Ben Boyd National Park

Light to Light Walk

Recommended Alignment and Construction

V1.0

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Figure 1. Locality Map.

Introduction

This report details the results of fieldwork carried out to determine a walking track realignment for the Light to Light multi day walk, a continuous 3 day (30 km) hike along the Ben Boyd National Park coastline. Starting from Boyd Tower in the north to Green Cape Lighthouse in the south. The report outlines the alignment, required construction techniques and estimated construction cost.

The NSW Office of Environment and Heritage (OEH) is exploring opportunities to deliver an outstanding immersive visitor experience in NSW National Parks. The Light to Light Walk is considered to be the walk which could provide this experience. Whilst the existing walk is a good experience, there is scope for improving the track alignment in terms of long term maintenance and sustainability, connection with the coast and the variety of landscapes the track passes through. Newscape Design were enlisted to produce a report detailing a Track and Facilities Upgrade Design Concept that would enable the Light to Light to meet great walk status. This originally included extending the walk by a day to Disaster Bay, but this last day has been removed from the concept due to the impact it would have on Aboriginal heritage sites.

In addition to the walking track upgrades recommended by Newscape, TTMS identified several other existing sections of the walk that could be improved with realignment, and (with approval of the project manager) these have been included in the report.

The field work was undertaken over a total of 4 weeks between 4thFebruary and 30th May 2019 by Gavin Rose with the assistance of local Sapphire Coast Area staff; Ranger and Senior Field Supervisor. The NPWS Senior Project Officer (South Coast Branch) provided the project documentation, advice on issues, constraints and desired outcomes.

Archaeological and ecological surveys have been undertaken on the realignments originally proposed by Newscape. Where archaeological sites were identified, it was generally possible to route the alignment away from them - and at the few sites where this was not practical an Aboriginal Heritage Impact Permit (AHIP) will be sort. The proposed alignment avoided going through ecologically significant habitat apart from one short section on the very edge of the Scrub She-oak - Swamp Banksia coastal lowland heath, which while not an endangered vegetation community is considered highly significant because of the restricted occurrence of coastal heaths and their importance for many plant and animal species including threatened species. It should also be noted that the new alignments will allow a large number existing tracks passing through coastal heath to be closed and rehabilitated.

The additional alignments proposed by TTMS have not had archaeological and ecological surveys carried out on them yet. Some sections of new track pass near cliff tops, cliff bases and potentially unstable coastal rock platforms. All sections of new track with potentially unstable geological features have been identified in the report, and will need a geotechnical assessment to determine if it is safe to take the track near them, and if not, what distance buffer will be required.

The existing section of the Light to Light between north of Hegarty's Bay and north of Bittangabee Bay was not recommended for realignment by Newscape and thus was not surveyed by TTMS. Given the less than optimal alignment of the rest of the original track, it is assumed that there is scope for improving this section (in terms of walker experience and track sustainability) and it is recommended that it be surveyed and scoped to ensure it meets the standards of the rest of the upgraded alignment. See Figure 1. Locality Map for alignment of the entire walk

In addition to this report .shp files of the proposed alignment have been provided to NSW NPWS.

Methodology

The various sections of the proposed alignment were walked a number of times with different routes investigated to determine the best alignment, with emphasis on ease of construction, long term sustainability and walker experience. Theodolite Pro app on an iPhone was used to determine gradients in percentage. The Geo Tracker app on a Samsung Galaxy tablet was used to record the proposed alignment and locate features.

The GPS provided horizontal accuracy of generally between +/-5 metres. This accuracy is satisfactory for track planning purposes. A GPS track log was produced for the proposed alignment. Photos were taken of representative areas and significant features. The proposed alignment was divided into logical sections to show different terrain, such as cross slope or works required.

Walk Description

The proposed alignment is summarised here as if walking from north to south and is broken up according to which day it is intended to be walked. The alignment starts at the Boyd Tower carpark and follows the coastline along beaches, bays, headlands and coastal bedrock in a generally southerly direction. The walk occasionally heads inland to contour in and out of natural drainages at a sustainable grade. The majority of the walk is on new alignments or beaches/coastal rock platforms, with the remainder consisting of existing track.

The walk goes along considerably more sections of new track than was outlined in the original concept prepared by NewScape Design. This was done because many of the existing tracks that were originally used for the walk did not meet the requirements of great walk status. The additional new track alignments greatly improve the walker experience by including many more coastal views and improve ease of walking by reducing the track grade. Installing the added alignments will be more cost effective than repairing or upgrading the old tracks and will require much less maintenance, and therefore reduce costs, in the long term. One section of the track - from north of Hegarty's Bay to north of Bittangabee Bay, was not surveyed as it was not part of the original proposal. Given the poor quality of existing track on other sections of the walk, TTMS recommends that this section be surveyed for potential improvements to the alignment. See Figure 7. Alignment & Work Sections 17-13 to 18.

Day One – The walk starts at the Boyd Tower carpark. From the carpark it heads along existing track towards Boyd Tower. Before reaching Boyd Tower the walk starts contouring along the cliff top on new track and then heads inland slightly to contour in and out of a gully to then rejoin the existing track near the cliff top. The walk then follows existing track along the cliff top. After this section the walk goes along a scoped but not yet surveyed route that contours around the edge of a swampy low lying area and then into open tall melaleuca on the clifftop with great views looking back to Boyd Tower (this section is recommended because it would be cheap to construct, more sustainable in the long term and has much better views than the existing track). It then continues on to rejoin the existing track for a short distance before contouring along the cliff top on a recommended but not surveyed route before rejoining the existing track to continue on to Red Sands Bay. From Red Sands Bay the walk follows the existing track to climb on copper log steps and then leaves the existing track to contour around two small headlands on new alignment. From the second headland the route follows the clifftop on a scoped but not surveyed alignment to Leather Jacket Bay (this section is recommended because it would be cheap to construct, more sustainable in the long term and is a much better experience than the existing track). Just before Leather Jacket Bay the walk rejoins existing track, drops down to cross the creek at the bay, then leaves the existing track again to contour and climb out of the bay and follow the clifftop around to the next headland on new track. From the headland the walk continues along the clifftop and then drops down to a small cobbled beach.

From this cobbled beach there are three options. The first option is to use the existing track. This has the advantage of avoiding any cultural or ecological issues. The disadvantages are that it will require work to replace the old timber steps and that these will require further maintenance and replacement over time, this route is also relatively uninteresting (going through dry sclerophyll forest) and missing out on views closer to the coast. The second option climbs and contours around to the headland then continues to follow the clifftop along the coast before contouring in and out of a gully. This option has the advantage of taking in great views along the coast and being simple to construct but has the disadvantage of passing near an Aboriginal stone arrangement and passing near unattractive existing 4WD tracks. The third option also climbs then contours out to the headland but then descends quickly down to the coastal rock platform to then follow the bedrock along for some distance before climbing again to the clifftop. The disadvantage of this route is that it also passes near the Aboriginal stone arrangement and will require some technical track construction. This option's advantages are that once constructed, it will require very little long term maintenance and that it will take the walker through arguably the most spectacular part of the Light to Light Walk.

From roughly where these three options finish, the route continues on scoped, but not surveyed, track along the clifftop, descending down to behind a cobbled beach with a sea cave. From there the route contours around the coast on new track to reach a small beach before Mowarry. From the small beach the route contours up and around to a small headland, passing over an historic farm dam wall then rejoining the existing track to descend down to Mowarry beach. From the beach the walk continues to the campground.

Day Two - From the campground the walk continues on existing track out to near Mowarry Point. Newscape originally proposed constructing a side track to go out to Mowarry Point but it was determined that the views at the point did not justify the cost of construction (it would have required a raised walkway) or disturbance to the Aboriginal cultural sites.

After passing through the neck of Mowarry Point on scoped but not surveyed track, the route rejoins existing track to continue inland through melaleuca scrub before coming to a cobbled beach. From the cobbled beach the track climbs onto bedrock and continues along the coastal rock platform. Where the bedrock finishes the route climbs and contours along the clifftop on new track, passing above some sea caves, and continues along to rejoin the existing track on some more coastal bedrock. The walk goes along the existing bedrock and then follows the clifftop around on scoped but not surveyed track through thick melaleuca scrub. After passing round the headland the vegetation transitions to very open and tall melaleuca woodland with great views of the coast from the clifftops. It then contours round into a shallow gully with an attractive understory of ferns before heading out to another headland with a spectacular sea bridge. From here the track heads along the cliff top with great views looking down onto a secluded beach. It goes around behind the beach, following the coastline and then goes onto bedrock, crossing another sea bridge, and continuing on to Saltwater Creek Beach.

The route continues south along Saltwater Creek Beach and then, at the south end of the beach, climbs and contours along on new track out to the headland. It then continues contouring along the clifftop to a point where there are two options. The first continues along the cliff top before contouring inland to rejoin the existing track which then continues to the accommodation node at Hegartys Bay. The second option, that has been scoped but not surveyed, drops down onto a bedrock shelf. From there it continues along the bedrock taking in fantastic views of the coastal rock formations. This option has to climb up around the head of a coastal ravine and then drops down to continue along bedrock before reaching a rocky beach of boulders. It can then either rejoin the existing track or continue on along the coast on an as yet unscoped and unsurveyed section of proposed track to the accommodation node at Hegartys Bay. The advantage of the second option is that it has much better views than the first option. The disadvantage is that it would be more expensive to build.

Day Three - From the accommodation node the walk would either continue on as yet unsurveyed track or existing track to near the mouth of Bittangabee Bay on the north side. From there the route leaves the existing track to contour round to the coast. It then contours inland to cross a gully, then contours back to the coast and follows the shoreline of the bay heading inland till it reaches a creek crossing. At the moment the walk follows the existing track to the Bittangabee Campground. Another option would be to follow the shoreline to the campground. This option is a better experience, as it takes in views of the bay, and will be more sustainable in the long term due to its better alignment.

From the southern side of the campground, the walk leaves the existing track to follow the coast along the clifftop. After some distance, the walk goes on to the coastal rock platform and follows this till a couple of hundred meters before the cobbled beach just north of Pulpit Rock. The route then travels south along the cobbled beach, climbs onto the coastal bedrock at the southern end and continues climbing till just south of the Pulpit Rock viewing area where it contours through open melaleuca along the clifftop to the lookout.

From Pulpit Rock the route continues along the cliff top for a short distance before contouring down onto the coastal rock platform. It then follows bedrock for most of the way to Green Cape Lighthouse with a few contoured climbs up and back down, to go around the head of impassable ravines. Before the Lighthouse the walk leaves the bedrock to start climbing at a gentle grade to the Green Cape lighthouse complex.

Construction Summary

Construction of the new alignment requires the clearing of vegetation and benching into the hill slope. This can mainly be done with a mini excavator but will require hand benching for some short sections.

Material produced from new track construction, such as cut vegetation and spoil, could be used to close and rehabilitate decommissioned track but this is not covered in this report as it was not part of the original brief.

Where the grade exceeds 10%, climbing turns will need to be installed to reduce the grade. Where this is not possible or not desirable, grade dips can be installed.

On many of the sites where stonework is recommended there is ample usable local stone, and it is recommended that this material be used. Some stonework sites have usable stone nearby but it is not practical to move it manually to the site. In this case moving the stone by helicopter will be necessary. In cases where stone work is recommended but there is no local stone available, imported stone from a quarry will need to be flown in by helicopter.

There are also many sections where the route follows bedrock. On these sections there are changes in level, small drop-offs, uneven and/or rough surfaces that will need chiselling with a jackhammer to create foot holds, steps and even tread. This should be done as subtlety as possible to minimise its visual impact.

There are a few sections that will need complex technical stone structures built such as large dry stone stairways. As these structures are expensive to build, they are only recommended where the cost of construction can be justified by the payoff of a significant improvement in the walker experience (for example giving access to spectacular coastal rock formations).

Timber steps will be installed on some sections of new track and some existing sections of track will be upgraded to have their old timber structures replaced with new timber.

There are also a few gully and stream crossings that will need stepping stones installed using local stone as well as some rocky sections that will need steps and low retaining walls installed using local stone.

There are two sections of track that will require imported gravel to stabilise the tread. For the remainder of the alignment the natural mineral soils are suitable for the track surface. Table 1 summarises the construction items and quantities. See Appendix One for description of all Construction Items.

The alignment is divided into 123 separate work sections (with some sections being broken down further into subsections) which detail all the construction items and quantities required for each individual section or subsection. See Alignment Work Section for tables providing details of all the individual work sections.

Although it was not part of the original brief and not included in the costings of the report, it is worth mentioning that the old sections of track that will become redundant after the new walk is created, could be closed and rehabilitated as the new one is built. The advantage of this is that the excavator that will be used for the new construction can be utilised to then rehabilitate the old track. Material produced in construction, such as soil and cut vegetation, can be used to close off the old track also.

Table 1. Summary Construction Items

Note - Includes Work Sections 9-1 to 9-17 but not Work Sections Alt-1 to 10 as only one is to be constructed. See Figure 3 for location of these two parallel options. These two alternate alignments are summarised separately below.

Item Summary	Qty	Unit	Comment
Clear vegetation	43.95	Person Days	
Benching by hand	52.5	Person Days	
Machine benching	15228.3	metre	
Stone Steps (900x200x400mm)	152	each	Recommended local rock used where available
Stepping stones 1000x400x400mm	53	each	Recommended local rock used where available
Chiselled step(600x300x200mm)	78	each	
Chisel tread	97	Person Days	
Stone work (Other tasks)	251.5	Person Days	Includes stone work tasks not listed in this table. Recommended local rock used where available
Excavate/chisel footing	3.5	Person Days	
Excavate footing	2.1	m^3	
Set up overhead rigging	8	Person Days	
Retaining wall/causeway rock	8	m^3	Recommended local rock used where available

Construction Description

This is a summary of the works which are described in detail in the Alignment Section Work Tables. The alignment is described from north to south.

Day one

Boyd Tower carpark to small cobbled beach.

- From the carpark to Red Sands Bay, Leatherjacket Bay and then the small cobbled beach is contoured machine benched construction, at no greater than 10% grade, interspersed with some sections of existing track.

Small cobbled beach to before sea cave beach.

- Option one is to reconstruct existing track with timber risers and install grade dips.
- Option two is a short section of stone step construction followed by contoured machine benched construction at no greater than 10% grade.
- Option three is short section of stone step construction then a section of contoured machine benching followed by chiselling, boulder splitting and stone step construction on coastal bedrock.

Sea cave beach to Mowarry.

- Contoured machine bench construction.

Day Two

Mowarry to south of Saltwater Creek Beach.

- Machine benched construction with climbing turns, interspersed with some existing sections of track.

South of Saltwater Creek Beach to cobbled beach north of Hegartys Bay.

- Option one continues machine benched construction to join up with existing track.
- Option two goes down onto bedrock and involves carving bedrock, stairway construction and step installation.

Cobbled beach north of Hegartys Bay to Hegartys Bay.

- Option one continues on existing track.
- Option two will need to be surveyed before construction methods are determined.

Day Three

Hegartys Bay to Bittangabee Bay.

- Option one continues on existing track.
- Option two will need to be surveyed before construction methods are determined.

Bittangabee Bay to Green Cape Lighthouse.

- Large portions of this section go along coastal bedrock and will need chiselling of bedrock as well as stone steps and stairways.
- A couple of boggy sections will need stone stepping stones.
- This section will also need some machine benching and short sections of hand benching.

