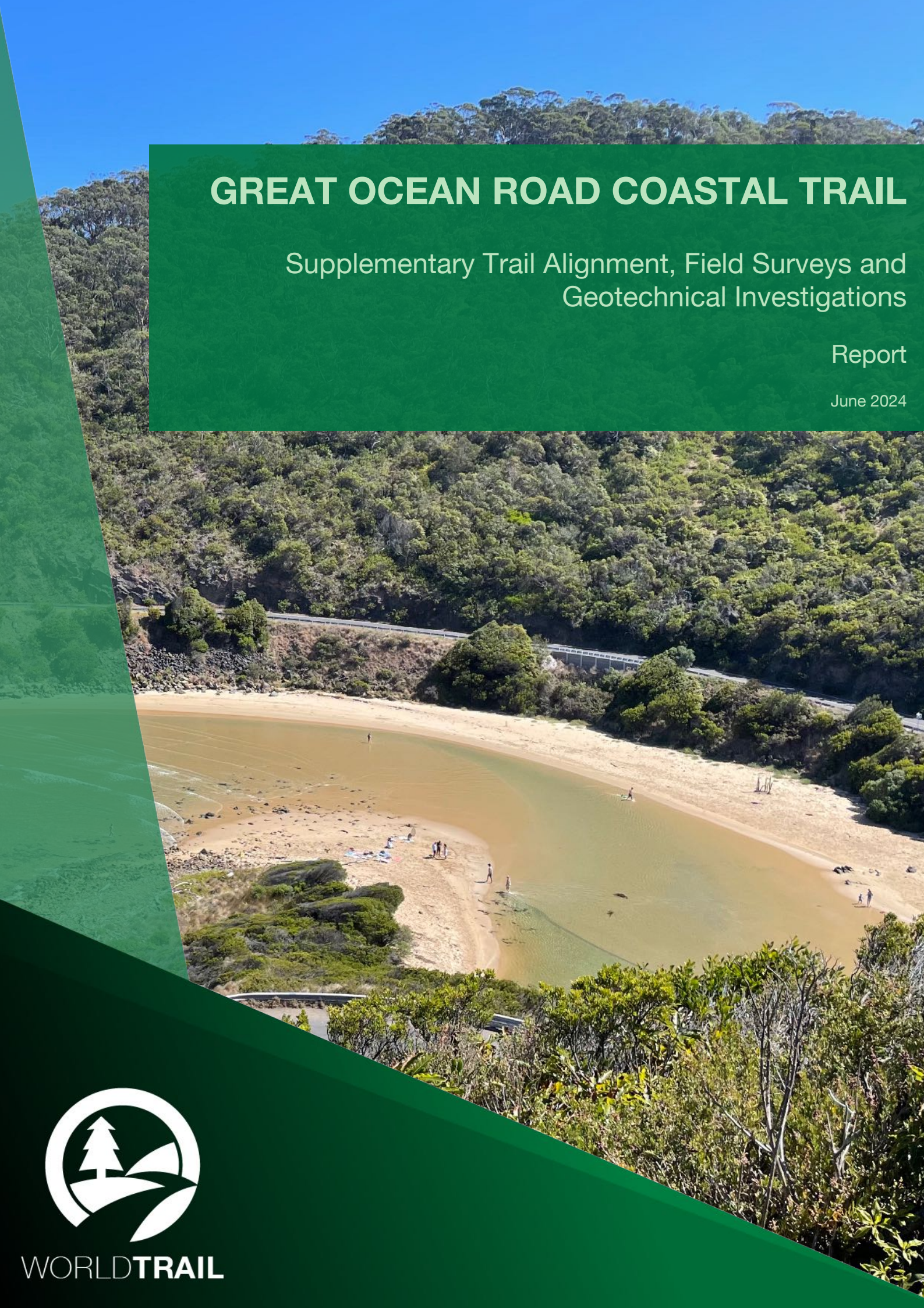
GREAT OCEAN ROAD COASTAL TRAIL

Supplementary Trail Alignment, Field Surveys and Geotechnical Investigations

Report

June 2024



WORLDTRAIL

World Trail acknowledges the Eastern Maar as the Traditional Custodians of the Lands, Waters, and Skies that includes the Great Ocean Road Coastal Trail, and pay respect to their elders, past and present.

