Figure 3.3. Estimated risks to life from Scenarios 1 and 5 for an individual most at risk walking along the track between approximate chainages 90m and 170m. The estimated likelihoods and consequences depicted in this tree are subjective but thought to be reasonable. Other risk assessors might adopt different inputs. The velocity and size inset tables apply to Figure 3.4 also.

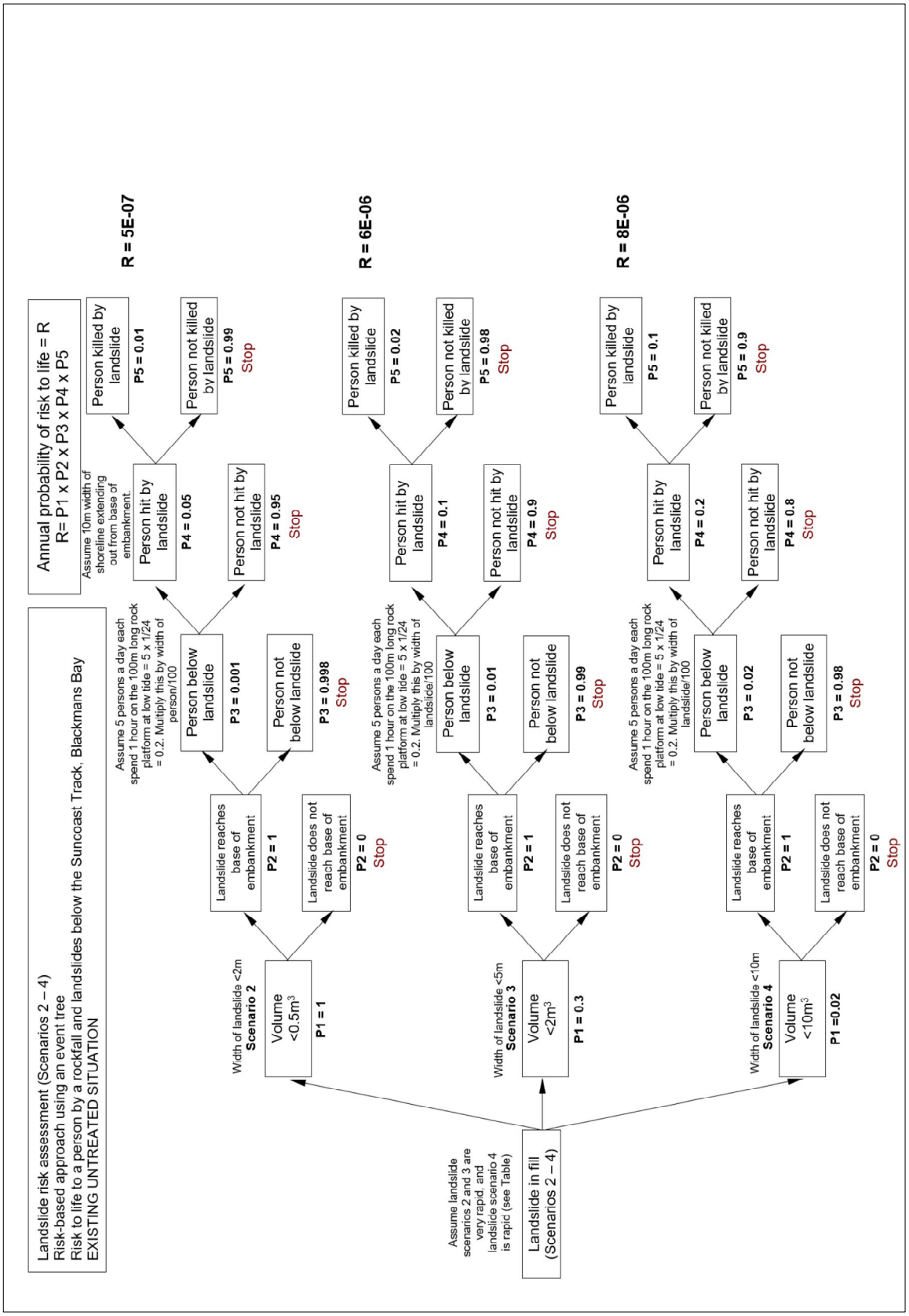


Figure 3.4. Estimated risks to life from Scenarios 2, 3 and 4 for an individual most at risk on the rock platform at low tide between approximate chainages 90m and 170m. The estimated likelihoods and consequences depicted in this tree are subjective but thought to be reasonable. Other risk assessors might adopt different inputs.