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Maps

Figure 2. Alignment & Work Sections 1 to 6-1

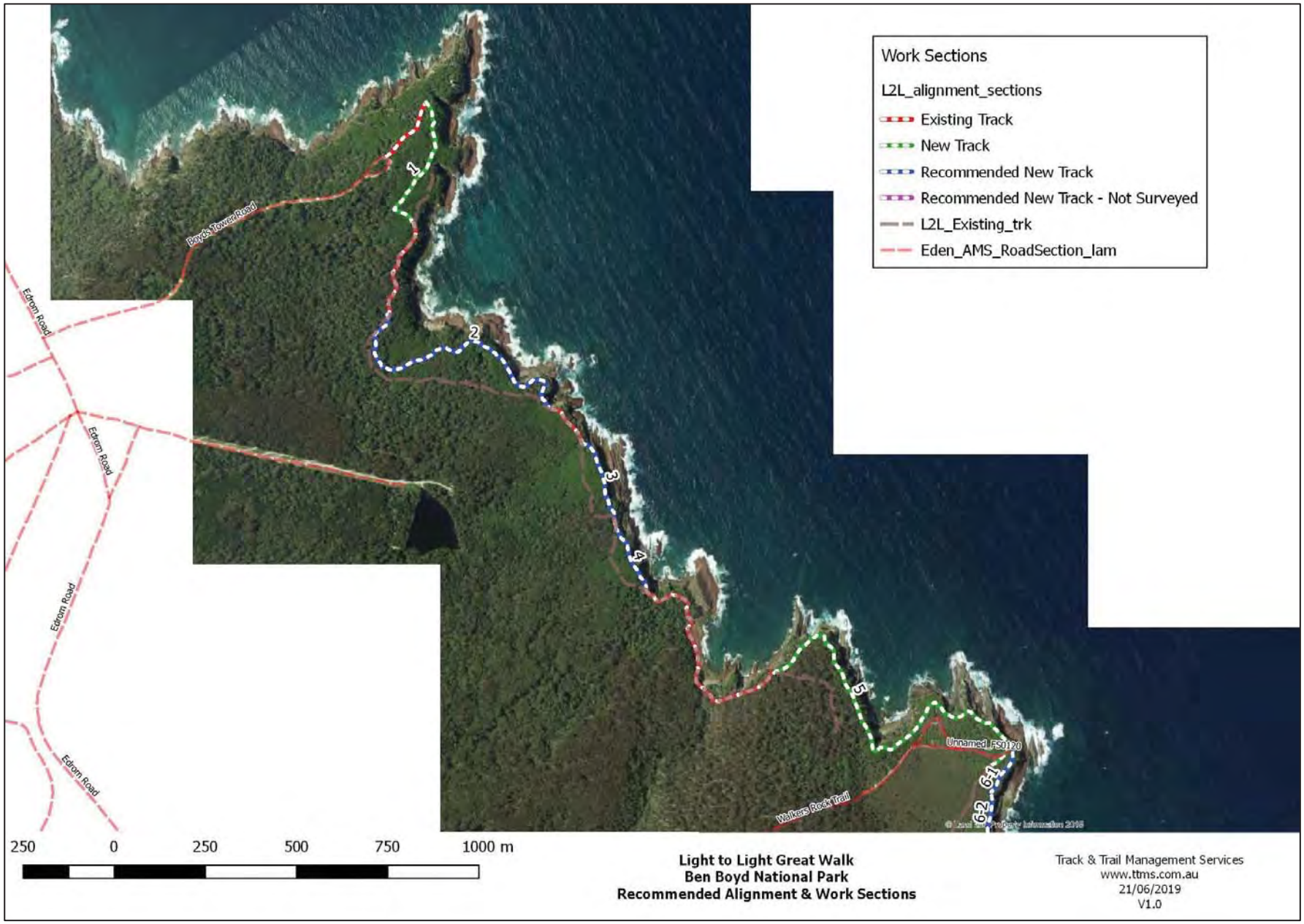


Figure 3. Alignment & Work Sections 6-2 to 10

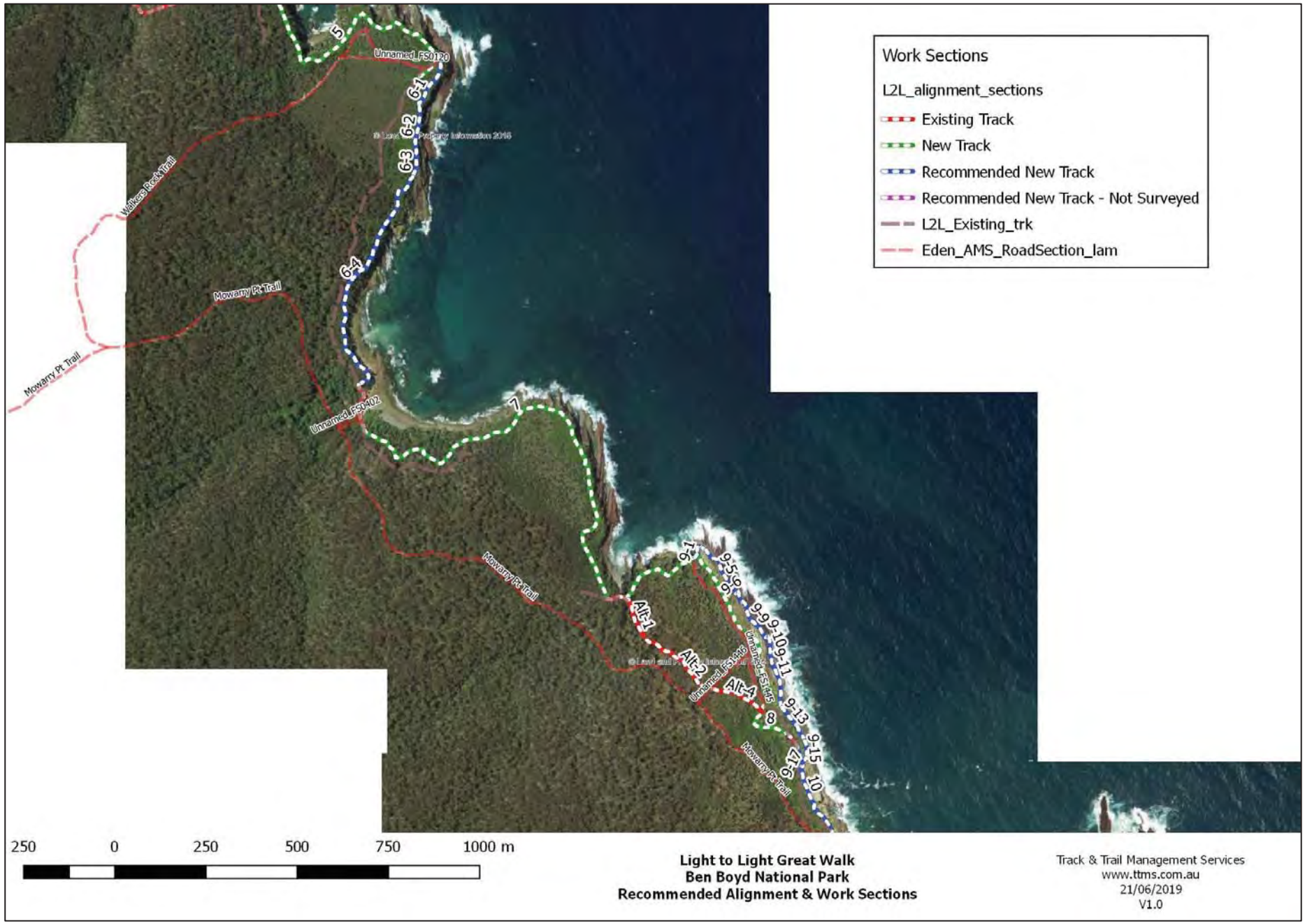


Figure 4. Alignment & Work Sections 10 to 14-2

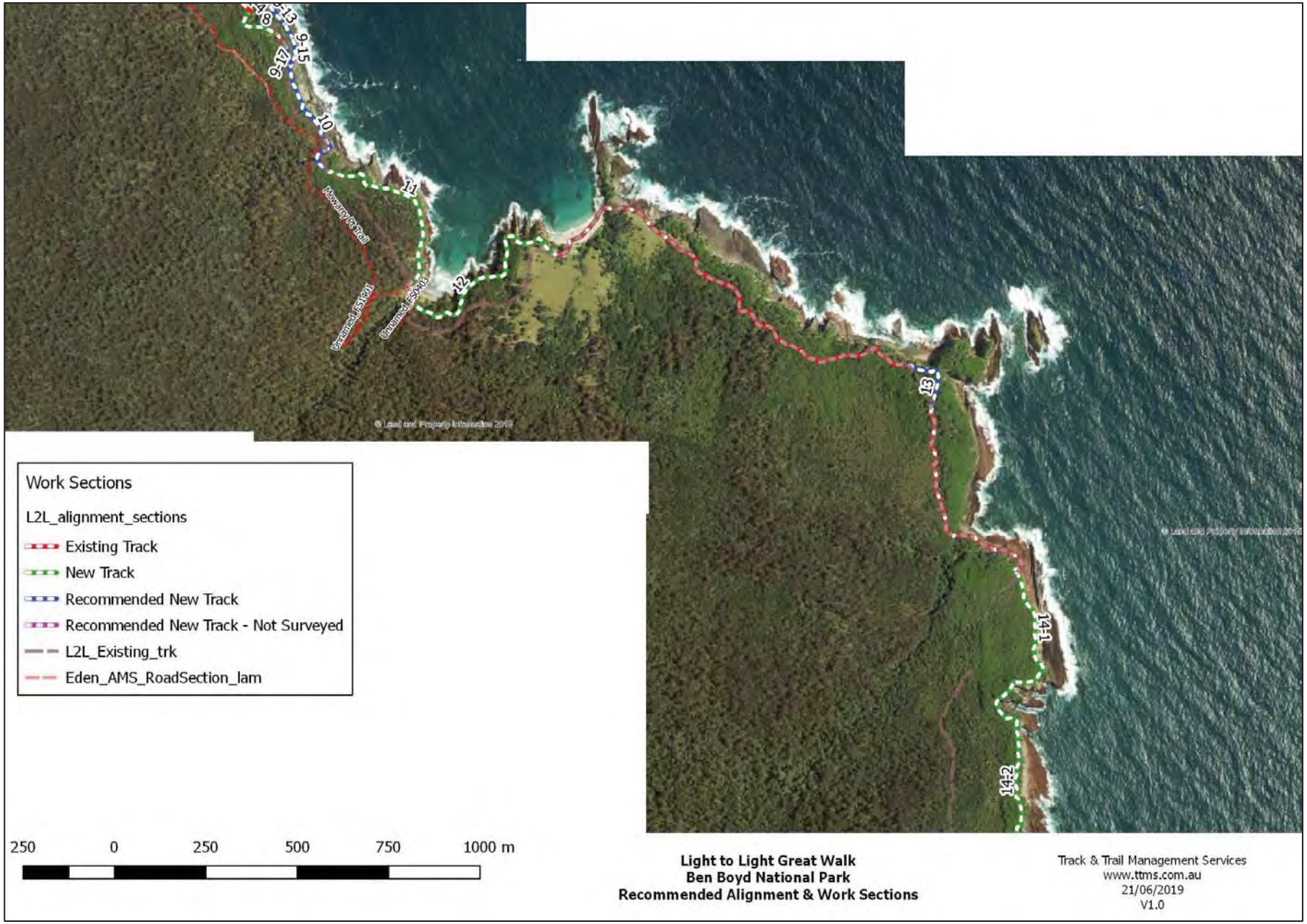


Figure 5. Alignment & Work Sections 14-1 to 15-3

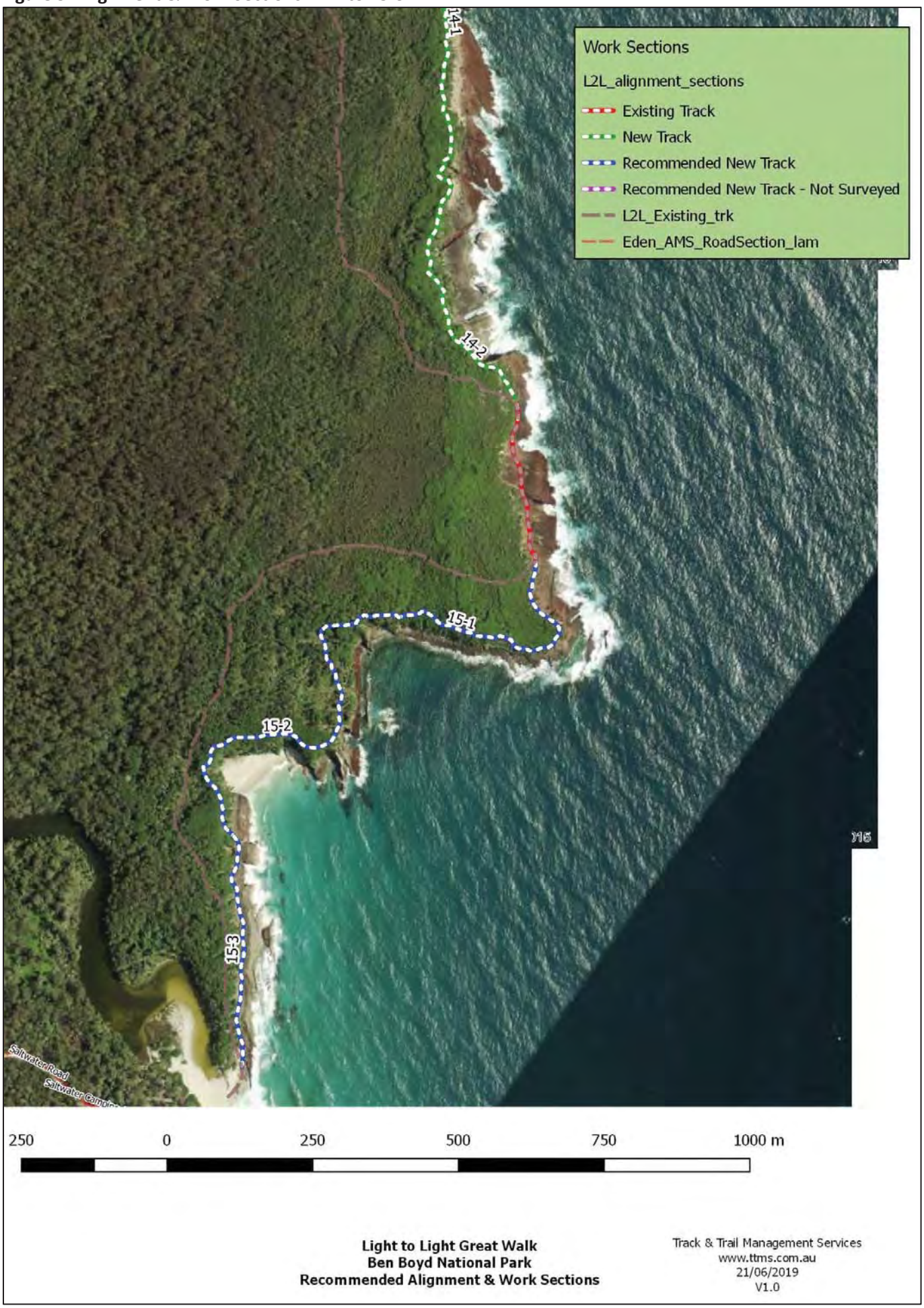


Figure 6. Alignment & Work Sections 15-3 to 17-13

Figure 7. Alignment & Work Sections 17-13 to 18

Figure 8. Alignment & Work Sections 18 to 30

Figure 9. Alignment & Work Sections 22 to 35

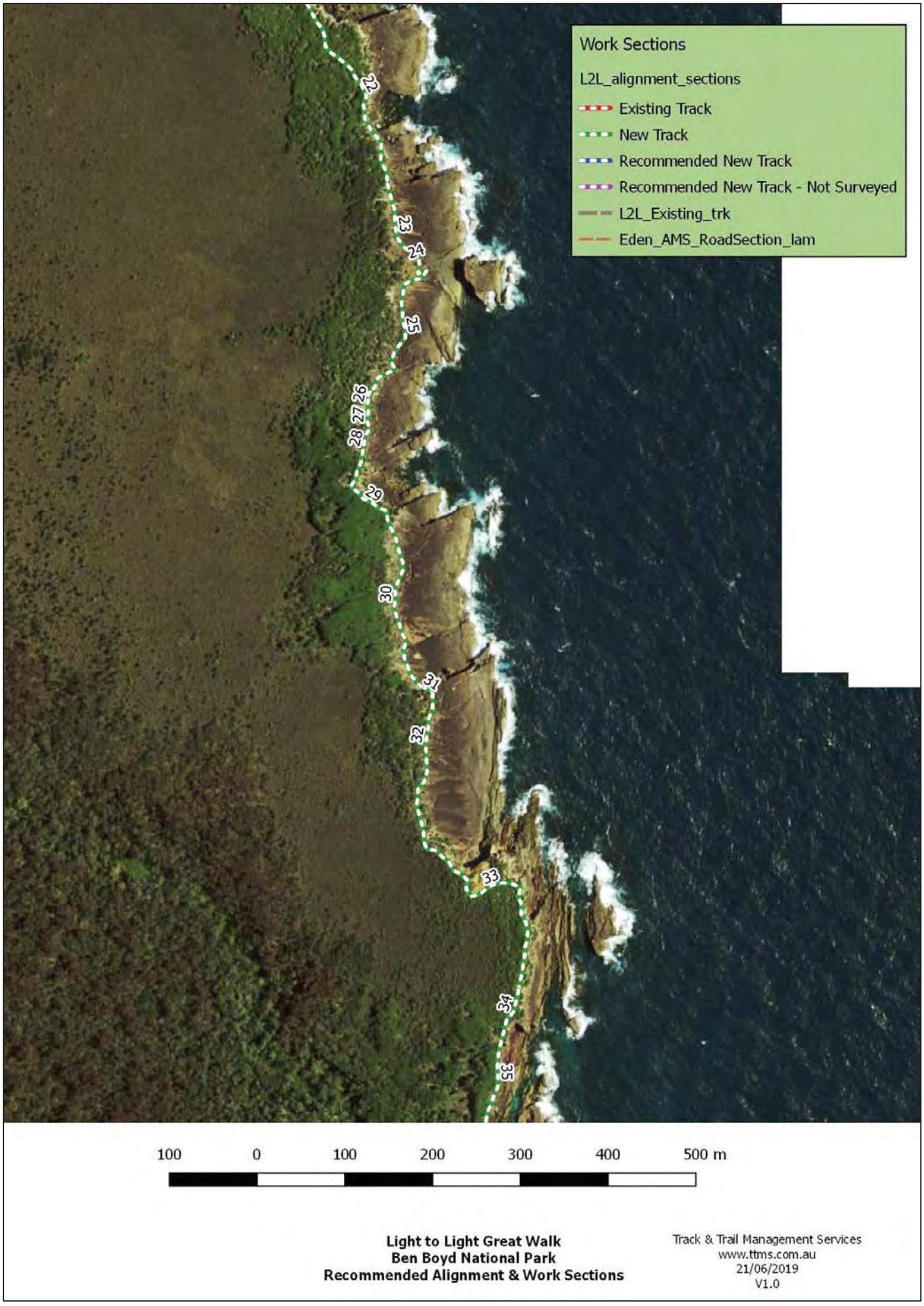


Figure 10. Alignment & Work Sections 33 to 69

Figure 11. Alignment & Work Sections 59 to 105

Figure 12. Alignment & Work Sections 104 to 123

L2L Work Sections

Work Section No.	**1**
Track Category	New Track
Length (m)	409
Cross Slope (%)	<5 - 5
Vegetation	Tall, open melaleuca. A fire has occurred recently so thick regrowth in patches.
Gradient (%)	0 - 5
Substrate	Sandy soil
Signage	Will need sign at start of section to indicate turn-off for Light to Light.
Descriptions/ Comments	This section starts from the existing Boyd Tower track.
Recommended Work (Text Details)	Machine benching. Incorporate grade dips as needed. May need stepping stone or two at shallow drainage. Use material from clearing vegetation and benching to rehabilitate closed old track.
Stone work - (Person Days)	1
Stepping stones 1000x400x400mm (ea.)	2
Machine benching (m)	404
Clear vegetation (Person Days)	1
Rehabilitate old track with soil and cleared vegetation.	y

Work Section No.	**2**
Track Category	Recommended New Track
Length (m)	794
Cross Slope (%)	5 - 20
Vegetation	Open woodland and open melaleuca, some short patches of thick scrub.
Gradient (%)	0 - 10
Substrate	Soil
Viewing/Rest points	At least two viewing points
Descriptions/ Comments	This route contours around the edge of a swampy area then follows the clifftop with several good, relatively close up views of Boyd Tower. There is a midden site that will need to be avoided or require an AHIP.
Recommended Work (Text Details)	Machine benching, may need climbing turn.
Machine benching (m)	794
Clear vegetation (Person Days)	1
Rehabilitate old track with soil and cleared vegetation.	y

Work Section No.	3
Track Category	Recommended New Track
Length (m)	243
Cross Slope (%)	0 - 10
Vegetation	About 35% thick scrub, 65% open melaleuca.
Gradient (%)	0 - 5
Substrate	Soil with 10m section of stoney ground.
Descriptions/ Comments	Route contours around cliff-top at gentle grade with good views of coastline.
Recommended Work (Text Details)	Machine benching.
Machine benching (m)	243
Clear vegetation (Person Days)	0.5
Rehabilitate old track with soil and cleared vegetation.	Y

Work Section No.	4
Track Category	Recommended New Track
Length (m)	195
Cross Slope (%)	0 - 10
Vegetation	35% thick scrub, 65% medium
Gradient (%)	0 - 5
Substrate	Soil
Descriptions/ Comments	Route contours around cliff-top at gentle grade with good views of coastline.
Machine benching (m)	195
Clear vegetation (Person Days)	0.5
Rehabilitate old track with soil and cleared vegetation.	Y

Work Section No.	5
Track Category	New Track
Length (m)	1113
Cross Slope (%)	<5 - 15, short sections of 25
Vegetation	Open woodland, open melaleuca scrub.
Gradient (%)	0 - 10
Substrate	Clay soil with occasional sandy soil. Occasional patches of rocky substrate.
Viewing/Rest points	Potential viewing point looking north up coast to Boyd tower and Red Sands Bay.
Signage	Will need markers where track crosses vehicular track (if vehicular track not closed and rehabilitated.
Descriptions/ Comments	This section leaves the existing track after it climbs up a copper log stairway from Red Sands Bay. It follows the coast and crosses a vehicle track before ending at another existing vehicular track. The new alignment has nice coastal views for much of its length.
Recommended Work (Text Details)	Machine benching. May need a climbing turn or two where grade becomes a little steep.
Machine benching (m)	1113
Clear vegetation (Person Days)	2
Rehabilitate old track with soil and cleared vegetation.	If vehicular track is to be closed - yes

Work Section No.	6-1
Track Category	Recommended New Track
Length (m)	167
Cross Slope (%)	10
Vegetation	Open melaleuca scrub. 20% thick scrub.
Gradient (%)	0 - 10
Substrate	Soil, some short patches of stony ground.
Descriptions/ Comments	Continues contouring along cliff top.
Recommended Work (Text Details)	Machine bench.
Machine benching (m)	167
Rehabilitate old track with soil and cleared vegetation.	Y

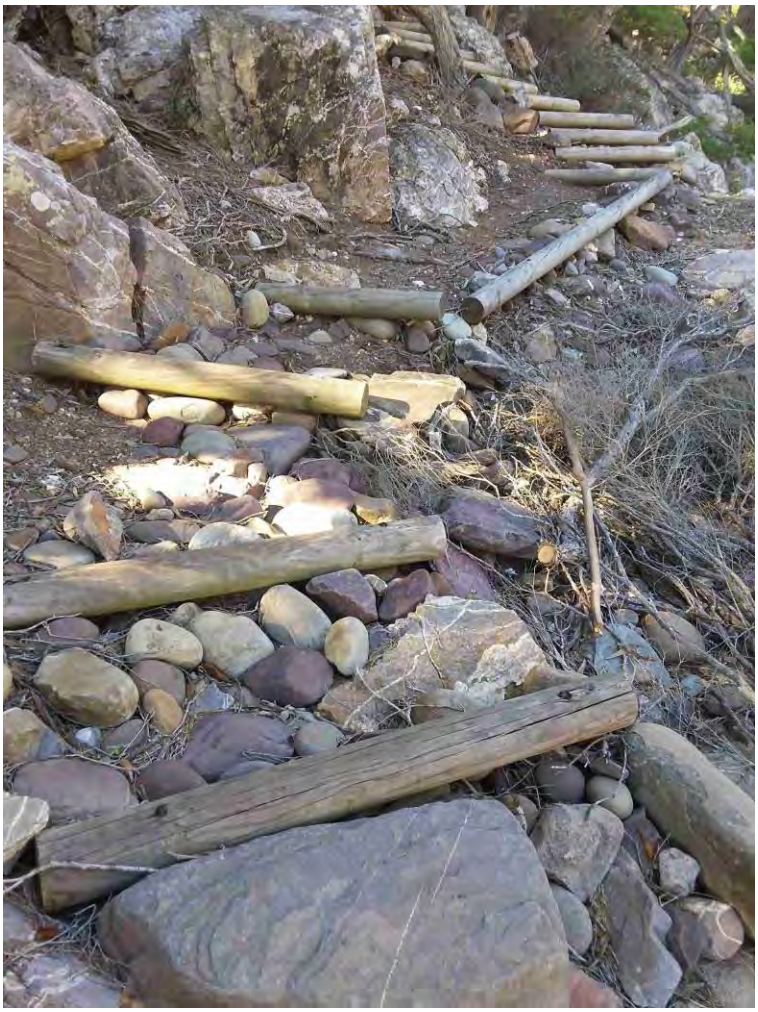
Work Section No.	6-2
Track Category	Recommended New Track
Length (m)	117
Cross Slope (%)	5 - 15
Vegetation	Medium melaleuca scrub.
Gradient (%)	10
Substrate	Rocky
Descriptions/ Comments	May need to move track inland slightly if impractical to build through rocky cliff top.
Recommended Work (Text Details)	Hand benching through stony ground.
Benching by hand (Person Days)	10
Rehabilitate old track with soil and cleared vegetation.	Y

Work Section No.	6-3
Track Category	Recommended New Track
Length (m)	77
Cross Slope (%)	0 - 5
Vegetation	Bedrock with a few bushes.
Gradient (%)	<10
Substrate	Bedrock.
Viewing/Rest points	Yes, excellent views of Leatherjacket Bay.
Descriptions/ Comments	Route goes along bedrock on coast.
Recommended Work (Text Details)	Some hand clearing of stones.
Benching by hand (Person Days)	1
Clear vegetation (Person Days)	0.2