We acknowledge and respect their continuing culture and the contribution they make to the local and regional communities.

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Document Name: Great Ocean Road Coastal Trail – Supplementary Trail Alignments
Document Version: Final
Release Date: 12 June 2024

Revisions:

Issue	Description	Date	Reviewed By
01	Progress Draft for Client Review	28 March 2024	Will Rayner
02	Progress Draft for Client Review	28 March 2024	Will Rayner
03	Draft Report	31 May 2024	Gerard McHugh
04	Final Report	11 June 2024	Will Rayner & Gerard McHugh

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1 EXECUTIVE SUMMARY

The Great Ocean Road Coastal Trail (GORCT) is a proposed 76km walking trail between Fairhaven and Grey River. The trail currently has a well-developed ground-truthed route including a mixture of new and existing trails (footpaths, management vehicle trails and existing walking trails), along with a range of supporting infrastructure including bridges, lookouts and a hiker campground.

The GORCT Master Plan was completed in December 2022 followed by the Planning and Design Report in February 2023. These documents and the associated spatial data provide the basis for the route and its construction. Note that route from Grey River to Skenes Creek has since been excluded from this project due to significant complexities, uncertainties and costs associated with this section.

The Geotechnical Risk Assessment (Golder, 2022 November) undertaken along the final trail alignment identified four sections of trail—one segment just above tolerable and three approaching the upper reaches of tolerable—where risk mitigation measures might be possible to reduce the cumulative geotechnical risk within their respective trail segments. In addition, since completing the project the Phytophthora (PC) Dieback Management Report (State of the Environment, 2023 October) has been completed that identifies a few sections of trail for possible realignments to reduce the risk of PC infection. As such, minor trail realignments and geotechnical risk assessment and mitigation recommendations are required to enable formal planning approvals and construction to proceed. For any proposed realignment, it is necessary to undertake ecological assessments to determine the ecological impact for feasibility and planning purposes. The ecological assessments were undertaken by Biosis, and the Biosis, 2022, *Great Ocean Road Coastal Trail Flora and Fauna Assessment* has been updated accordingly.

This report is focussed on the recommended PC trail realignments but includes a high-level summary of the proposed mitigation strategies for the identified areas of geotechnical risk – the complete detail of which is provided in the Geotechnical Risk Mitigation Report, May 2024, completed by WSP Geotechnical. The report also includes an assessment of the two stepping stone crossings along the existing Cumberland River Walk trail (trail to Jebbs Pool), to consider possible alternative design solutions to that which was recommended in the Planning and Design Report.

Trail Realignments

Three sections of trail were realigned in response to the Phytophthora Dieback Management Report. A fourth section of realignment at the beginning of the walk was assessed—its possible use pending further negotiation with a private landowner regarding potential access arrangements—for the improved walk experience it provides. These four sections were ground-truthed and mapped and are summarised in the following table. The three PC realignments result in a net reduction in vegetation removal of 610m^2.

The new trail realignments have been recorded in the GIS dataset as new trail alignment: Ground-truthed Route 3.

The ecological assessments that were undertaken along each of the four proposed trail realignments did not identify any values of significance requiring that the realignments be modified or reconsidered.

No geotechnical risk assessments were undertaken along the proposed trail realignments on the basis that they are all located in areas that had previously been mapped as Very Low to Low for rockfall hazard (*Great Ocean Road Trail – Geotechnical Hazard Assessment*, Golder Associates Pty Ltd, April 2022).

Trail Realignment Section	Net increase/decrease new trail (m)	Net increase/reduction vegetation clearing (m^2) [1]
Coalmine Creek East	-169	-422.5
Coalmine Creek West	-5	-12.5
Reedy Creek East	-70	-175.0
Subtotal PC realignments	***-244***	***-610.0***
Gentle Annie	724	1810.0
Subtotal other realignments	***724***	***1810.0***
Total	***480***	***1200.0***

Geotechnical Risk Mitigation Measures

Eleven discreet sites were assessed for potential risk mitigation measures. The only section of trail that was just above the acceptable range for cumulative risk was between Cumberland River and Wye River. This section contained three high risk locations along the Cumberland River Walk—a popular existing trail—and another high risk location along the proposed new trail alignment leading from the river walk up to Langdale Pyke lookout. At the three high-risk areas along the trail the respective mitigation strategies were assessed as achievable and appropriate:

- Micro-rerouting of the trail to avoid the risk.
- Hazard signage to warn walkers of the risk and encourage that they move through the site without lingering.
- Physical removal of loose rock from above the trail (moved to downslope side).

The other areas were all within the tolerable risk range and the risk level was reduced further following detailed assessment and minor mitigation recommendations.

Stepping Stones

Having assessed the two crossings along the Cumberland River Trail it is recommended that the design considerations and construction methodology outlined in the Planning and Design Report remains the most cost effective and least impactful solution. The design methodology entails:

- Moving/manipulating large, selected boulders from the surrounding area (using techniques such as winching), which are large enough to resist movement.
- Where possible, secure the boulders more securely using grouted anchors.

Should flooding impact the crossings (i.e. displace the boulders) and become an ongoing management issue, then the alternative construction options should be considered, including:

- Cast (in-situ or pre-cast) concrete stones either gravity or anchored to the bedrock.
- Using a concrete strip footing foundation to more securely fix boulders in place.
- Small suspension bridges above the high-water mark.

[1] Vegetation impact/removal is based on a 2.5m trail corridor as applied in the Biosis, 2022, *Great Ocean Road Coastal Trail Flora and Fauna Assessment* (1 metre built trail surface and a 0.75 metre construction buffer either side of the trail surface to allow for earthworks and drainage). The Great Ocean Road Coastal Trail Style Guide and Construction Manual (being developed at the time of writing this report) has slightly modified this figure to a 2.4m corridor.

2 INTRODUCTION

The Great Ocean Road Coastal Trail (GORCT) is a proposed 76km walking trail between Fairhaven and Grey River. The trail currently has a well-developed ground-truthed route including a mixture of new and existing trails (footpaths, management vehicle trails and existing walking trails), along with a range of supporting infrastructure including bridges, lookouts and a hiker campground.

The GORCT Master Plan was completed in December 2022 followed by the Planning and Design Report in February 2023. These documents and the associated spatial data provide the basis for the route and its construction. Note that route from Grey River to Skenes Creek has since been excluded from this project due to significant complexities, uncertainties and costs associated with this section.

The Geotechnical Risk Assessment (Golder, 2022 November) undertaken along the final trail alignment identified a number of sections of trail risk mitigation measures might be possible to reduce the cumulative geotechnical risk—one segment just above tolerable and three approaching the upper reaches of tolerable—within their respective trail segments. In addition, since completing the project the Phytophthora (PC) Dieback Management Report (State of the Environment, 2023 October) has been completed that identifies a few sections of trail for possible realignments to reduce the risk of PC infection. As such, minor trail realignments and geotechnical risk assessment and mitigation recommendations are required to enable formal planning approvals and construction to proceed. For any proposed realignment, it is necessary to undertake ecological assessments to determine the ecological impact for feasibility and planning purposes. The ecological assessments were undertaken by Biosis, and the Biosis, 2022, *Great Ocean Road Coastal Trail Flora and Fauna Assessment* has been updated accordingly.

2.1 PROJECT SCOPE

The key project components are:

1. **Trail Realignments to avoid the spread of Phytophthora**
   Three areas of track need further trail treatments or realignment based on the Phytophthora Dieback Management Report:
- Coalmine Creek East (Trails 14/15)
- Coalmine Creek West (Trail 19)
- Reedy Creek East (Trail 41)

2. **Geotechnical Investigations**
   The *Geotechnical Risk Assessment Report (Golder, 2022 December)* identified four segments of the trail – containing a total of eleven discreet sites – where the cumulative risk outcome was not acceptable or within the upper reaches of tolerable. These sites were identified for potential risk mitigation measures to reduce the geotechnical risk within their respective trail segments. The four trail segments for investigation were:
- Cumberland River to Wye River – Cumberland River Walking Trail, Trail 55
- South Lorne to Cumberland – Tramway Track, Trail 47
- Fairhaven to North Lorne – Trail 45
- North Lorne to South Lorne – Bert Alsop Track, Trail 46a

3. **Cumberland River Stepping Stone River Crossings**
   Further assessment of the two stepping stone crossings along the Cumberland River Walk to consider options for an alternative methodology and/or design specification to assist with construction.