Work Section No.	6-4
Track Category	Recommended New Track
Length (m)	685
Cross Slope (%)	5 - 20
Vegetation	Open woodland, open melaleuca scrub.
Gradient (%)	0 - 13
Substrate	Soil, short stony sections.
Descriptions/ Comments	Route leaves rock shelf to contour along cliff-top then descends into Leatherjacket Bay.
Recommended Work (Text Details)	May need some hand benching and rough stone work for first 20m as there is a small boulder field to pass. Machine benching.
Benching by hand (Person Days)	2
Machine benching (m)	685
Clear vegetation (Person Days)	1.5
Rehabilitate old track with soil and cleared vegetation.	Y

Work Section No.	7
Track Category	New Track
Length (m)	1251
Cross Slope (%)	<5 - 15
Vegetation	Open woodland and melaleuca scrub, 30% of section thick scrub.
Gradient (%)	0 - 10
Substrate	Soil with about 20% through stony ground
Descriptions/ Comments	Climbs gradually out of Leather Jacket Bay on a contoured alignment. Follows coast around before descending down to small bay.
Recommended Work (Text Details)	Machine benching. May need a couple of stepping stones where crosses drainage. Use local stone. Use material from benching and clearing vegetation to close and rehab old track.
Stone work - (Person Days)	1
Machine benching (m)	1251
Clear vegetation (Person Days)	2
Rehabilitate old track with soil and cleared vegetation.	Y

Work Section No.	Alt-1
Track Category	Existing Track
Comment	Alternative route if proposed route not to go through midden
Length (m)	120
Cross Slope (%)	0 - 40
Vegetation	Open woodland.
Gradient (%)	15 - 50
Substrate	soil, rocky soil
Descriptions/ Comments	This is an existing section of track that may have to be included because the proposed new alignment passes through a significant Aboriginal site. It leaves the small bay and climbs up the fall line. The existing copper log stairway will need to be replaced as many of the steel pegs are nearly rusted through and the logs are reaching the end of their life span.
Recommended Work (Text Details)	Remove existing steps. Dig trench. Install timber or stone steps using imported material flown in. Install returns on lower section.
Timber step (600x200mm) ea.	150
Timber return(mm) total length	50000
Galvanized steel pipe pegs(600X30mm) ea.	325
Excavate footing (m^3)	14.4
Remove existing timber/steel /FRP and pack in Heli bags (Person Days)	4

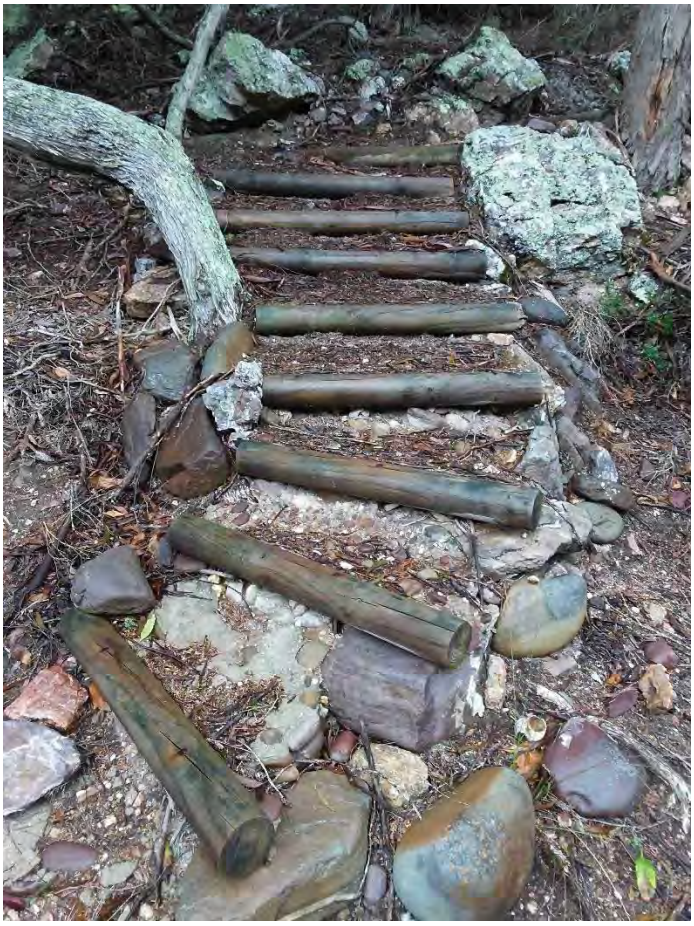


Work Section No.	Alt-2
Track Category	Existing Track
Comment	Alternative route if proposed route not to go through midden
Length (m)	206
Cross Slope (%)	0
Vegetation	Open woodland.
Gradient (%)	0 - 10
Substrate	soil, clay
Descriptions/ Comments	Existing track continues up fall line at very gentle grade.
Recommended Work (Text Details)	No work required.

Work Section No.	Alt-3
Track Category	New Track
Comment	Alternative route if proposed route not to go through midden
Length (m)	35
Cross Slope (%)	0 - 5
Vegetation	Open woodland.
Gradient (%)	10
Substrate	soil, clay
Descriptions/ Comments	Short reroute to remove dog leg in existing track. Ends at existing 4WD track.
Recommended Work (Text Details)	Light machine benching.
Machine benching (m)	35

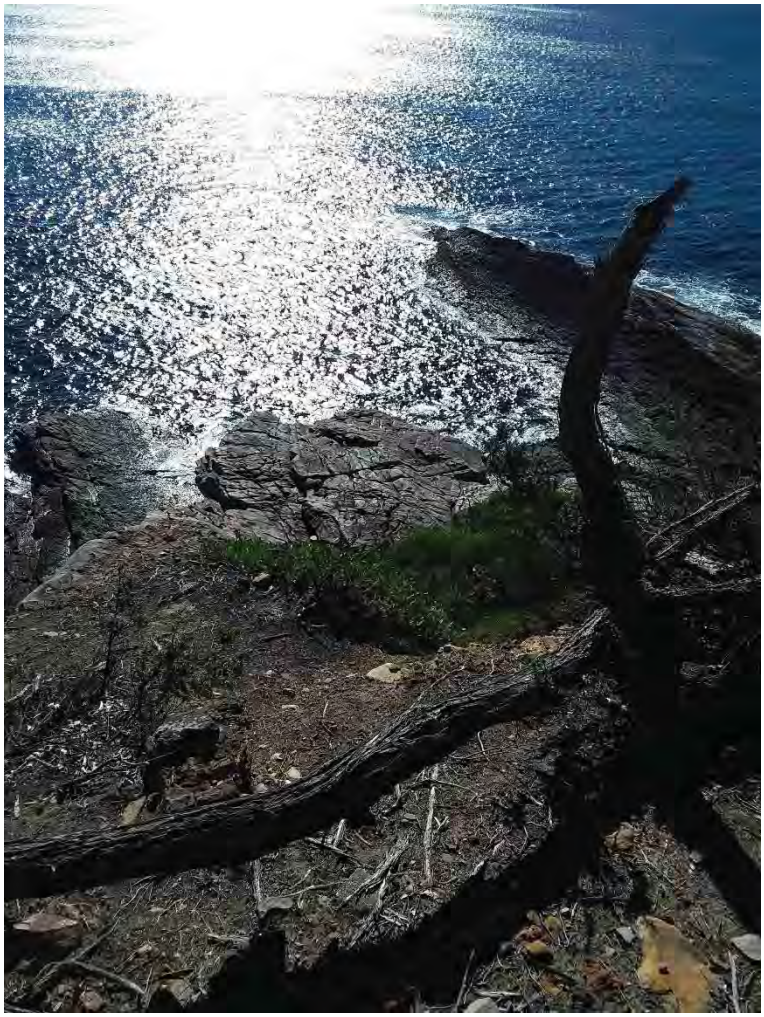
Work Section No.	Alt-4
Track Category	Existing Track
Comment	Alternative route if proposed route not to go through midden
Length (m)	153
Cross Slope (%)	5 - 10
Vegetation	Open woodland.
Gradient (%)	10 - 25
Substrate	soil, clay
Descriptions/ Comments	Existing track that starts from existing 4WD track. Descends at close to fall line. Existing timber steps could be replaced. Construct three metres of new track to link to new route, avoids needless dogleg.
Recommended Work (Text Details)	Remove existing timber steps. Install timber steps. Install grade dips. Construct three metres of new track to join with other route at southern end to straighten out
Timber step (600x200mm) ea.	50
Galvanized steel pipe pegs(600X30mm) ea.	100
Grade dip (ea.)	5

Work Section No.	**8**
Track Category	New Track
Length (m)	**924**
Cross Slope (%)	5 - 10 with short sections of 20
Vegetation	15% open woodland. 10% open melaleuca. 75% thick melaleuca scrub.
Gradient (%)	5 - 10 with 20m at start 30%.
Substrate	70% soil, 30% stony.
Descriptions/ Comments	The last two thirds of this section will be redundant if the recommended route along the coastal bedrock is used. Leaves existing track of old copper log stairway soon after climbing up from small bay. First 20m is steep and rocky, then begins to contour around coast. Towards the end, the route heads inland to contour around drainage. The existing 10m section of copper log stairway at the start of this section should be replaced with stone steps as it is in poor condition.
Recommended Work (Text Details)	Build stone stairway/steps for 20m steep section at start using local material. Machine benching for rest of section. Use cut vegetation and benched material to close old tracks if required.
Stone work - (Person Days)	16
Machine benching (m)	924
Clear vegetation (Person Days)	2
Rehabilitate old track with soil and cleared vegetation.	If vehicular tracks are to be closed - yes

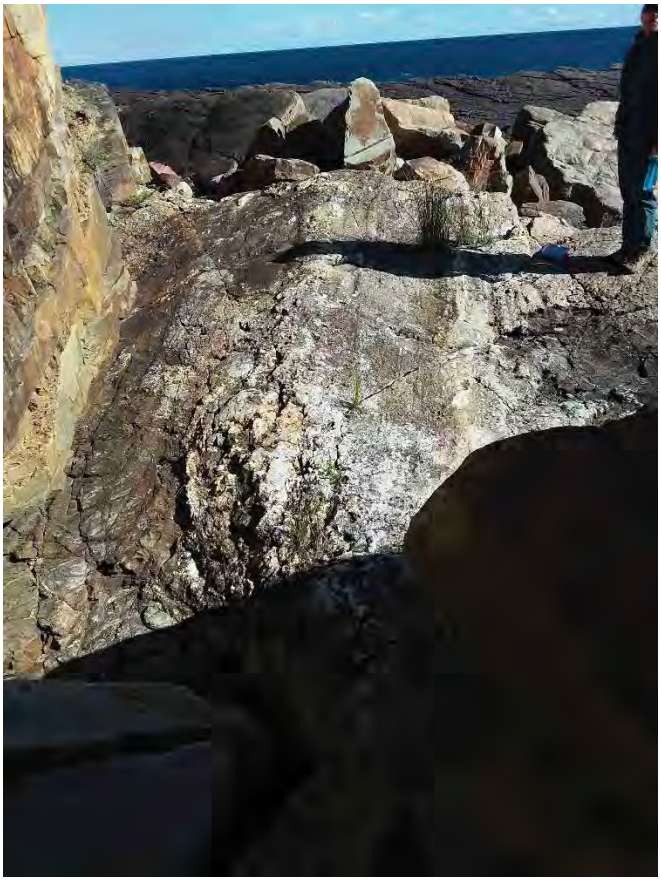


Work Section No.	9-1
Track Category	Recommended New Track
Length (m)	20
Cross Slope (%)	0 - 5
Vegetation	Light melaleuca scrub.
Gradient (%)	15
Substrate	Stoney soil.
Viewing/Rest points	Excellent views from clifftop.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Short section on clifftop leading to steep descent down to coastal rock platform.
Recommended Work (Text Details)	Light machine benching. May need climbing turn to reduce grade.
Machine benching (m)	20
Clear vegetation (Person Days)	0.2

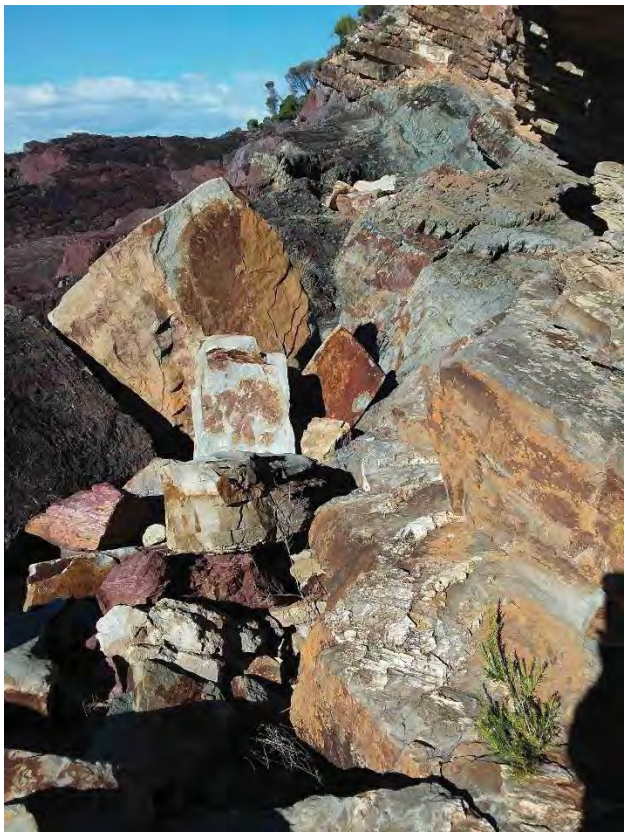
Work Section No.	9-2
Track Category	Recommended New Track
Length (m)	20
Cross Slope (%)	0 - 5
Vegetation	Melaleuca bushes
Gradient (%)	70
Substrate	Soil, crumbly bedrock
Signage	May need marker to indicate descent down to rock platform.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Short steep descent down to coastal rock platform.
Recommended Work (Text Details)	Dig trench and install 26 stone steps using local stone (will need to fly up from platform). Lower stone into place with winch. About 10m of bedrock platform then natural steps (may want to chisel 3 steps to make more walker friendly). Clear boulders at base(1man day and install 3 stone steps at base using local stone
Stone work - (Person Days)	1
Stone Steps 900x200x400mm (ea.)	29
Excavate footing (m^3)	1.5
Chiselled step(900-1200x300x200mm) (ea.)	3
Chisel tread (Person Days)	1
Clear vegetation (Person Days)	0.1



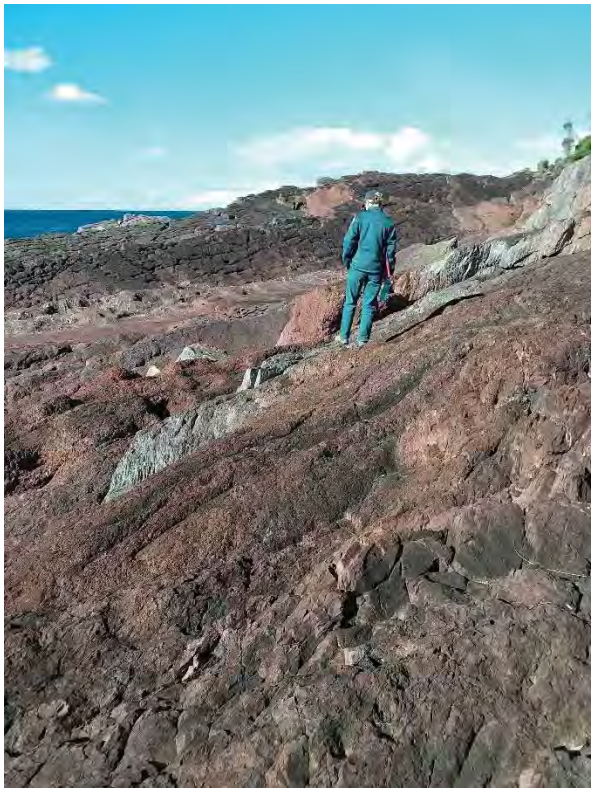
Work Section No.	9-3
Track Category	Recommended New Track
Length (m)	5
Cross Slope (%)	0 - 5
Vegetation	none
Gradient (%)	0 - 25
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	**This route along the rock platform is possibly the most spectacular section of the whole Light to Light walk.**
Recommended Work (Text Details)	none



Work Section No.	9-4
Track Category	Recommended New Track
Length (m)	11
Cross Slope (%)	0 - 5
Vegetation	none
Gradient (%)	
Substrate	bedrock, large boulders
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route needs to pass through boulders in order to avoid Geotech hazards closer to base of cliff.
Recommended Work (Text Details)	Drill and split boulders then clear route.
Stone work - (Person Days)	8



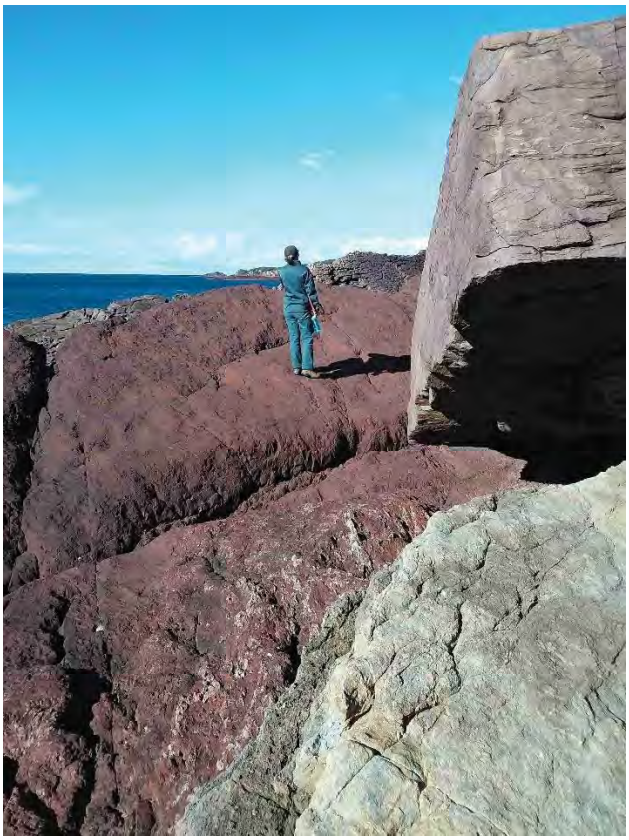
Work Section No.	9-5
Track Category	Recommended New Track
Length (m)	151
Cross Slope (%)	0 - 35
Vegetation	none
Gradient (%)	0 - 25
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route follows bedrock shelves.
Recommended Work (Text Details)	No work required apart from stencilled arrows



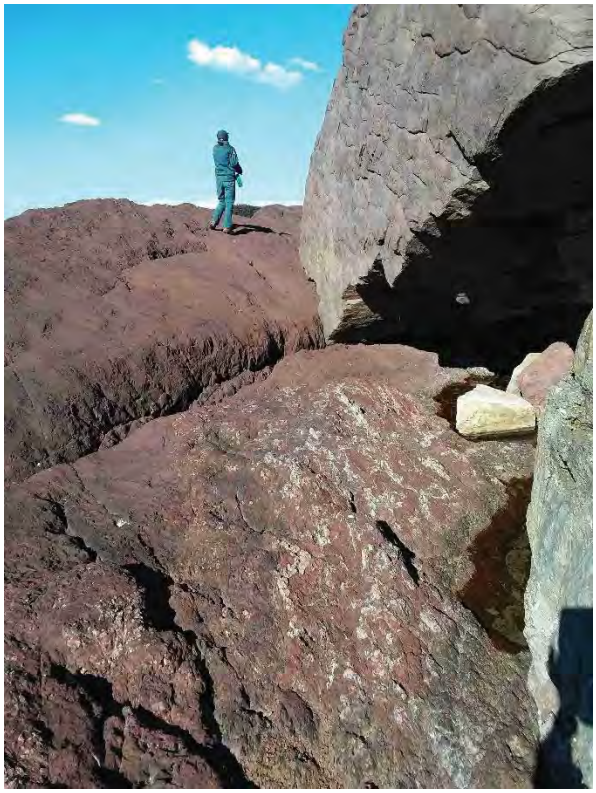
Work Section No.	9-6
Track Category	Recommended New Track
Length (m)	9
Cross Slope (%)	0 - 5
Vegetation	none
Gradient (%)	50 - 70
Substrate	bedrock
Signage	Will need marker to indicate turn and descent down to lower platform.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route turns and descends down sloping bedrock to lower platform.
Recommended Work (Text Details)	Carve 6 steps. 4 man days to rearrange boulders and install 4 steps using local stone.
Stone work - (Person Days)	4
Stone Steps 900x200x400mm (ea.)	4
Chiselled step(900-1200x300x200mm) (ea.)	6

Work Section No.	9-7
Track Category	Recommended New Track
Length (m)	31
Cross Slope (%)	5 - 20
Vegetation	none
Gradient (%)	0 - 10
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	End of descent down bedrock to lower platform. Route follows platform.
Recommended Work (Text Details)	No work required.

Work Section No.	9-8
Track Category	Recommended New Track
Length (m)	4
Cross Slope (%)	25
Vegetation	none
Gradient (%)	70
Substrate	bedrock
Geotech Assessment Recommended	yes
Descriptions/ Comments	Small drop off on route along platform.
Recommended Work (Text Details)	Carve 3 steps at small drop off (or install three steps using local stone).
Chiselled step(900-1200x300x200mm) (ea.)	3



Work Section No.	9-9
Track Category	Recommended New Track
Length (m)	130
Cross Slope (%)	30
Vegetation	none
Gradient (%)	0 - 10
Substrate	bedrock
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route passes large boulders that push walkers near cliff edge.
Recommended Work (Text Details)	May need to drill and slit two boulders to take walkers away from cliff edge.
Stone work - (Person Days)	4



Work Section No.	9-10
Track Category	Recommended New Track
Length (m)	3
Cross Slope (%)	25
Vegetation	none
Gradient (%)	0 - 10
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route follows platform.
Recommended Work (Text Details)	No work required.

No photo available

Work Section No.	9-11
Track Category	Recommended New Track
Length (m)	153
Cross Slope (%)	15
Vegetation	none
Gradient (%)	100
Substrate	bedrock
Geotech Assessment Recommended	yes
Descriptions/ Comments	1 meter drop along bedrock
Recommended Work (Text Details)	Carve 4 steps (or install 4 steps using local stone). Another alternative is to leave as is and let walkers' scramble up and down.
Chiselled step(900-1200x300x200mm) (ea.)	4

Work Section No.	9-12
Track Category	Recommended New Track
Length (m)	46
Cross Slope (%)	25
Vegetation	none
Gradient (%)	0 - 25
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route follows rock platform.
Recommended Work (Text Details)	No work required.

Work Section No.	9-13
Track Category	Recommended New Track
Length (m)	68
Cross Slope (%)	25
Vegetation	none
Gradient (%)	0 - 10
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows platform with boulders across it.
Recommended Work (Text Details)	Clear boulders off route along platform.
Stone work - (Person Days)	8

Work Section No.	9-14
Track Category	Recommended New Track
Length (m)	44
Cross Slope (%)	25
Vegetation	none
Gradient (%)	15 - 20
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route climbs up sloping bedrock slab.
Recommended Work (Text Details)	No work required.

Work Section No.	9-15
Track Category	Recommended New Track
Length (m)	48
Cross Slope (%)	10
Vegetation	Melaleuca
Gradient (%)	0 - 5
Substrate	bedrock
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route continues on bedrock with some melaleuca bushes.
Recommended Work (Text Details)	Clear vegetation and rocks on route.
Stone work - (Person Days)	1
Clear vegetation (Person Days)	0.2

Work Section No.	9-16
Track Category	Recommended New Track
Length (m)	19
Cross Slope (%)	0 - 5
Vegetation	Some melaleuca, mostly grass patches.
Gradient (%)	0 - 5
Substrate	soil
Geotech Assessment Recommended	yes
Descriptions/ Comments	End bedrock and start of soil. Midden at this way point.
Recommended Work (Text Details)	Light hand benching.
Benching by hand (Person Days)	1

Work Section No.	9-17
Track Category	Recommended New Track
Length (m)	28
Cross Slope (%)	35
Vegetation	melaleuca bushes
Gradient (%)	40
Substrate	Soft bedrock.
Descriptions/ Comments	Start steep ascent up crumbly bedrock.
Recommended Work (Text Details)	Carve steps in soft bedrock.
Chiselled step(900-1200x300x200mm) (ea.)	14

Work Section No.	10
Track Category	Recommended New Track
Length (m)	366
Cross Slope (%)	5 - 25
Vegetation	Medium melaleuca scrub
Gradient (%)	0 - 15
Substrate	Soil with some patches of stone.
Descriptions/ Comments	Route contours long cliff-top to next stony bay.
Recommended Work (Text Details)	Machine benching.
Machine benching (m)	366
Clear vegetation (Person Days)	1
Rehabilitate old track with soil and cleared vegetation.	Y

Work Section No.	10-1
Track Category	Recommended New Track
Length (m)	52
Cross Slope (%)	
Vegetation	Medium melaleuca scrub
Descriptions/ Comments	Short linking track from existing track. Will only be used if Sections 9 not used but Section 8 is used
Machine benching(m)	52
Clear vegetation - person days.	0.2

No photo available

Work Section No.	11
Track Category	New Track
Length (m)	517
Cross Slope (%)	5 - 15 with short section or two at 30
Vegetation	15% open woodland, 50% open melaleuca and 35% thick melaleuca scrub.
Gradient (%)	5 - 10, short sections of 15
Substrate	Soil with occasional stony patches.
Signage	If existing tracks are to be kept - yes.
Descriptions/ Comments	New route leaves existing track behind small bay to contour around coast and rejoins existing track just before next small bay.
Recommended Work (Text Details)	Machine benching. Can adjust realignment to avoid steep sections or install climbing turn or two to reduce grade. Install climbing turns around thick vegetation to avoid short cutting.
Machine benching (m)	538
Clear vegetation (Person Days)	1.5
Rehabilitate old track with soil and cleared vegetation.	Y

Work Section No.	12
Track Category	New Track
Length (m)	611
Cross Slope (%)	0 - 20, mostly 10 - 15, 50m section of 60
Vegetation	Open woodland, 15% thicker melaleuca scrub.
Gradient (%)	0 - 10
Substrate	Soil, one 20m rocky section.
Viewing/Rest points	Viewing point at end of section. Overlooking beach.
Signage	Will need track markers at start of section if existing track not closed.
Descriptions/ Comments	Track contours up from beach crossing two gullies. Contours out to small headland crossing historic dam wall before joining existing track. This section may need to be resurveyed by archaeologist as was altered after cultural survey done.
Recommended Work (Text Details)	Machine benching. 20m rocky section will need some jackhammering and a stone step or two. May need a climbing turn or two towards headland to maintain 10% grade. Good views along this section.
Stone work - (Person Days)	1
Machine benching (m)	420
Clear vegetation (Person Days)	1
Rehabilitate old track with soil and cleared vegetation.	If existing tracks are to be closed - yes

Work Section No.	13
Track Category	New Track
Length (m)	192
Cross Slope (%)	<5 - 15
Vegetation	Medium density melaleuca scrub.
Gradient (%)	0 - 10
Substrate	Soil with some rocky patches.
Signage	Wil need sign indicating side route to Mowarry Point.
Descriptions/ Comments	Route leaves existing track to head out to narrow neck on headland then contours back at flat grade to rejoin existing track.
Recommended Work (Text Details)	Machine benching.
Stone work - (Person Days)	1
Machine benching (m)	187
Clear vegetation (Person Days)	0.5
Rehabilitate old track with soil and cleared vegetation.	Y

Work Section No.	14-1
Track Category	New Track
Length (m)	661
Cross Slope (%)	5 - 10, short sections at 25
Vegetation	75% thick melaleuca scrub, 25% open melaleuca.
Gradient (%)	0 - 10, short section at 15
Substrate	Rocky soil, some patches of soil.
Signage	Will need marker at start of section.
Descriptions/ Comments	Route follows cliff edge through low scrub, leave buffer around midden just before sea caves. Melaleuca becomes less dense near top of sea caves, then thickens again towards end of section. Section ends where alignment goes onto bedrock on coast.
Recommended Work (Text Details)	Machine benching. A climbing turn is needed at the start. Install climbing turns around thick vegetation if grade is exceeding 10%.
Machine benching (m)	640
Clear vegetation (Person Days)	2
Rehabilitate old track with soil and cleared vegetation.	Y

Work Section No.	14-2
Track Category	New Track
Length (m)	724
Cross Slope (%)	5-10, short sections of 20 - 30
Vegetation	25% thick scrub, 50% medium, 25% open melaleuca.
Gradient (%)	0 - 10, short sections at 15%
Substrate	Soil
Signage	Will need marker at end of section.
Descriptions/ Comments	This is the second half of the sea caves reroute. Route continues contouring along cliff-top from sea caves. There are views of the coast through the vegetation which now and then open up to more expansive views. Route ends at existing track on bedrock.
Recommended Work (Text Details)	Machine benching. Will need to install some climbing turns where alignment is greater than 10% grade.
Machine benching (m)	730
Clear vegetation (Person Days)	2
Rehabilitate old track with soil and cleared vegetation.	y

Work Section No.	15-1	
Track Category	Recommended New Track	
Length (m)	460	
Cross Slope (%)	0 - 15	
Vegetation	Thick melaleuca scrub.	
Gradient (%)	0 - 5	
Substrate	Soil	
Geotech Assessment Recommended	Route follows clifftop for part of section. Will need assessment.	
Descriptions/ Comments	Route starts where existing track on bedrock ends and heads inland. Route follows clifftop out to headland and contours around coastline. Finishes where thick melaleuca ends and open melaleuca starts.	**No photo available**
Recommended Work (Text Details)	Machine benching.	
Machine benching (m)	460	
Clear vegetation (Person Days)	1.5	
Rehabilitate old track with soil and cleared vegetation.	Y	

Work Section No.	15-2	
Track Category	Recommended New Track	
Length (m)	748	
Cross Slope (%)	0 - 15	
Vegetation	Very open tall melaleuca with not much understory - some ferns and fallen logs for about 40m.	
Substrate	Soil	
Descriptions/ Comments	This section contours around clifftops and a drainage through very open mature melaleuca forest. It has great coastal views looking onto a sea bridge and secluded beach. Will need to be aligned to avoid a very large midden.	**No photo available**
Recommended Work (Text Details)	Machine benching.	
Machine benching (m)	748	
Clear vegetation (Person Days)	0.5	

Work Section No.	15-3
Track Category	Recommended New Track
Length (m)	411
Cross Slope (%)	5 - 15
Vegetation	Mostly open bedrock, about 5m of melaleuca scrub.
Gradient (%)	0 -10
Substrate	Bedrock.
Viewing/Rest points	Yes
Signage	Will need signage or marker at end of section. Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	Towards start of section route goes near clifftops and over sea bridge. Will need to access.
Descriptions/ Comments	Route starts at clifftop overlooking small beach. It goes along bedrock, crosses a sea bridge and continues along bedrock to Saltwater Creek Beach. About half way along, the route passes a midden and an AHIP may be needed.
Recommended Work (Text Details)	A 5m section of melaleuca scrub will need to be cleared and about 50m of the route will need to have boulders/rocks cleared and some steps installed using local stone.
Stone work - (Person Days)	3
Stone Steps 900x200x400mm (ea.)	5
Clear vegetation (Person Days)	0.2

Work Section No.	16-1
Track Category	New Track
Length (m)	819
Cross Slope (%)	5 - 10, short sections at 15 - 20
Vegetation	66% thick scrub, 33% open woodland and melaleuca.
Gradient (%)	0 - 10, short sections at 15%
Substrate	Sandy soil, hard clay, one 10m rocky patch.
Signage	Will need to replace existing sign with one showing new distances and directions at start of section.
Descriptions/ Comments	This section starts from south end of Saltwater Creek Beach and contours along coastline. It ends where the route heads out onto the coastal rock platform. There are a number of midden sites on the coastline that were avoided by installing climbing turns. Although a threatened Plant Community Type (PCT) was marked on the route corridor map, it was not identified in the field by park ranger Sarah Fergusson.
Recommended Work (Text Details)	Machine benching. Install climbing turns to reduce grade on steeper sections or where midden sites present. May need some hand benching on sections with steep cross slope.
Benching by hand (Person Days)	4
Machine benching (m)	1440
Clear vegetation (Person Days)	3
Rehabilitate old track with soil and cleared vegetation.	Y

Work Section No.	16-2	No photo available
Track Category	New Track	
Length (m)	685	
Cross Slope (%)	5 - 10, short sections at 15 - 20	
Vegetation	50% thick scrub, 50% medium scrub	
Gradient (%)	0 -10	
Substrate	Sandy soil, hard clay	
Descriptions/ Comments	This section continues along top of steep slope following the coastline before heading inland to join the existing track. It will be redundant if the the preferred route along the coastal rock platform is used.	
Recommended Work (Text Details)	Machine benching.	
Machine benching (m)	685	
Clear vegetation (Person Days)	2	

Work Section No.	17-1	
Track Category	Recommended New Track	
Length (m)	16	
Cross Slope (%)	0 - 5	
Vegetation	thick scrub	
Gradient (%)	35	
Substrate	Hard clay, crumbly bedrock.	
Descriptions/ Comments	Short descent down to rock platform.	
Recommended Work (Text Details)	Install stone steps using local stone. May need to be flown from elsewhere.	
Stone Steps 900x200x400mm (ea.)	12	
Clear vegetation (Person Days)	0.1	

Work Section No.	17-2
Track Category	Recommended New Track
Length (m)	237
Cross Slope (%)	0 - 5
Vegetation	none
Gradient (%)	0 - 5
Substrate	Bedrock
Geotech Assessment Recommended	Will need assessment.
Descriptions/ Comments	Route follows coastal rock platform with great views. Passes midden at start of section.
Recommended Work (Text Details)	No work required.

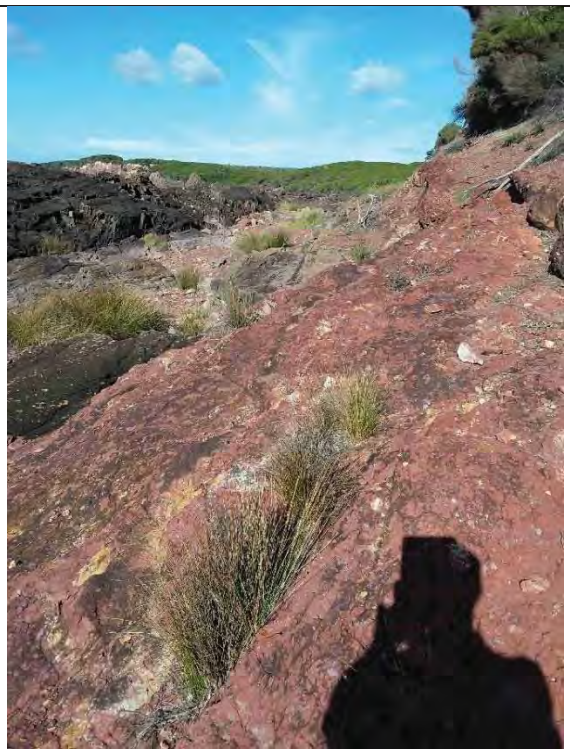
Work Section No.	17-3
Track Category	Recommended New Track
Length (m)	39
Cross Slope (%)	70
Vegetation	thick scrub
Gradient (%)	10
Substrate	Some soil, mostly soft bedrock.
Geotech Assessment Recommended	Will need assessment.
Descriptions/ Comments	Short section with very steep cross slope. Will need to be accessed for fall height issues.
Recommended Work	Full benching through soft bedrock using demo saw and jackhammer. Leave vegetation on downhill side to mitigate fall height issues.
Chisel tread (Person Days)	39
Clear vegetation (Person Days)	0.1

Work Section No.	17-4
Track Category	Recommended New Track
Length (m)	90
Cross Slope (%)	0 - 5
Vegetation	none
Gradient (%)	0 - 5
Substrate	Bedrock
Geotech Assessment Recommended	Will need assessment.
Descriptions/ Comments	Rock platform starts again.
Recommended Work (Text Details)	Carve to steps in bedrock at start of section.
Chiselled step(900-1200x300x200mm) (ea.)	2

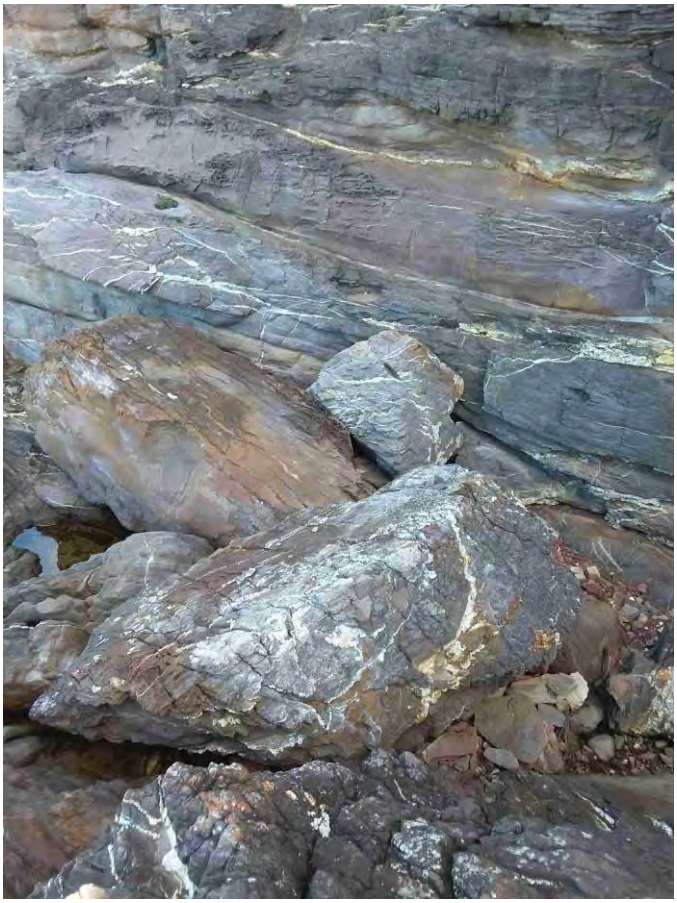
Work Section No.	17-5
Track Category	Recommended New Track
Length (m)	19
Cross Slope (%)	0 - 10
Vegetation	some grass and small bushes
Gradient (%)	0 - 5
Substrate	bedrock
Geotech Assessment Recommended	Will need assessment.
Descriptions/ Comments	Bedrock becomes rough and uneven in some spots.
Recommended Work	Chisel rough spots
Chisel tread (Person Days)	5

Work Section No.	17-6
Track Category	Recommended New Track
Length (m)	13
Cross Slope (%)	0 - 5
Vegetation	none
Gradient (%)	100
Substrate	bedrock
Geotech Assessment Recommended	Will need assessment.
Descriptions/ Comments	Platform ends with 4m high cliff face. To continue following rock platform will require large stone stairway.
Recommended Work (Text Details)	Install 5m long by 4m high by 1.5m wide stairway (15 cubic meters) stone stairway.
Stone work - (Person Days)	125
Set up overhead rigging - person days.	4

Work Section No.	17-7
Track Category	Recommended New Track
Length (m)	71
Cross Slope (%)	0 - 5
Gradient (%)	0 - 10
Substrate	bedrock
Descriptions/ Comments	Route follows bedrock.
Recommended Work (Text Details)	No work needed.