4. **Flora and Fauna Surveys**
   Flora and Fauna investigations are required for all realigned trail sections. The new alignments and assessment details and recommendations are to be updated in the Biosis, 2022, *Great Ocean Road Coastal Trail Flora and Fauna Assessment*.

5. **Reissue Geospatial Data**
   Updating of the GIS mapping and dataset to incorporate the new trail alignments.

This report is focussed on the recommended PC trail realignments but includes a high-level summary of the proposed mitigation strategies for the identified areas of geotechnical risk – the complete detail of which is provided in the Geotechnical Risk Mitigation Report, May 2024, completed by WSP Geotechnical. The report also includes an assessment of the two stepping stone crossings along the existing Cumberland River Walk trail (trail to Jebbs Pool).

3 TRAIL REALIGNMENTS

This section provides a summary of the issue and assessment for each proposed realignment. The final proposed trail realignments have been mapped into the GIS database as the updated final trail layer: Ground-truthed Route 3. Each realignment summary includes two maps: one showing the original trail alignment, Ground-truthed Route 2, and another showing the updated alignment, Ground-truthed route 3.

3.1 PHYTOPHTHORA REALIGNMENTS

3.1.1 Coalmine Creek East (Trails 14/15)

Issue

A section of trail 14 and 15 passes through an area that is impacted by Phytophthora dieback. It is recommended to realign these sections of trail along the existing fire management roads to the northwest to reduce the risk of spreading Phytophthora. Using the fire management track has an added advantage of reducing the amount of native vegetation removal.

Assessment

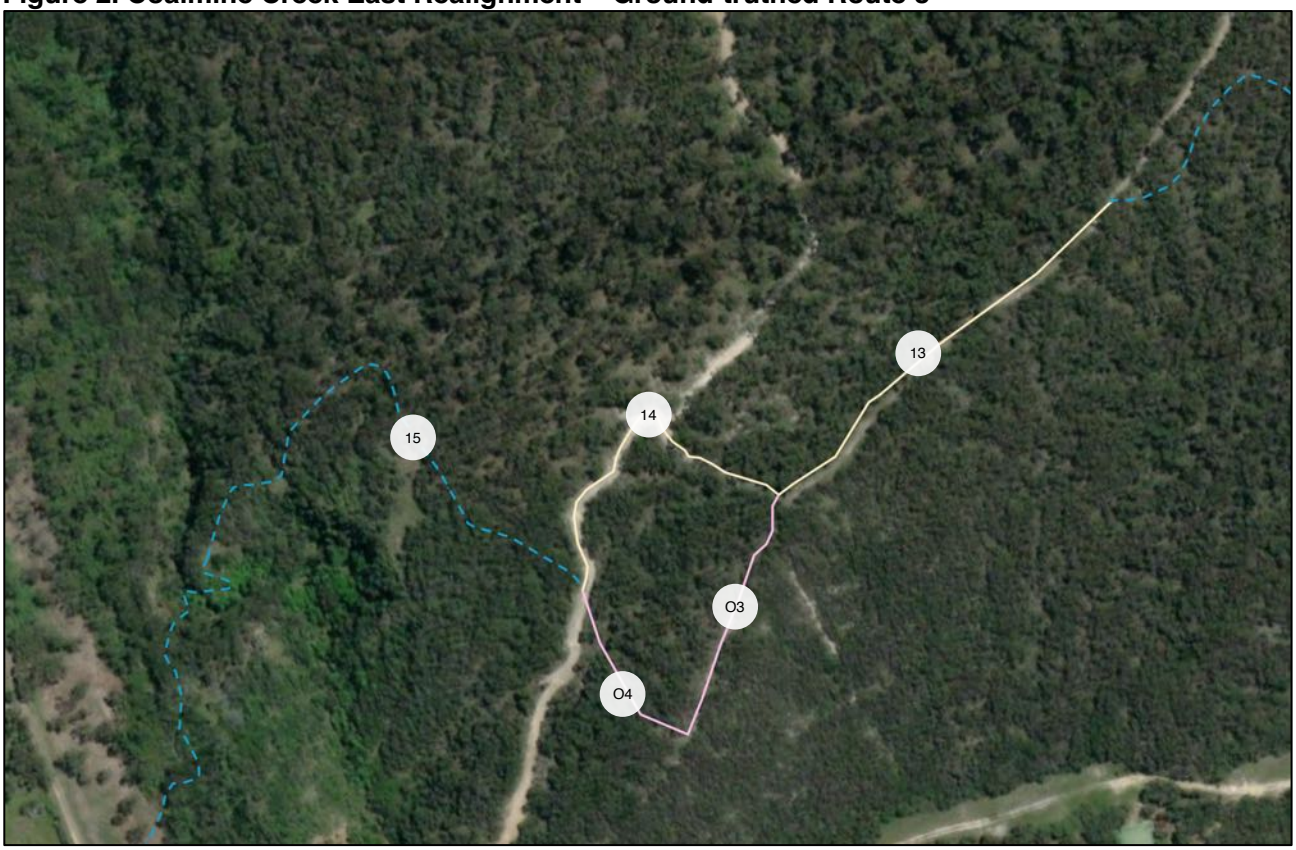
The recommended alternative route was assessed as acceptable. Although the realignment will take walkers off a portion of single track, it is only for a short section along a relatively pleasant management vehicle track. The gradient descending to reconnect with Trail 15 does get above 20 per cent, however this is still within the tolerance for a Grade 3 walking trail as it is only for approximately 30 metres and the surface is stable under foot.