Work Section No.	17-8
Track Category	Recommended New Track
Length (m)	8
Cross Slope (%)	0 - 20
Vegetation	none
Gradient (%)	5 -30
Substrate	large boulders
Geotech Assessment Recommended	Will need assessment.
Descriptions/ Comments	Bedrock ends with crossing over large boulders that form natural causeway.
Recommended Work (Text Details)	Boulders can be maneuverered to make easier to cross causeway. Boulders and rough wall can be added to make more walker friendly.
Stone work - (Person Days)	12



Work Section No.	17-9
Track Category	Recommended New Track
Length (m)	3
Cross Slope (%)	0 - 15
Vegetation	none
Gradient (%)	70
Substrate	bedrock
Geotech Assessment Recommended	Will need assessment.
Descriptions/ Comments	Route climbs up small escarpment.
Recommended Work (Text Details)	Chisel bedrock to reduce cross slope. Chisel steps into bedrock.
Chiselled step(900-1200x300x200mm) (ea.)	12
Chisel tread (Person Days)	1

Work Section No.	17-10
Track Category	Recommended New Track
Length (m)	21
Cross Slope (%)	0 - 5
Vegetation	some bushes
Gradient (%)	0 - 5
Substrate	Crumbly bedrock
Geotech Assessment Recommended	Will need assessment.
Descriptions/ Comments	Route follows rough bedrock.
Recommended Work (Text Details)	Rough bedrock will need some chiselling and sledge hammering to make more walker friendly.
Chisel tread (Person Days)	3

Work Section No.	17-11
Track Category	Recommended New Track
Length (m)	10
Cross Slope (%)	0 - 5
Vegetation	some
Gradient (%)	40
Substrate	Crumbly bedrock
Descriptions/ Comments	Short climb up crumbly bedrock slope then benching in crumbly bedrock.
Recommended Work (Text Details)	Carve 5 steps then full bench in crumbly bedrock. Bench in bedrock for 5m.
Chiselled step(900-1200x300x200mm) (ea.)	5
Chisel tread (Person Days)	2

Work Section No.	17-12
Track Category	Recommended New Track
Length (m)	54
Cross Slope (%)	5 - 25
Vegetation	melaleuca scrub
Gradient (%)	0 - 10
Substrate	soil
Geotech Assessment Recommended	Will need assessment.
Descriptions/ Comments	Route contours at gentle grade to pass small coastal ravine. Contours back down onto bedrock once passed head of ravine.
Recommended Work (Text Details)	Hand benching - not worth flying in machine for such a short easy section.
Benching by hand (Person Days)	1.5
Clear vegetation (Person Days)	0.1

Work Section No.	17-13
Track Category	Recommended New Track
Length (m)	112
Cross Slope (%)	0 - 5
Vegetation	Some low bushes.
Gradient (%)	0 - 10
Substrate	Bedrock.
Geotech Assessment Recommended	Will need assessment.
Descriptions/ Comments	Route goes along rough uneven bedrock to cobbled beach.
Recommended Work (Text Details)	Will need some clearing of loose rock and chiselling of uneven patches.
Chisel tread (Person Days)	5

Work Section No.	18
Track Category	New Track
Length (m)	1593
Cross Slope (%)	70% at <10, 25% at 10 - 25, 5% at 30 - 50
Vegetation	10% thick scrub, 10% medium scrub, 80% Open woodland and melaleuca.
Gradient (%)	0 - 10
Substrate	Soil, some patches of clay, 50m section of very rocky ground.
Viewing/Rest points	Yes
Descriptions/ Comments	Route leaves existing track to contour at gentle grade to clifftop then contours into gully to cross at small bridge on existing track. The route then contours back towards coast and follows clifftop into Bittangabee Bay to rejoin existing track at creek crossing. Two middens were avoided but one will need an AHIP to build over. Most of the threatened heathland was avoided by taking route along clifftop but a 10m section will need to be built through.
Recommended Work (Text Details)	Machine benching. A steep 100m rocky section may need to be benched by hand.
Timber return(mm) total length	
Benching by hand (Person Days)	5
Machine benching (m)	1480
Clear vegetation (Person Days)	2
Rehabilitate old track with soil and cleared vegetation.	Y

Work Section No.	19
Track Category	New Track
Length (m)	100
Cross Slope (%)	0 - 5
Vegetation	open melaleuca
Gradient (%)	10 - 20
Substrate	soil
Signage	This is where the route leaves the camp ground. Signs with distances etc. will be needed.
Descriptions/ Comments	Route leaves campground area and heads to shoreline.
Recommended Work (Text Details)	Light machine benching. May need a climbing turn to keep grade below 10%.
Machine benching (m)	100
Clear vegetation (Person Days)	0.1

Work Section No.	20
Track Category	New Track
Length (m)	3
Cross Slope (%)	
Vegetation	none
Gradient (%)	0
Substrate	bedrock
Descriptions/ Comments	Stream crossing over bedrock.
Recommended Work (Text Details)	Insert two stepping stones. Use local stone.
Stepping stones 1000x400x400mm (ea.)	2

Work Section No.	21	No photo available
Track Category	New Track	
Length (m)	142	
Cross Slope (%)	0 - 5	
Gradient (%)	0 - 10	
Substrate	bedrock	
Descriptions/ Comments	Route follows bedrock on coast.	
Recommended Work (Text Details)	Chisel uneven rough sections.	
Chisel tread (Person Days)	2	

Work Section No.	22	
Track Category	New Track	
Length (m)	1473	
Cross Slope (%)	5 - 20	
Vegetation	Melaleuca scrub.	
Gradient (%)	0 - 15	
Substrate	soil	
Descriptions/ Comments	Route leaves bedrock and follows clifftop through melaleuca scrub. Occasionally heads inland to avoid middens.	
Recommended Work (Text Details)	May need to switchback inland to avoid fall hieght at start and keep grade below 10%. Machine bench.	
Machine benching(m)	1473	
Clear vegetation - person days.	3	

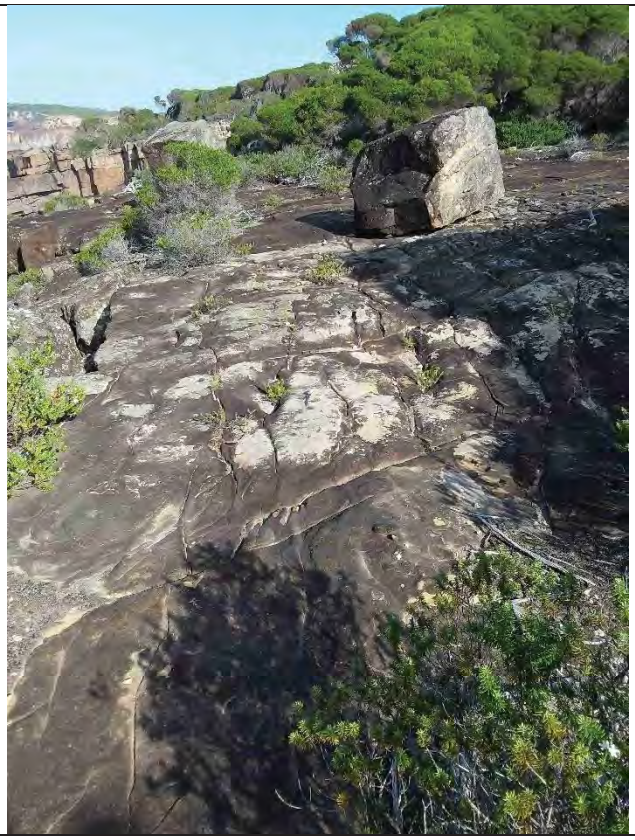
Work Section No.	23
Track Category	New Track
Length (m)	101
Cross Slope (%)	0 - 20
Vegetation	none
Gradient (%)	0 - 15
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows coastal bedrock.
Recommended Work (Text Details)	No work required.

Work Section No.	24
Track Category	New Track
Length (m)	1
Cross Slope (%)	0 - 10
Vegetation	none
Gradient (%)	0 - 10
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route passes along uneven bedrock with some boulders.
Recommended Work (Text Details)	Clear boulders off route chisel bedrock.
Stone work - (Person Days)	2

Work Section No.	25
Track Category	New Track
Length (m)	200
Cross Slope (%)	0 - 10
Vegetation	none
Gradient (%)	0 - 10
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows coastal bedrock.
Recommended Work (Text Details)	No work required.

Work Section No.	26
Track Category	New Track
Length (m)	9
Cross Slope (%)	<5
Vegetation	melaleuca bushes
Gradient (%)	<5
Substrate	soil
Descriptions/ Comments	Route goes through patch of melaleuca with soil substrate.
Recommended Work (Text Details)	Light hand benching.
Chisel tread (Person Days)	
Benching by hand (Person Days)	0.3
Clear vegetation (Person Days)	0.2

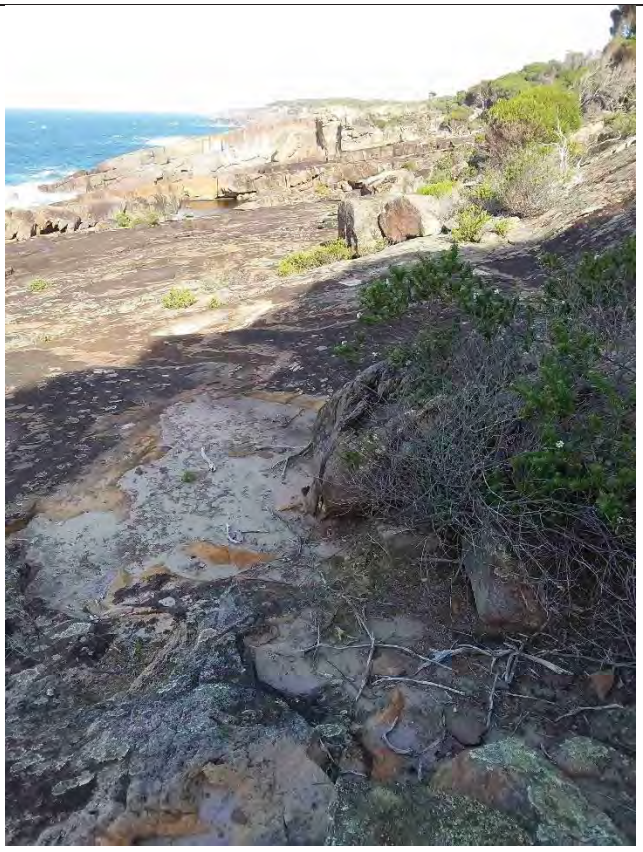
Work Section No.	27
Track Category	New Track
Length (m)	37
Cross Slope (%)	5
Vegetation	none
Gradient (%)	5
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route passes along bedrock.
Recommended Work (Text Details)	No work required.



Work Section No.	28
Track Category	New Track
Length (m)	23
Cross Slope (%)	<5
Vegetation	melaleuca scrub
Gradient (%)	5
Substrate	bedrock with patches of soil and stones on top
Descriptions/ Comments	Start of bedrock mixed with patches soil and stones on top with melaleuca scrub.
Recommended Work (Text Details)	Will need some clearing of vegetation. Light hand benching.
Benching by hand (Person Days)	0.3
Clear vegetation (Person Days)	0.2

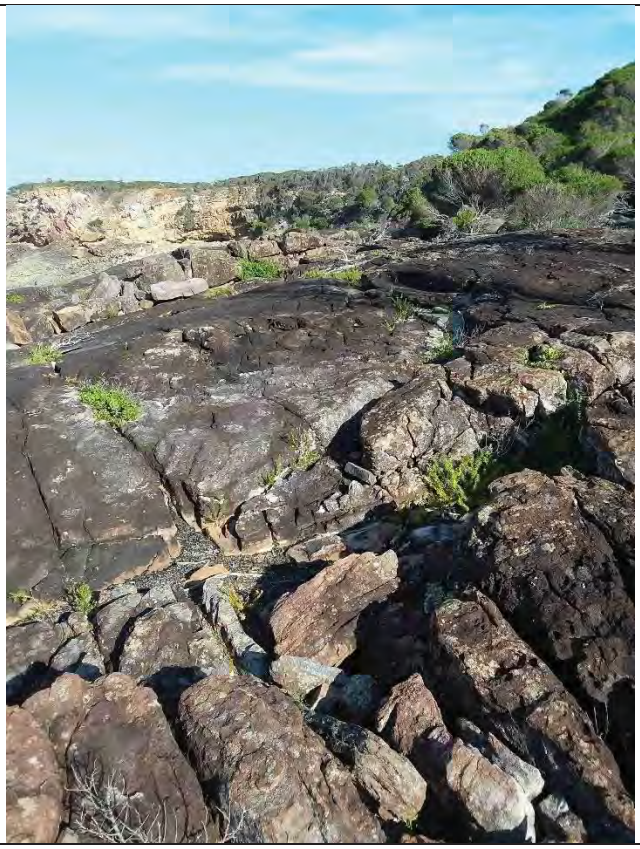
Work Section No.	29
Track Category	New Track
Length (m)	114
Cross Slope (%)	5 - 20
Vegetation	melaleuca scrub
Gradient (%)	0 - 10
Substrate	Stoney soil
Descriptions/ Comments	Route leaves bedrock and starts climbing and contouring around clifftop before returning to bedrock.
Recommended Work (Text Details)	Hand benching (not worth bring in machine for this short section.
Benching by hand (Person Days)	3
Clear vegetation (Person Days)	1

Work Section No.	30
Track Category	New Track
Length (m)	194
Cross Slope (%)	5
Vegetation	none
Gradient (%)	5 - 10
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows bedrock.
Recommended Work (Text Details)	No work required.



Work Section No.	31
Track Category	New Track
Length (m)	15
Cross Slope (%)	0
Vegetation	none
Gradient (%)	50 - 60
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Rugged bedrock section. This section is passable as is butcould install small carved steps and install three stone step using local stone to make more walker friendly. 8 man days
Recommended Work (Text Details)	Chisel small carved steps. Install stone steps using local stone.
Stone Steps 900x200x400mm (ea.)	3
Chiselled step(900-1200x300x200mm) (ea.)	7

Work Section No.	32
Track Category	New Track
Length (m)	101
Cross Slope (%)	5 - 20
Vegetation	none
Gradient (%)	0 - 10
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows bedrock.
Recommended Work (Text Details)	No work required.



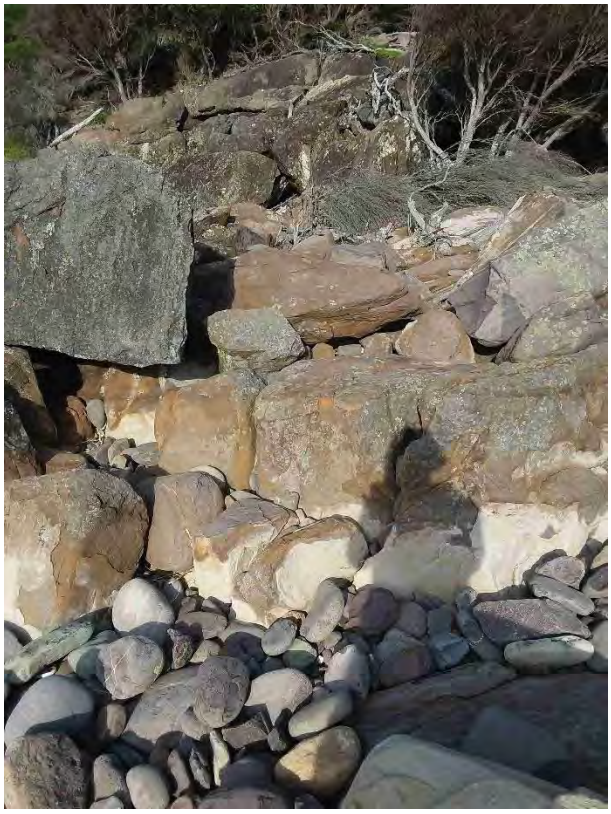
Work Section No.	33
Track Category	New Track
Length (m)	348
Cross Slope (%)	5 - 10
Vegetation	melaleuca scrub
Gradient (%)	0 - 10
Substrate	soil, stoney soil
Signage	Will need marker or sign to show where route leaves bedrock.
Descriptions/ Comments	Route leaves bedrock and contours around clifftop. May need to leave bedrock earlier to keep grade below 10%.
Recommended Work (Text Details)	Machine benching.
Machine benching (m)	348
Clear vegetation (Person Days)	2

Work Section No.	34
Track Category	New Track
Length (m)	38
Cross Slope (%)	5 - 15
Vegetation	melaleuca scrub
Gradient (%)	0 - 10
Substrate	crumbly bedrock
Descriptions/ Comments	Route passes over crumbly bedrock. Climb at 10% to maintain grade for next section.
Recommended Work (Text Details)	Chisel bedrock in places.
Chisel tread (Person Days)	2
Clear vegetation (Person Days)	0.3

Work Section No.	35
Track Category	New Track
Length (m)	207
Cross Slope (%)	5 - 15
Vegetation	melaleuca scrub
Gradient (%)	0 - 10
Substrate	soil
Descriptions/ Comments	Route continues contouring around clifftop. Maintain 0% grade (do not start descending) till pasted control point before cobbled beach.
Recommended Work (Text Details)	Machine benching.
Machine benching (m)	207
Clear vegetation (Person Days)	1

Work Section No.	36
Track Category	New Track
Length (m)	147
Cross Slope (%)	10
Vegetation	none
Substrate	beach cobbles
Signage	Will need marker at both ends of beach.
Descriptions/ Comments	Route goes along beach.
Recommended Work (Text Details)	No work required.

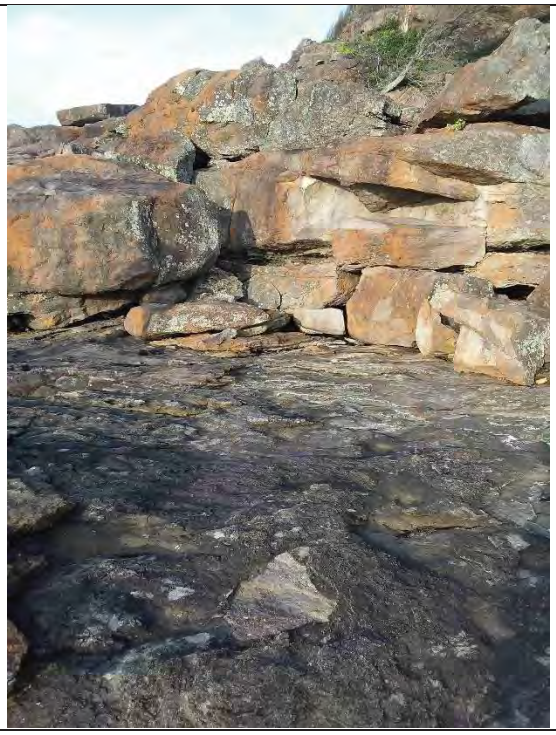
Work Section No.	37
Track Category	New Track
Length (m)	32
Cross Slope (%)	
Vegetation	none
Gradient (%)	
Substrate	bedrock
Descriptions/ Comments	Exit off cobbled beach onto rugged bedrock with boulders.
Recommended Work (Text Details)	Install steps using local stone. Rearrange boulders to make more walker friendly.
Stone work - (Person Days)	1
Stone Steps 900x200x400mm (ea.)	2



Work Section No.	38
Track Category	New Track
Length (m)	6
Cross Slope (%)	0
Vegetation	none
Substrate	bedrock
Descriptions/ Comments	End rugged bedrock. Route goes up small cliff.
Recommended Work (Text Details)	Construct stairway using local stone and carved steps.
Stone Steps 900x200x400mm (ea.)	6
Chiselled step(900-1200x300x200mm) (ea.)	2

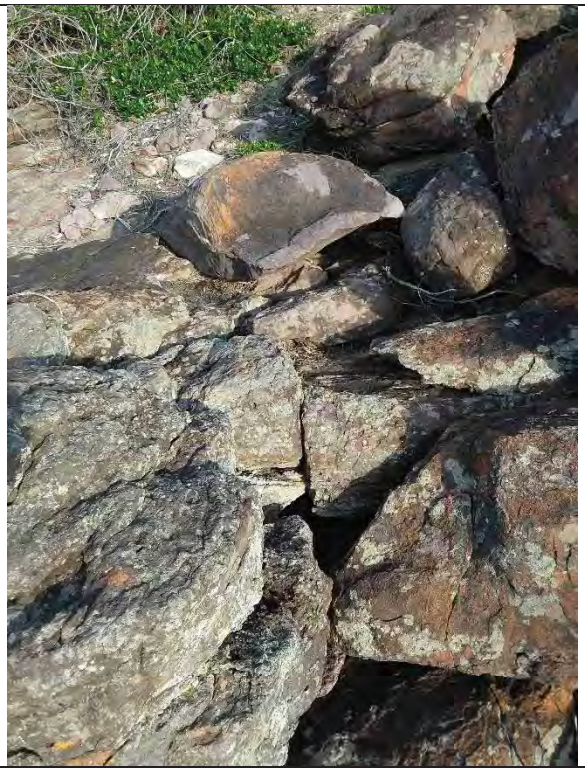
Work Section No.	39
Track Category	New Track
Length (m)	6
Cross Slope (%)	0
Vegetation	none
Gradient (%)	90
Substrate	bedrock
Descriptions/ Comments	Route goes up small cliff.
Recommended Work (Text Details)	Carve steps in bedrock.
Chiselled step(900-1200x300x200mm) (ea.)	7

Work Section No.	40
Track Category	New Track
Length (m)	4
Cross Slope (%)	0
Vegetation	none
Gradient (%)	0
Substrate	bedrock
Descriptions/ Comments	End stairway, start short section of bedrock.
Recommended Work (Text Details)	No work required.

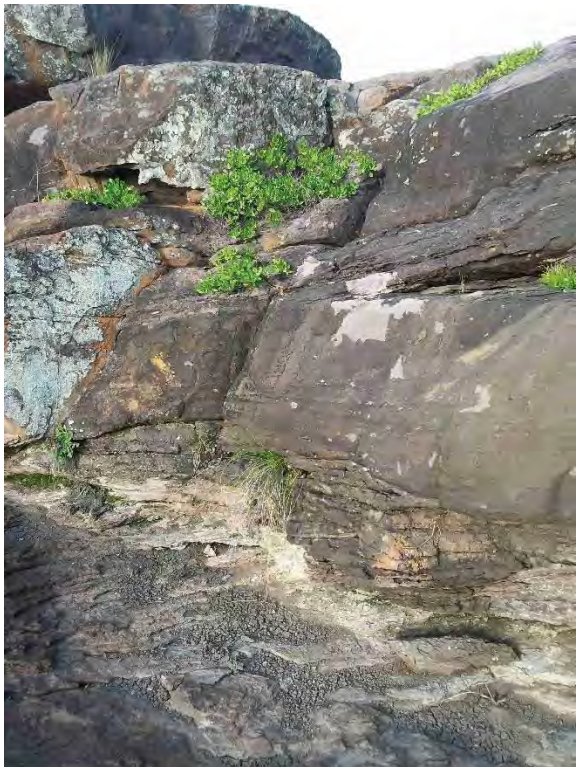


Work Section No.	41
Track Category	New Track
Length (m)	3
Cross Slope (%)	0
Vegetation	none
Gradient (%)	70
Substrate	bedrock, boulders
Descriptions/ Comments	Route goes up small rise.
Recommended Work (Text Details)	Construct stairway - install steps using local split boulders. May need to move boulders to create barrier and remove fall hazard.
Stone work - (Person Days)	4
Stone Steps 900x200x400mm (ea.)	10

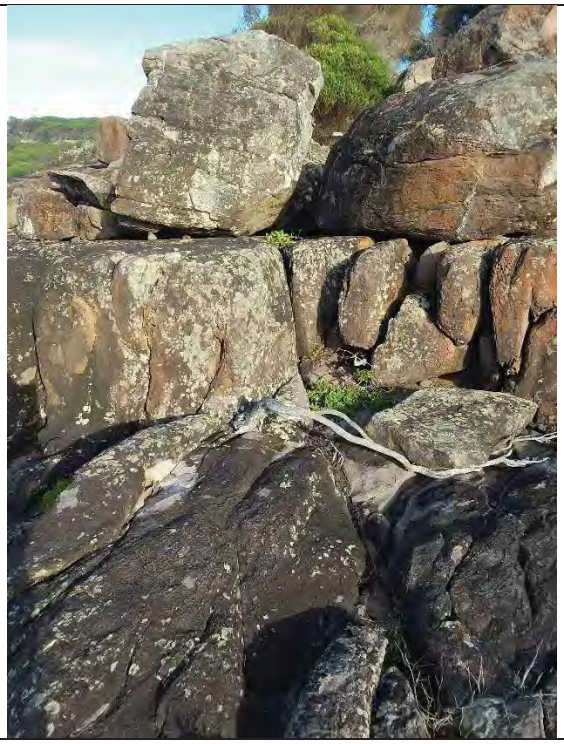
Work Section No.	42
Track Category	New Track
Length (m)	16
Cross Slope (%)	0
Vegetation	none
Gradient (%)	0
Substrate	bedrock
Descriptions/ Comments	End stairway. Start short section of bedrock.
Recommended Work (Text Details)	No work required.



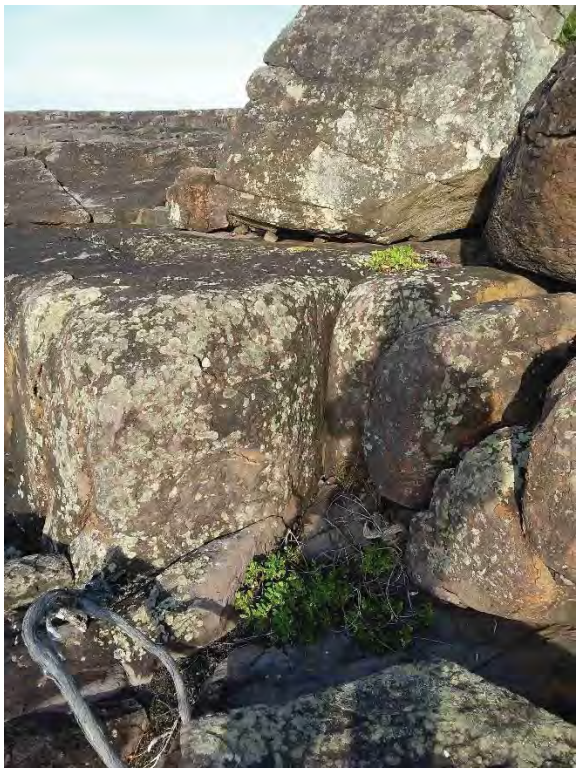
Work Section No.	43
Track Category	New Track
Length (m)	3
Cross Slope (%)	0
Vegetation	none
Gradient (%)	80
Substrate	bedrock
Descriptions/ Comments	End bedrock, start stairway.
Recommended Work (Text Details)	Install 6 steps from local split boulders. Carve upper steps from bedrock.
Stone Steps 900x200x400mm (ea.)	6
Chiselled step(900-1200x300x200mm) (ea.)	5



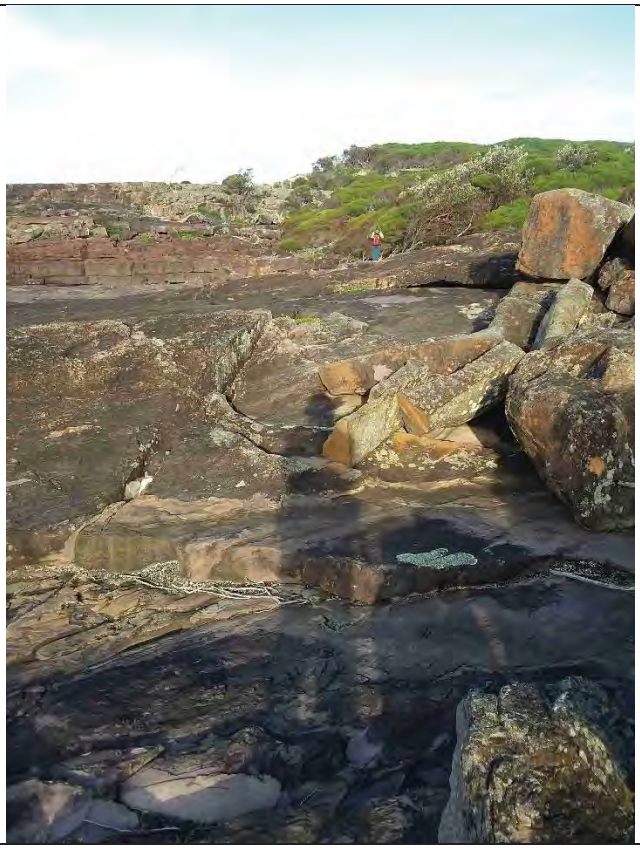
Work Section No.	44
Track Category	New Track
Length (m)	3
Cross Slope (%)	0
Vegetation	none
Gradient (%)	0
Substrate	bedrock
Descriptions/ Comments	End stairway. Short section of bedrock.
Recommended Work (Text Details)	No work required.



Work Section No.	45
Track Category	New Track
Length (m)	2
Cross Slope (%)	0
Vegetation	none
Gradient (%)	50
Substrate	bedrock
Descriptions/ Comments	Small rise.
Recommended Work (Text Details)	Install 3 stone steps made from split boulders. Carve 1 step (upper step).
Stone Steps 900x200x400mm (ea.)	3
Chiselled step(900-1200x300x200mm) (ea.)	1

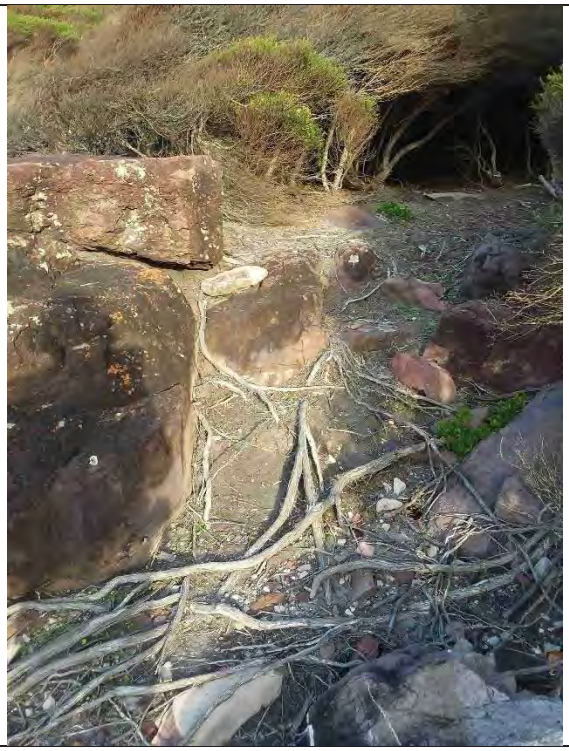


Work Section No.	46
Track Category	New Track
Length (m)	64
Cross Slope (%)	0 - 10
Vegetation	none
Gradient (%)	0 - 10
Substrate	bedrock
Descriptions/ Comments	Route follows bedrock. Passes near midden site.
Recommended Work (Text Details)	No work required.

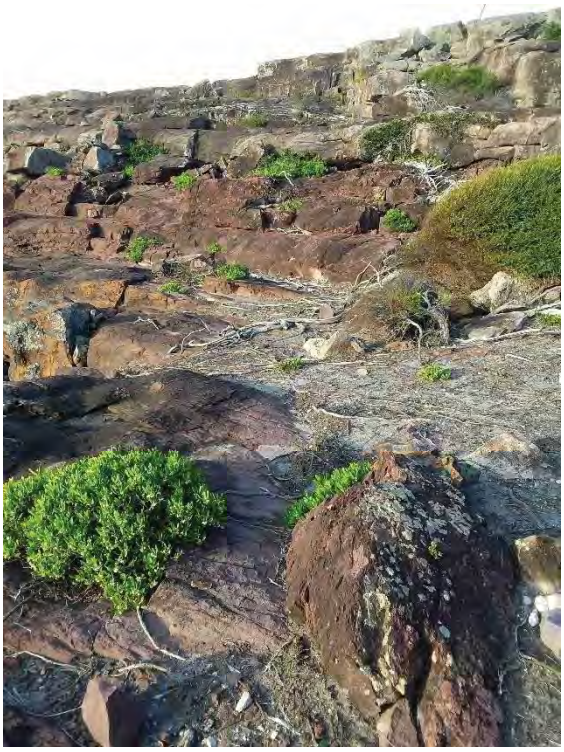


Work Section No.	47
Track Category	New Track
Length (m)	11
Cross Slope (%)	10
Vegetation	some bushes
Gradient (%)	10
Substrate	soil and rocks
Descriptions/ Comments	End bedrock. start short section of soil and rock
Recommended Work (Text Details)	Hand benching
Benching by hand (Person Days)	0.2
Machine benching (m)	
Clear vegetation (Person Days)	0.1

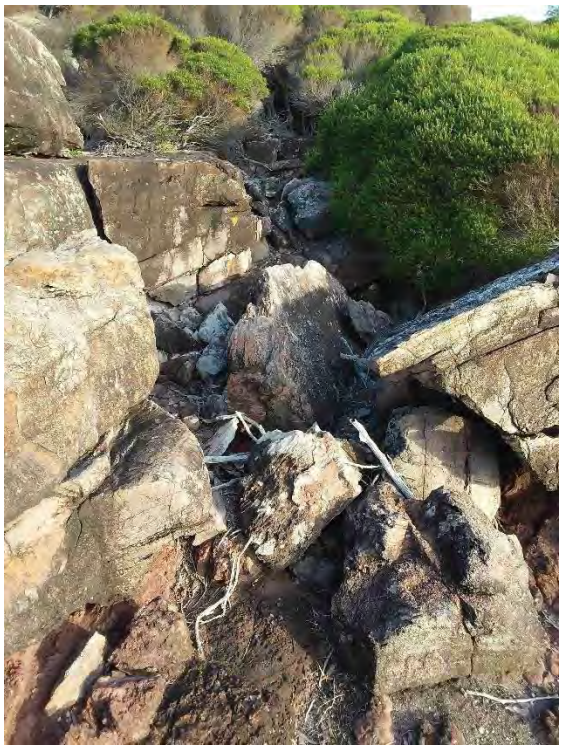
Work Section No.	48
Track Category	New Track
Length (m)	5
Cross Slope (%)	0
Vegetation	none
Gradient (%)	60
Substrate	soil and rocks
Descriptions/ Comments	Small rise to get onto bedrock platform.
Recommended Work (Text Details)	Install stone steps using local stone.
Stone Steps 900x200x400mm (ea.)	5



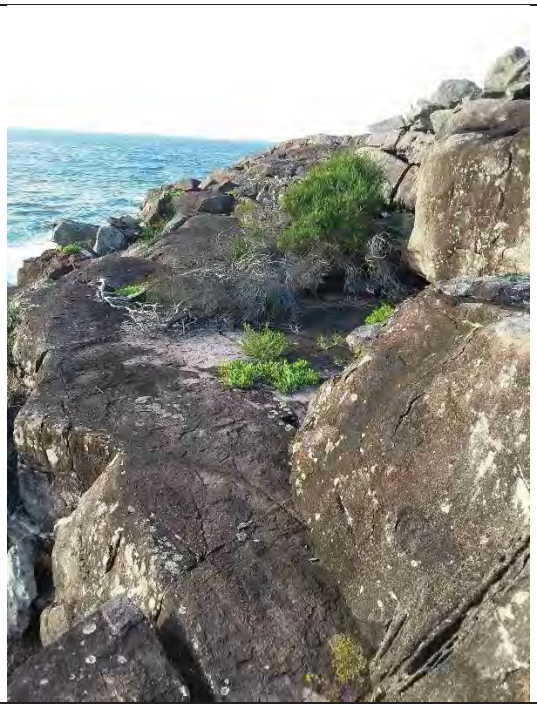
Work Section No.	49
Track Category	New Track
Length (m)	11
Cross Slope (%)	0
Vegetation	none
Gradient (%)	5
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows flat bedrock for short distance.
Recommended Work (Text Details)	No work required.



Work Section No.	50
Track Category	New Track
Length (m)	4
Cross Slope (%)	0
Vegetation	none
Gradient (%)	30
Substrate	bedrock
Descriptions/ Comments	Route goes through rugged bedrock section.
Recommended Work (Text Details)	Move stones to make move walker friendly install steps with local stone.
Stone work - (Person Days)	1
Stone Steps 900x200x400mm (ea.)	2



Work Section No.	51
Track Category	New Track
Length (m)	94
Cross Slope (%)	0
Vegetation	one bush
Gradient (%)	30
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows bedrock.
Recommended Work (Text Details)	No work required.



Work Section No.	52
Track Category	New Track
Length (m)	176
Cross Slope (%)	
Vegetation	melaleuca bushes
Descriptions/ Comments	Bedrock ends, route contours along clifftop. May need climbing turn or two to keep grade at 10%. Head inland slightly to avoid midden.
Recommended Work (Text Details)	Machine benching.
Machine benching (m)	176
Clear vegetation (Person Days)	0.3

Work Section No.	53
Track Category	New Track
Length (m)	117
Cross Slope (%)	0 - 5
Vegetation	melaleuca scrub
Gradient (%)	5
Substrate	Stoney soil
Signage	Route leaves from Pulpit Rock. Will need sign with distances etc.
Descriptions/ Comments	Route starts from Pulpit Rock and heads along clifftop.
Recommended Work (Text Details)	Light machine benching.
Machine benching (m)	117
Clear vegetation (Person Days)	0.3

Work Section No.	54
Track Category	New Track
Length (m)	25
Cross Slope (%)	60
Vegetation	melaleuca scrub
Gradient (%)	15
Substrate	Crumbly bedrock
Descriptions/ Comments	Route leaves clifftop and contours down bank with steep cross slope to coastal rock platform.
Recommended Work (Text Details)	Chisel bench out of crumbly bedrock. Will need to do by hand as bank too steep for machine.
Stone work - (Person Days)	6
Clear vegetation (Person Days)	0.2

Work Section No.	55
Track Category	New Track
Length (m)	12
Cross Slope (%)	55
Vegetation	light
Gradient (%)	20
Substrate	bedrock
Descriptions/ Comments	End crumbly bedrock. Start bedrock. Route continues descending to rock platform.
Recommended Work (Text Details)	Cut and chisel bench.
Chisel tread (Person Days)	8

Work Section No.	56
Track Category	New Track
Length (m)	7
Cross Slope (%)	50
Vegetation	light
Gradient (%)	35
Substrate	Crumbly bedrock
Descriptions/ Comments	Route continues descending to rock platform.
Recommended Work (Text Details)	Carve bench or chisel steps into crumbly bedrock.
Stone work - (Person Days)	4

Work Section No.	57
Track Category	New Track
Length (m)	137
Cross Slope (%)	0 - 10
Vegetation	none
Gradient (%)	10
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route follows bedrock platform.
Recommended Work (Text Details)	No work required.

Work Section No.	58
Track Category	New Track
Length (m)	7
Cross Slope (%)	0
Vegetation	thick melaleuca
Gradient (%)	80
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Short section of melaleuca with small drop on bedrock.
Recommended Work (Text Details)	Install stone steps using local stone.
Stone Steps 900x200x400mm (ea.)	2
Clear vegetation (Person Days)	0.1

Work Section No.	59
Track Category	New Track
Length (m)	143
Cross Slope (%)	5 - 25
Vegetation	none
Gradient (%)	0 - 10
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route follows bedrock. Great views.
Recommended Work (Text Details)	No work required.

Work Section No.	60
Track Category	New Track
Length (m)	3
Cross Slope (%)	5
Vegetation	none
Gradient (%)	0
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Tight squeeze through two large boulders.
Recommended Work (Text Details)	Cleave large flake off boulder with rifting hammer and sledge hammer along existing fault line to make wider. Avoid using jackhammer or small hand tools as 'natural' face is desirable.
Stone work - person days	1

Work Section No.	61
Track Category	New Track
Length (m)	27
Cross Slope (%)	10
Vegetation	none
Gradient (%)	0
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route follows bedrock.
Recommended Work (Text Details)	No work required.

Work Section No.	62
Track Category	New Track
Length (m)	19
Cross Slope (%)	0
Vegetation	light
Gradient (%)	30
Substrate	bedrock
Signage	Will need marker to indicate leaving platform.
Descriptions/ Comments	End coastal platform. Start following sloped bedrock up water coarse.
Recommended Work (Text Details)	Trim back vegetation.
Clear vegetation (Person Days)	0.1

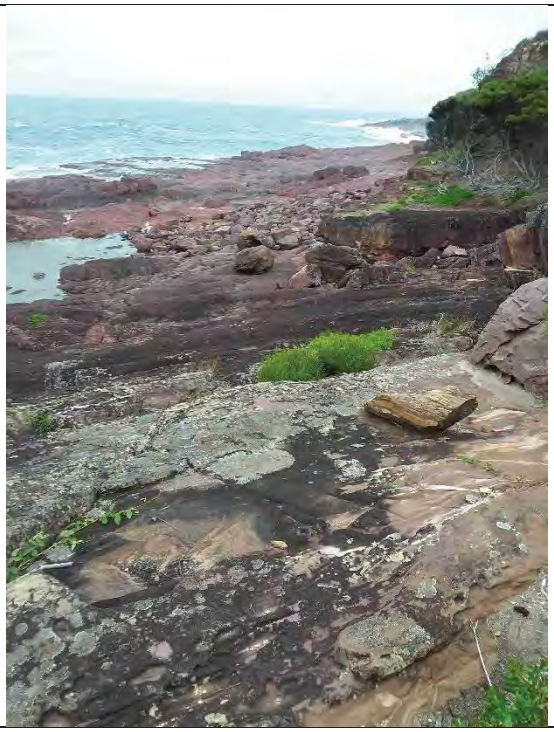
Work Section No.	63
Track Category	New Track
Length (m)	101
Cross Slope (%)	5 - 20
Vegetation	melaleuca scrub
Gradient (%)	0 - 10
Substrate	soil
Descriptions/ Comments	Route leaves bedrock water coarse and starts start contouring through melaleuca scrub to head of ravine.
Recommended Work (Text Details)	Hand bench (not worth bring machine in for short section). Install climbing turn or two to maintain grade below 10%.
Benching by hand (Person Days)	3
Clear vegetation - person days.	0.5

Work Section No.	64
Track Category	New Track
Length (m)	57
Cross Slope (%)	0 - 20
Vegetation	thick scrub
Gradient (%)	10 - 30
Substrate	soil
Descriptions/ Comments	From near head of costal ravine route heads down towards coastal rock platform. To get to platform below, route must go through midden. AHIP is being sort.
Recommended Work (Text Details)	Hand bench (not worth bring machine in for short section). Install climbing turn or two to maintain grade below 10%.
Benching by hand (Person Days)	0.5
Clear vegetation (Person Days)	0.3

Work Section No.	65
Track Category	New Track
Length (m)	9
Cross Slope (%)	0
Vegetation	light
Gradient (%)	50
Substrate	crumbly bedrock
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route goes through pinch point continuing down to platform through midden.
Recommended Work (Text Details)	Carve steps into crumbly bedrock. Keep route away from cliff edge to avoid fall height issues.
Chiselled step(900-1200x300x200mm) (ea.)	5

Work Section No.	66
Track Category	New Track
Length (m)	6
Cross Slope (%)	0
Vegetation	light
Gradient (%)	40
Substrate	soil, rocks, crumbly bedrock
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route continues through midden and pinch point and ends at rock platform. Install 10 steps using local rock.
Recommended Work (Text Details)	Install steps using local stone.
Stone Steps 900x200x400mm (ea.)	10

Work Section No.	67
Track Category	New Track
Length (m)	45
Cross Slope (%)	0 - 10
Vegetation	none
Gradient (%)	5 - 30
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows bedrock.
Recommended Work (Text Details)	No work required.



Work Section No.	68
Track Category	New Track
Length (m)	29
Cross Slope (%)	0
Vegetation	none
Gradient (%)	0
Substrate	Large boulders on bedrock.
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Start boulder field.
Recommended Work (Text Details)	Make more walker friendly by rearranging boulders.
Stone work - (Person Days)	8

Work Section No.	69
Track Category	New Track
Length (m)	188
Cross Slope (%)	0 - 10
Vegetation	none
Gradient (%)	0
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows rock platform.
Recommended Work (Text Details)	No work required.

Work Section No.	70
Track Category	New Track
Length (m)	20
Cross Slope (%)	50
Vegetation	none
Gradient (%)	35
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Bedrock becomes steep with strong cross slope. Take route slightly inland to avoid high tide hazards.
Recommended Work (Text Details)	Carve bench. Carve steps in bedrock at end of section.
Chiselled step(900-1200x300x200mm) (ea.)	5
Chisel tread (Person Days)	8

Work Section No.	71
Track Category	New Track
Length (m)	47
Cross Slope (%)	
Vegetation	none
Substrate	Large boulders on bedrock.
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Start large boulders, needed to raise track level and guide walkers away from high tide hazards.
Recommended Work (Text Details)	Rearrange boulders and build rough causeway where needed to raise track level.
Stone work - (Person Days)	16

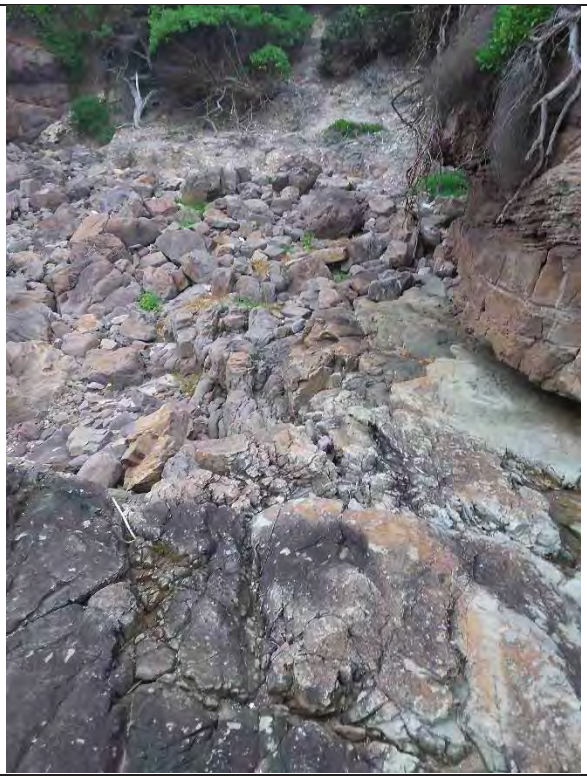
Work Section No.	72
Track Category	New Track
Length (m)	102
Cross Slope (%)	0
Vegetation	none
Gradient (%)	0
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows bedrock.
Recommended Work (Text Details)	No work required.

Work Section No.	73
Track Category	New Track
Length (m)	1
Cross Slope (%)	0
Vegetation	none
Gradient (%)	90
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Small drop in bedrock.
Recommended Work (Text Details)	Install steps using local stone.
Stone Steps 900x200x400mm (ea.)	2

Work Section No.	74
Track Category	New Track
Length (m)	64
Cross Slope (%)	0
Vegetation	none
Gradient (%)	0
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route continues along bedrock.
Recommended Work (Text Details)	No work required.

Work Section No.	75
Track Category	New Track
Length (m)	3
Cross Slope (%)	0
Vegetation	none
Gradient (%)	100
Substrate	bedrock
Descriptions/ Comments	Drop in bedrock.
Recommended Work (Text Details)	Carve steps.
Chiselled step(900-1200x300x200mm) (ea.)	2

Work Section No.	76
Track Category	New Track
Length (m)	5
Cross Slope (%)	10
Vegetation	none
Gradient (%)	10
Substrate	bedrock
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route continues along bedrock.
Recommended Work (Text Details)	No work required.

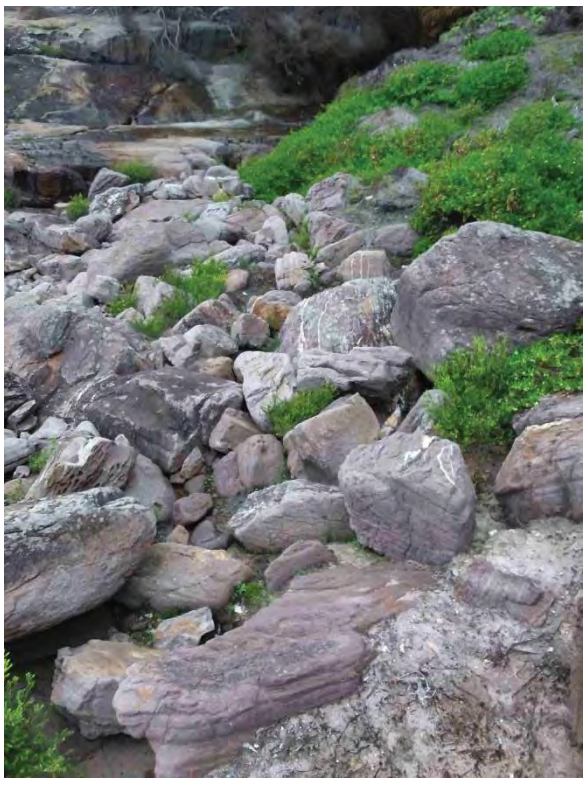


Work Section No.	77
Track Category	New Track
Length (m)	16
Cross Slope (%)	10
Vegetation	none
Gradient (%)	10
Substrate	rocks, boulders
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route goes along boulder field.
Recommended Work (Text Details)	Clear boulders and create bench by hand.
Benching by hand (Person Days)	4

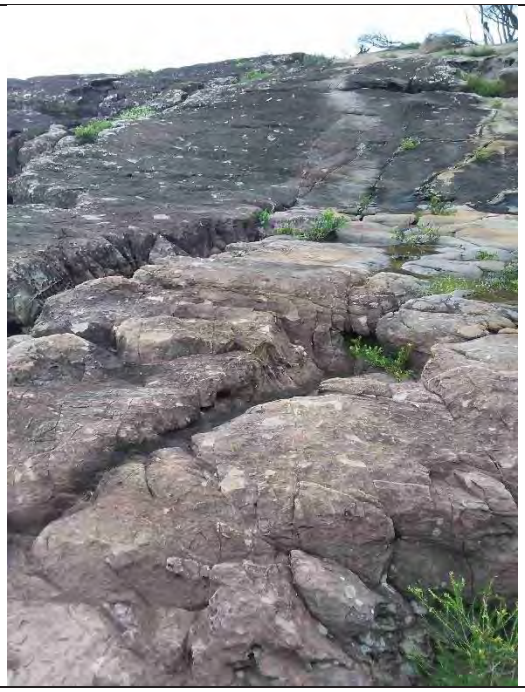
Work Section No.	78
Track Category	New Track
Length (m)	13
Cross Slope (%)	10
Vegetation	none
Gradient (%)	100
Substrate	rocks, boulders
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route needs to ascend 3 meter cliff face as alternative route is hazardous at high tide and/or with rough seas.
Recommended Work (Text Details)	Install 7m x 3mx 0.5m retaining wall with steps using local stone.
Stone Steps 900x200x400mm (ea.)	15
Retaining wall/causeway rock (m^3)	5.5
Excavate footing (m^3)	2.1
Set up overhead rigging (Person Days)	4

Work Section No.	79
Track Category	New Track
Length (m)	7
Cross Slope (%)	0
Vegetation	light
Gradient (%)	0 - 35
Substrate	bedrock
Signage	Will need marker.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route descends down rock platform to boulder field.
Recommended Work (Text Details)	No work required.

Work Section No.	80
Track Category	New Track
Length (m)	16
Cross Slope (%)	5 - 15
Vegetation	very light
Gradient (%)	10
Substrate	boulders, soil
Signage	Will need some stencilled arrows on boulders to indicate route.
Descriptions/ Comments	Route goes through boulder field.
Recommended Work (Text Details)	Rearrange boulders to make more walker friendly.
Stone work - (Person Days)	4



Work Section No.	81
Track Category	New Track
Length (m)	11
Cross Slope (%)	5
Vegetation	none
Gradient (%)	10 - 35
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route climbs up sloping bedrock.
Recommended Work (Text Details)	No work required.



Work Section No.	82
Track Category	New Track
Length (m)	36
Cross Slope (%)	5 - 15
Vegetation	melaleuca scrub
Gradient (%)	35
Substrate	soil, sandy soil
Signage	Will need marker to indicate exit off bedrock.
Descriptions/ Comments	End platform and start ascent up bank through melaleuca.
Recommended Work (Text Details)	Install steps using local stone. Fly up from near boulder field.
Stone Steps 900x200x400mm (ea.)	40
Clear vegetation - person days.	0.3

Work Section No.	83
Track Category	New Track
Length (m)	263
Cross Slope (%)	5 - 50
Vegetation	melaleuca scrub
Gradient (%)	5 - 20
Substrate	sandy soil
Descriptions/ Comments	Route switchbacks to start contouring along and up cross slope to get to top of bank/clifftop. Continues following clifftop to head of coastal ravine. Heads inland before head of ravine to avoid midden.
Recommended Work (Text Details)	Install switchback around thick vegetation to discourage short cutting. Full hand bench. May want to climb more gradually than on track log to keep grade at 10%. After about 80m route reaches top of bank/clifftop - from here onwards light benching to ravine head. Once passed head of ravine contour and descend down at 10% then install climbing turn to then contour to next section (will have to deviate from track log to achieve this).
Benching by hand (Person Days)	8
Clear vegetation (Person Days)	1

Work Section No.	84
Track Category	New Track
Length (m)	7
Cross Slope (%)	0
Vegetation	light
Gradient (%)	40
Substrate	crumbly bedrock
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route descends steeply down crumbling bedrock towards coastal rock platform.
Recommended Work (Text Details)	Chisel bedrock to make ramp. Keep route away from cliff edge to avoid fall height issues. Will need Geotech assessment.
Chisel tread (Person Days)	1

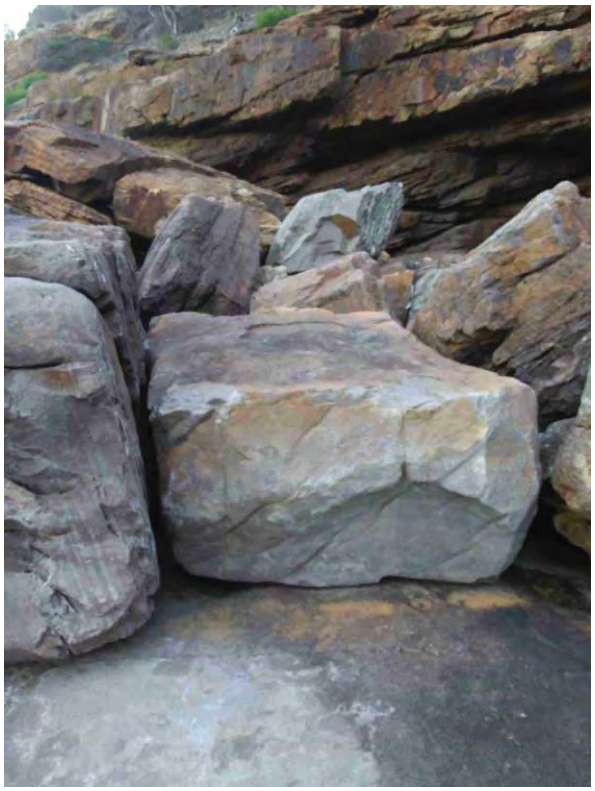
Work Section No.	85
Track Category	New Track
Length (m)	27
Cross Slope (%)	0
Vegetation	light
Gradient (%)	25
Substrate	bedrock
Geotech Assessment Recommended	yes
Descriptions/ Comments	Tread changes from crumbly bedrock to bedrock and reduces in grade. Will need Geotech assessment. Descends to coastal rock platform.
Recommended Work (Text Details)	Carve two steps at start of section. Keep route away from cliff edge to avoid fall height hazards (will need to deviate from track log).
Chiselled step(900-1200x300x200mm) (ea.)	2

Work Section No.	86
Track Category	New Track
Length (m)	16
Cross Slope (%)	30
Vegetation	none
Gradient (%)	20
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route follows bedrock platform.
Recommended Work (Text Details)	No work required.

Work Section No.	87
Track Category	New Track
Length (m)	4
Cross Slope (%)	0
Vegetation	none
Gradient (%)	100
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Mini escarpment. Although there is an easier route to get down, it goes too near the cliff edge.
Recommended Work (Text Details)	Move or fly in large boulder to base of mini escarpment to make step and carve 4 steps into bedrock for upper section.
Stone Steps 900x200x400mm (ea.)	3
Chiselled step(900-1200x300x200mm) (ea.)	4

Work Section No.	88
Track Category	New Track
Length (m)	48
Cross Slope (%)	5
Vegetation	none
Gradient (%)	5
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes

Work Section No.	89
Track Category	New Track
Length (m)	13
Cross Slope (%)	0
Vegetation	none
Gradient (%)	50
Substrate	boulders, bedrock
Signage	Will need some stencilled arrows on boulders to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	End platform, start boulders.
Recommended Work (Text Details)	Rearrange boulders and install steps using local stone to make passable.
Stone work - (Person Days)	8
Stone Steps 900x200x400mm (ea.)	3



Work Section No.	90
Track Category	New Track
Length (m)	290
Cross Slope (%)	5
Vegetation	none
Gradient (%)	5
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route follows bedrock.
Recommended Work (Text Details)	No work required.

Work Section No.	91
Track Category	New Track
Length (m)	15
Cross Slope (%)	0 - 10
Vegetation	light
Gradient (%)	15 - 50
Substrate	bedrock, soil
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Rock platform ends and climbs to next rock ledge through sandy soil.
Recommended Work (Text Details)	Install stone steps using local stone. Move local stone to site with helicopter.
Stone Steps 900x200x400mm (ea.)	15

Work Section No.	92
Track Category	New Track
Length (m)	23
Cross Slope (%)	0 - 10
Vegetation	light
Gradient (%)	0
Substrate	Bedrock, thin layer of soil covering bedrock in places.
Geotech Assessment Recommended	yes
Descriptions/ Comments	End climb, start bedrock ledge.
Recommended Work (Text Details)	Very light hand benching.
Benching by hand (Person Days)	0.2

Work Section No.	93
Track Category	New Track
Length (m)	9
Cross Slope (%)	50
Vegetation	light
Gradient (%)	40
Substrate	soil, rock, bedrock
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route leaves bedrock platform and climbs up mini escarpment.
Recommended Work (Text Details)	Dig footing 5x1x0.5m, build retaining wall 5x2x0.4m. Install stone steps using local stone flown to site. Chisel last step into bedrock.
Stone Steps 900x200x400mm (ea.)	7
Retaining wall/causeway rock (m^3)	2
Chiselled step(900-1200x300x200mm) (ea.)	1
Excavate/chisel footing - (Person Days)	2.5

Work Section No.	94
Track Category	New Track
Length (m)	6
Cross Slope (%)	20
Vegetation	light
Gradient (%)	10
Substrate	soil, bedrock possibly close to surface
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route contours cross gentle slope.
Recommended Work (Text Details)	Light hand benching. Bedrock may be close to surface - if so will need to chisel bench.
Benching by hand (Person Days)	3

Work Section No.	95
Track Category	New Track
Length (m)	13
Cross Slope (%)	25
Vegetation	light
Gradient (%)	10 - 30
Substrate	boggy soil
Descriptions/ Comments	Route crosses boggy gully.
Recommended Work (Text Details)	Install stepping stones across boggy gully - will need to fly stones in.
Stepping stones 1000x400x400mm (ea.)	16

Work Section No.	96
Track Category	New Track
Length (m)	36
Cross Slope (%)	50
Vegetation	thick melaleuca
Gradient (%)	10 - 15
Substrate	soil
Descriptions/ Comments	Route leaves boggy section and contours along steep cross slope through dense melaleuca scrub. Keep track away from cliff edge.
Recommended Work (Text Details)	Full hand benching.
Benching by hand (Person Days)	1
Clear vegetation - person days.	0.2

Work Section No.	97
Track Category	New Track
Length (m)	23
Cross Slope (%)	70
Vegetation	none
Gradient (%)	0 - 15
Substrate	soil
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route contours through site of old landslip.
Recommended Work (Text Details)	Full hand benching on 70% cross slope.
Benching by hand (Person Days)	3

Work Section No.	98
Track Category	New Track
Length (m)	13
Cross Slope (%)	35
Vegetation	melaleuca scrub
Gradient (%)	0 - 15
Substrate	soil
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route leaves land slip site and contours across gentler slope through melaleuca scrub.
Recommended Work (Text Details)	Full hand benching.
Benching by hand (Person Days)	0.5

Work Section No.	99
Track Category	New Track
Length (m)	3
Cross Slope (%)	0 - 5
Vegetation	none
Gradient (%)	60
Substrate	bedrock
Geotech Assessment Recommended	yes
Descriptions/ Comments	Short descent down small ledge. Keep track away from cliff edge.
Recommended Work (Text Details)	Carve four steps or foot holds into small cliff to rock platform.
Chiselled step(900-1200x300x200mm) (ea.)	3

Work Section No.	100
Track Category	New Track
Length (m)	23
Cross Slope (%)	10
Vegetation	none
Gradient (%)	0
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route follows bedrock. Small midden found.
Recommended Work (Text Details)	No work required.

Work Section No.	101
Track Category	New Track
Length (m)	32
Cross Slope (%)	50
Vegetation	light
Gradient (%)	10
Substrate	soil, bedrock may be below surface
Descriptions/ Comments	Rock platform ends, start benching. Could reroute higher to avoid minor midden and carve step if necessary.
Recommended Work (Text Details)	Full benching, if bedrock found will need to chisel bench.
Chisel tread (Person Days)	3

Work Section No.	102
Track Category	New Track
Length (m)	14
Cross Slope (%)	5
Vegetation	none
Gradient (%)	10
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows bedrock.
Recommended Work (Text Details)	No work required.

Work Section No.	103
Track Category	New Track
Length (m)	23
Cross Slope (%)	25
Vegetation	grass
Gradient (%)	10
Substrate	soil
Descriptions/ Comments	End bedrock, start short section of benching with gentle cross slope.
Recommended Work (Text Details)	Light hand benching.
Benching by hand (Person Days)	0.5

Work Section No.	104
Track Category	New Track
Length (m)	88
Cross Slope (%)	5
Vegetation	none
Gradient (%)	5
Substrate	bedrock
Descriptions/ Comments	End benching, start bedrock.
Recommended Work (Text Details)	No work required.

Work Section No.	105
Track Category	New Track
Length (m)	143
Cross Slope (%)	10 - 50
Vegetation	thick melaleuca
Gradient (%)	10
Substrate	Bedrock for first 7m then soil.
Descriptions/ Comments	Start alternative upper route - avoids fall height issues and need for stepping stones. Goes near site of collapsed cabin with asbestos material - will need to be professionally removed. Climbs and contours across steep cross slope. If machine benching, will have to fly digger in or access site from existing track.
Recommended Work (Text Details)	Machine benching - full bench.
Machine benching (m)	143
Clear vegetation (Person Days)	1

Work Section No.	106
Track Category	New Track
Length (m)	32
Cross Slope (%)	5
Vegetation	melaleuca
Gradient (%)	0 - 5
Substrate	soil
Descriptions/ Comments	End steep cross slope, start following cliff top. Site of collapsed cabin with tiles and asbestos found - will need to cost in removal of asbestos.
Recommended Work (Text Details)	Machine benching.
Machine benching (m)	32
Clear vegetation (Person Days)	0.25

Work Section No.	107
Track Category	New Track
Length (m)	10
Cross Slope (%)	60
Vegetation	Thick scrub
Gradient (%)	10
Substrate	soil, some rock
Descriptions/ Comments	Start descending and contouring cross steep cross slope.
Recommended Work (Text Details)	Full benching by hand - cannot machine bench due to steep cross slope.
Machine benching (m)	10
Clear vegetation (Person Days)	0.1

Work Section No.	108
Track Category	New Track
Length (m)	14
Cross Slope (%)	60
Vegetation	coral fern
Gradient (%)	10
Substrate	soil
Descriptions/ Comments	Route contours through damp section with coral fern.
Recommended Work (Text Details)	Install stepping stones. Fly in nearby local stone.
Stepping stones 1000x400x400mm (ea.)	13
Clear vegetation (Person Days)	0.1

Work Section No.	109
Track Category	New Track
Length (m)	328
Cross Slope (%)	50
Vegetation	Thick melaleuca, open grassy area towards end of section.
Gradient (%)	10
Substrate	Soil - may be bedrock near surface in grassy area towards end of section.
Descriptions/ Comments	End coral fern. Continues contouring along cross slope. Avoid rock outcrop by going above.
Recommended Work (Text Details)	Full machine bench. Possibly chisel tread for 10m
Chisel tread (Person Days)	5
Machine benching (m)	328
Clear vegetation (Person Days)	3

Work Section No.	110
Track Category	New Track
Length (m)	4
Cross Slope (%)	5
Vegetation	none
Gradient (%)	50
Substrate	bedrock
Descriptions/ Comments	Start descent down sloping bedrock.
Recommended Work (Text Details)	Tread is ok as is but could carve 9 foot holds to make more walker friendly.
Chisel tread (Person Days)	2

Work Section No.	111
Track Category	New Track
Length (m)	8
Cross Slope (%)	25
Vegetation	One tree to clear.
Gradient (%)	10
Substrate	soil
Descriptions/ Comments	Short section of benching.
Recommended Work (Text Details)	Hand bench.
Machine benching (m)	25
Clear vegetation (Person Days)	0.1

Work Section No.	112
Track Category	New Track
Length (m)	53
Cross Slope (%)	0 - 20
Vegetation	none
Gradient (%)	5 - 20
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows bedrock.
Recommended Work (Text Details)	No work required.

Work Section No.	113
Track Category	New Track
Length (m)	21
Cross Slope (%)	10 - 30
Vegetation	Light to medium bushes.
Gradient (%)	10
Substrate	soil
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route leaves bedrock and contours along slope. May need to move route up slope slightly to keep away from cliff edge.
Recommended Work (Text Details)	Hand bench.
Benching by hand (Person Days)	1

Work Section No.	114
Track Category	New Track
Length (m)	10
Cross Slope (%)	25
Vegetation	melaleuca bushes
Gradient (%)	10
Substrate	Shallow soil with bedrock underneath.
Geotech Assessment Recommended	yes
Descriptions/ Comments	Route goes over shallow soil and bedrock.
Recommended Work (Text Details)	Carve tread.
Excavate/chisel footing - (Person Days)	1
Clear vegetation (Person Days)	0.1

Work Section No.	115
Track Category	New Track
Length (m)	5
Cross Slope (%)	25
Vegetation	light
Gradient (%)	50
Substrate	crumbly bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route drops down low escarpment.
Recommended Work (Text Details)	Carve steps.
Chiselled step(900-1200x300x200mm) (ea.)	8

Work Section No.	116
Track Category	New Track
Length (m)	131
Cross Slope (%)	5
Vegetation	none
Gradient (%)	10
Substrate	Bedrock with some patches of soil and boulders.
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows bedrock.
Recommended Work (Text Details)	Will need some light benching on small sections of soil and some boulder moving and chiselling to define track.
Stone work - (Person Days)	0.5
Chisel tread (Person Days)	4
Benching by hand (Person Days)	0.5

Work Section No.	117
Track Category	New Track
Length (m)	5
Cross Slope (%)	30
Gradient (%)	40
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route goes down sloping uneven bedrock.
Recommended Work (Text Details)	Chisels steps.
Chiselled step(900-1200x300x200mm) (ea.)	7

Work Section No.	118
Track Category	New Track
Length (m)	15
Cross Slope (%)	0 - 25
Vegetation	none
Gradient (%)	10
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows bedrock.
Recommended Work (Text Details)	Clear boulders to define track.
Stone work - (Person Days)	6

Work Section No.	119
Track Category	New Track
Length (m)	21
Cross Slope (%)	5
Vegetation	none
Gradient (%)	25
Substrate	bedrock
Signage	Will need some stencilled arrows on bedrock to indicate route.
Descriptions/ Comments	Route follows bedrock.
Recommended Work (Text Details)	No work required.

Work Section No.	120
Track Category	New Track
Length (m)	32
Cross Slope (%)	5
Vegetation	Patch of melaleuca.
Gradient (%)	10
Substrate	soil and bedrock
Signage	Will need a marker to indicate exit from coastal platform.
Descriptions/ Comments	Route starts climbing away from coast through melaleuca.
Recommended Work (Text Details)	Light machine benching.
Machine benching (m)	32
Clear vegetation (Person Days)	0.2

Work Section No.	121
Track Category	New Track
Length (m)	55
Cross Slope (%)	35 -50
Vegetation	Thick melaleuca
Gradient (%)	10
Substrate	soil
Descriptions/ Comments	Contours and climbs cross steep cross slope.
Recommended Work (Text Details)	Machine benching.
Machine benching (m)	55
Clear vegetation - person days.	0.5

Work Section No.	122
Track Category	New Track
Length (m)	21
Cross Slope (%)	45
Vegetation	Thick melaleuca
Gradient (%)	10
Substrate	bedrock with some soil
Descriptions/ Comments	Route crosses patch of bedrock.
Recommended Work (Text Details)	Chisel tread.
Chisel tread (Person Days)	7
Clear vegetation - person days.	0.2

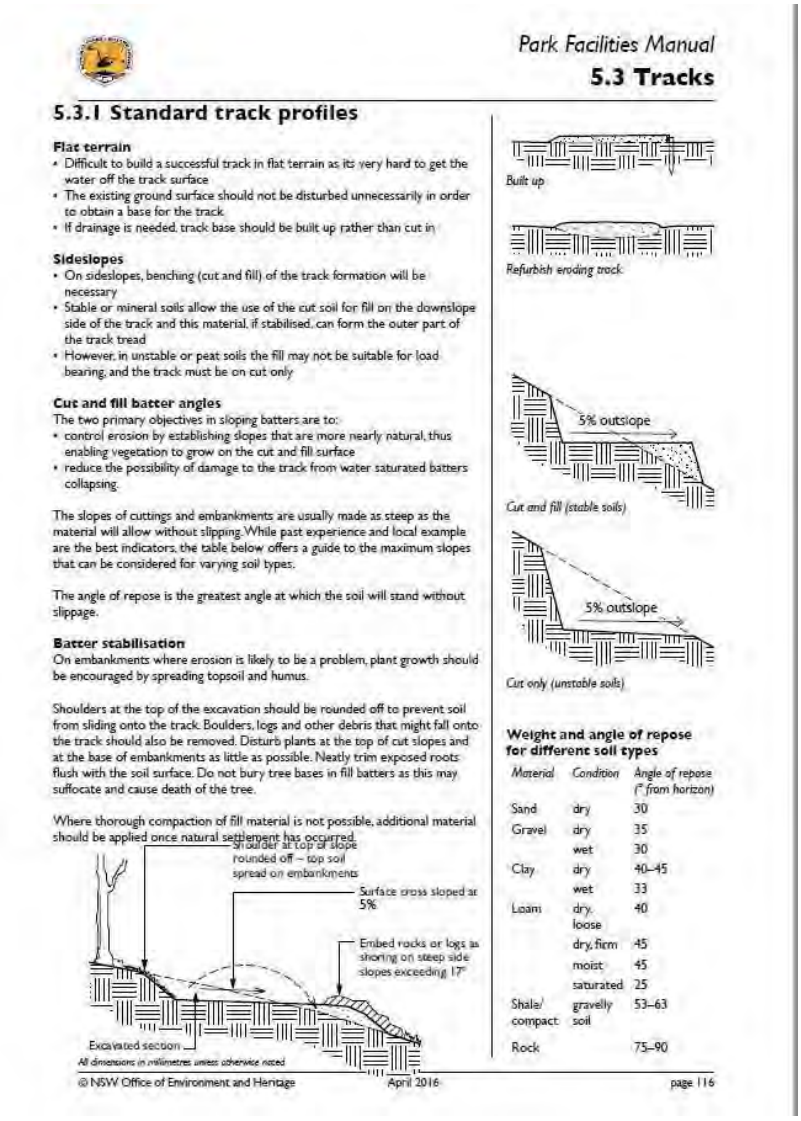
Work Section No.	123
Track Category	New Track
Length (m)	120
Cross Slope (%)	20 - 50
Vegetation	Thick melaleuca
Gradient (%)	10
Substrate	soil
Descriptions/ Comments	Route continues contouring along slope to arrive at lighthouse complex. Can adjust route to that marked to improve separation from lighthouse and optimize coastal views.
Recommended Work (Text Details)	Machine benching.
Machine benching (m)	120
Clear vegetation (Person Days)	1

Construction Techniques

Machine Benching

The majority of the new track alignment can be built by mini excavator. It is recommended that track width by maximum of 800mm. Mini excavators with vehicle width of one metre or less are recommended to minimise the tendency to build to the width of the excavator. Page 114 of the NPWS Parks Facilities Manual 5.3.1 Standard Track Profiles should be used as a guide in new track formation.

Typical small excavator suitable for walking track construction



Park Facilities Manual

5.3 Tracks

5.3.1 Standard track profiles

Flat terrain

- Difficult to build a successful track in flat terrain as its very hard to get the water off the track surface
- The existing ground surface should not be disturbed unnecessarily in order to obtain a base for the track
- If drainage is needed, track base should be built up rather than cut in

Sideslopes

- On sideslopes, benching (cut and fill) of the track formation will be necessary
- Stable or mineral soils allow the use of the cut soil for fill on the downslope side of the track and this material, if stabilised, can form the outer part of the track tread
- However, in unstable or peat soils the fill may not be suitable for load bearing, and the track must be on cut only

Cut and fill batter angles

The two primary objectives in sloping batters are to:

- control erosion by establishing slopes that are more nearly natural, thus enabling vegetation to grow on the cut and fill surface
- reduce the possibility of damage to the track from water saturated batters collapsing.

The slopes of cuttings and embankments are usually made as steep as the material will allow without slipping. While past experience and local example are the best indicators, the table below offers a guide to the maximum slopes that can be considered for varying soil types.

The angle of repose is the greatest angle at which the soil will stand without slippage.

Batter stabilisation

On embankments where erosion is likely to be a problem, plant growth should be encouraged by spreading topsoil and humus.

Shoulders at the top of the excavation should be rounded off to prevent soil from sliding onto the track. Boulders, logs and other debris that might fall onto the track should also be removed. Disturb plants at the top of cut slopes and at the base of embankments as little as possible. Neatly trim exposed roots flush with the soil surface. Do not bury tree bases in fill batters as this may suffocate and cause death of the tree.

Where thorough compaction of fill material is not possible, additional material should be applied once natural settlement has occurred.

All dimensions in millimetres unless otherwise noted

Built up

Refurbish eroding track

Cut and fill (stable soils)

Cut only (unstable soils)

Weight and angle of repose for different soil types

Material	*Condition*	*Angle of repose (° from horizon)*
Sand	dry	30
Gravel	dry	35
	wet	30
Clay	dry	40–45
	wet	33
Loam	dry, loose	40
	dry, firm	45
	moist	45
	saturated	25
Shale/ compact	gravelly soil	53–63
Rock		75–90

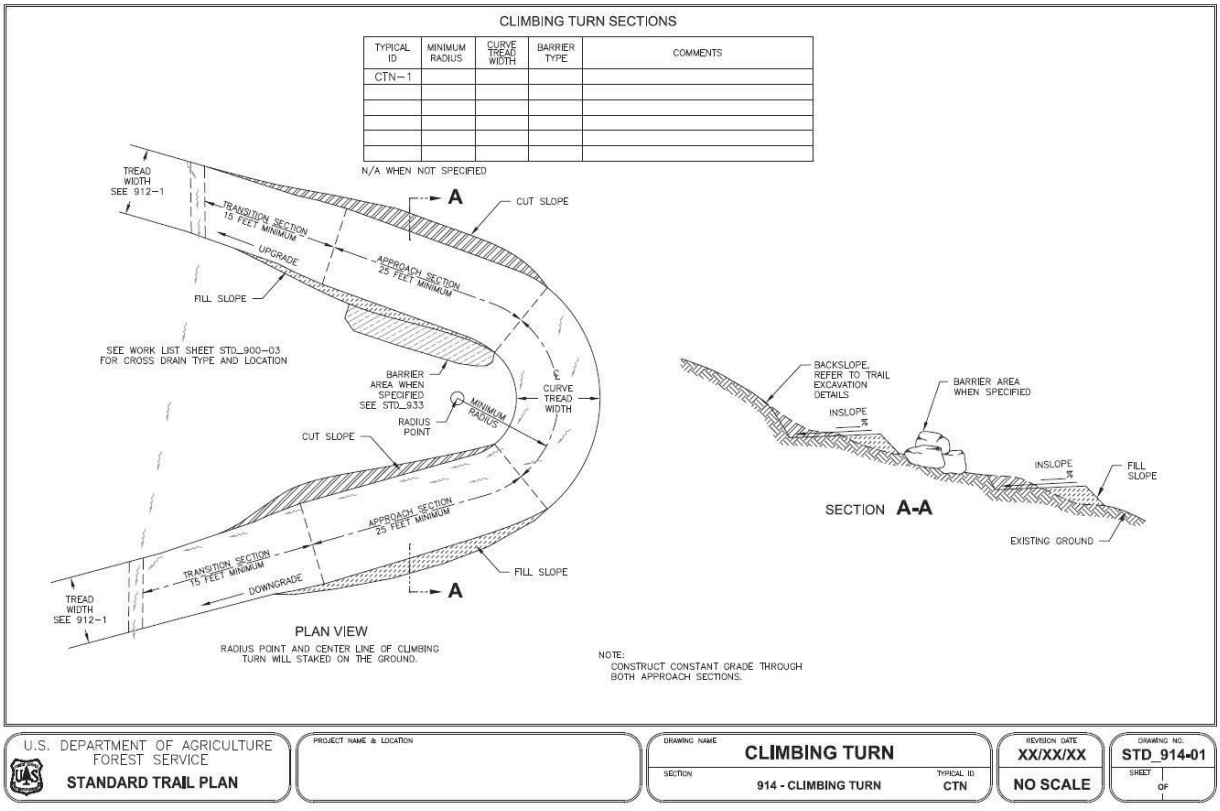
Hand Benching

Hand benching is recommended on steep cross slopes, where it may be impractical to use a mini-excavator. All hand benching should be a full bench where the entire tread is benched into the hill slope. This means that the track surface is completely solid and is not partly using the excavated fill to form the track surface. The down slope fill batter should have cut vegetation pulled over it to reduce the short term bareness of the slope and will assist in vegetation re-establishing. The upslope cut batter should be shaped at an approximately uniform angle leaning back slightly into the slope. All exposed root material should be trimmed flush. The photos show two fully benched tracks on hill slopes greater than 25º.


Examples of full bench done by hand

Climbing Turn

Climbing turns are built to change direction across the fall line without an abrupt change in direction. They do not require the construction of a platform, such as occurs in a switchback. They enable better separation of the upper and lower potions than a switch backed track. Climbing turns need a wide radius and require a grade dip or water bar just before turning directly through the fall line. Consideration needs to be made to site climbing turns to prevent shortcutting by using local features such as large trees or rock outcrops. If obstacles are not available manoeuvring logs or rocks to discourage shortcutting may be necessary.



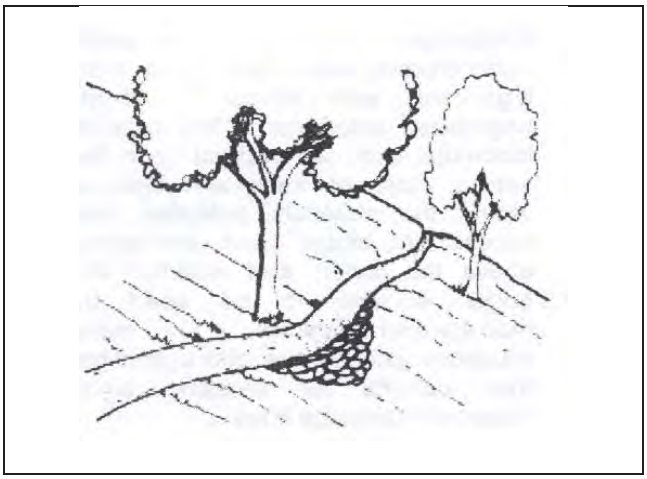
Principles of climbing turn design


Examples of climbing turns

Rock Retaining Wall

Retaining walls are built on the lower side of the track where slippage or erosion occurs. They are particularly useful when benching a track on a slope and it necessary to go around a large tree or boulder, which cannot be removed, and to go above or below would dramatically alter the track gradient. In areas of slippage they are also useful to build up the track edge to prevent it from collapsing down slope.

The best retaining walls are built from interlocking rock, which is constructed in an off-vertical manner (i.e. the wall leans into itself with the base being wider than its top). A strong foundation is required for a good retaining wall. The wall is backfilled with rubble and gravel/soil, which allows free drainage, preventing the build-up of water/moisture behind the wall, which could push it out. The diagram shows typical stone retaining wall around a large obstacle. The photo shows a retaining wall which was constructed around a rock outcrop.

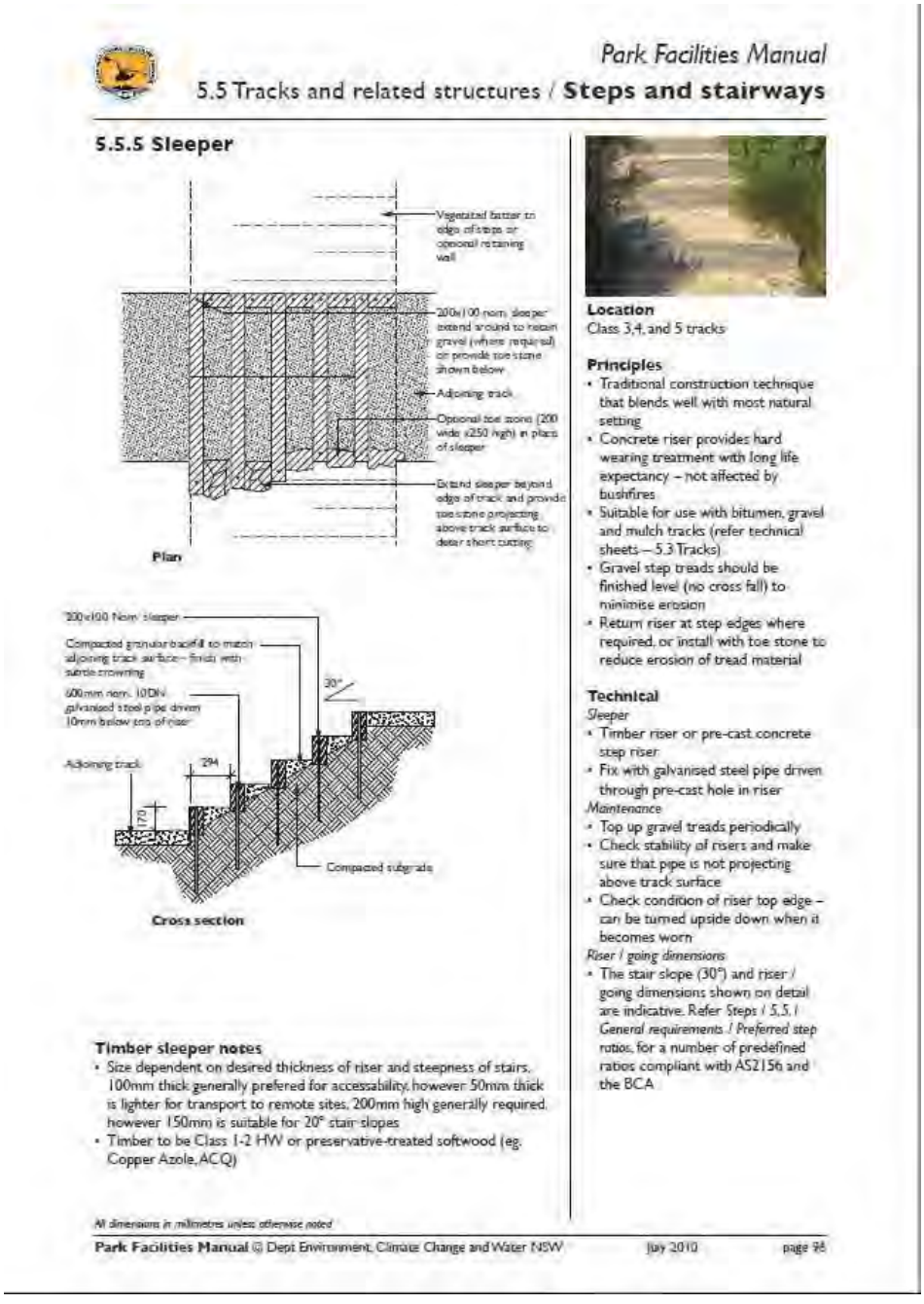



Examples of rock retaining walls

Timber Steps

Timber steps have been recommended where the gradient is too steep for a graded surface. Page 96 of the NPWS Parks Facilities Manual 5.5.5 Steps and Stairways can be used as a guide for step construction. For the coast track the existing and new steps are recommended to be from half split tread pine rounds in preference to straight edged timber sleepers. The recommended dimensions are 900x200x100 with two pre-drilled holes for staking with galvanised pipe.

Example of half round TP timber steps
(Edge rocks seen here are not necessary on most of the Coast Track steps)



5.5.5 Sleeper

Location
Class 3,4, and 5 tracks

Principles
- Traditional construction technique that blends well with most natural setting
- Concrete riser provides hard wearing treatment with long life expectancy – not affected by bushfires
- Suitable for use with bitumen, gravel and mulch tracks (refer technical sheets – 5.3 Tracks)
- Gravel step treads should be finished level (no cross fall) to minimise erosion
- Return riser at step edges where required, or install with toe stone to reduce erosion of tread material

Technical
Sleeper
- Timber riser or pre-cast concrete step riser
- Fix with galvanised steel pipe driven through pre-cast hole in riser

Maintenance
- Top up gravel treads periodically
- Check stability of risers and make sure that pipe is not projecting above track surface
- Check condition of riser top edge – can be turned upside down when it becomes worn

Riser / going dimensions
- The stair slope (30°) and riser / going dimensions shown on detail are indicative. Refer *Steps / 5.5.1 General requirements / Preferred step ratios*, for a number of predefined ratios compliant with AS2156 and the BCA

Timber sleeper notes
- Size dependent on desired thickness of riser and steepness of stairs. 100mm thick generally prefered for accessability, however 50mm thick is lighter for transport to remote sites, 200mm high generally required, however 150mm is suitable for 20° stair slopes
- Timber to be Class 1-2 HW or preservative-treated softwood (eg. Copper Azole, ACQ)

All dimensions in millimetres unless otherwise noted

Chiselled Steps

Where the track ascends over large boulder and rock slab surfaces, well planned and crafted rock chisel can form a stepped surface to safely ascend a potentially hazardous or awkward natural surface. Rock chiselling can avoid the need to install ugly and intrusive staircase or the expense and difficulty of building stone steps over a rock surface.

Chiselled steps in Ku-ring-Gai Chase NP

Chiselled steps in Royal NP

Stepping Stones

Rock inserted into a drainage line at regular intervals can form a pleasant and easy means to cross a shallow creek or poorly drained area via stepping stones.

Example of stepping stones through a creek which floods in Lamington NP, Qld

Stepping stones across an intermittent creek in Anakie Gorge, Victoria