Realignment Details

	Trail name	Trail type	Construction treatments	Trail length (m)
New trail section/s	Trail 14	Existing MVO Track	• No works required	142
Obsolete trail section/s	Obsolete 3 (formerly Trail 14)	Existing Informal Trail	• 107 steps	98
	Obsolete 4 (formerly part of Trail 15)	New Walking Trail	• Standard bench construction	71
Net increase/decrease vegetation impact (metres of trail)				-169m

Figure 1. Coalmine Creek East Realignment – Ground-truthed Route 2

Figure 2. Coalmine Creek East Realignment – Ground-truthed Route 3



3.1.2 Coalmine Creek West (Trail 19)

Issue

The existing informal vehicle and motorbike trail that was used for Trail 19 has since been constructed into a steep five-metre-wide fire containment line. To make it appropriate for walkers, the new fire break will require stairs along one edge, or the trail will need to be realigned.

The area also contains a community of high-value grass trees, which need to be protected from Phytophthora infection. A 100 metre boardwalk and boot wash station is recommended at each end.

Assessment

The newly constructed fire containment line along Trail 19 is shown in Figure 3 below. Construction of stairs along one edge of the steep fire break was not considered a suitable outcome, especially due to the likelihood of damage when the fire containment line is maintained. Trail realignments to both the north and south were therefore investigated.

The proposed southerly alignment was shorter and provided better views, however the vegetation was relatively dense with healthy grass trees. The northerly alignment was longer through more open forest, and also avoided using the small section of public gravel road adjacent to a few residential houses.

The two alignments were referred to DEECA to provide an informed judgement on which of the proposed trail alignments and trail treatments would most effectively reduce the risk of spreading Phytophthora. Expert advice back to DEECA advised that protecting the vegetation community to the south (on the downslope) from Phytophthora infection had now been significantly compromised due to the unmanaged soil disruption caused during reinstatement of the fire containment line; the contaminated soil particles were now likely to be carried downslope during wet conditions. Notwithstanding that Phytophthora prevention measures (protective spraying) are going to be undertaken by DEECA / PV along the fire containment line, having a trail through the southern section is not considered to be a likely primary source of possible infection risk, particularly if other mitigation measures are included in the trail design.

The southern realignment was therefore preferred as it provides a quality user experience and presents an opportunity to incorporate elements of public education about the significance of the grass tree habitat. The mitigation measures to be included in the trail design include a boot-wash station at either end and a section of boardwalk through the community of grass trees.

Figure 3. New fire control line over Trail 19

Realignment Details

	Trail name	Trail type	Construction treatments	Trail length (m)
New trail section	Trail 19b	New Walking Trail	• Standard bench construction. • 100m of boardwalk. • Two sections of stairs totaling 57 steps. • Boot wash station at either end.	217
Removed trail section	Obsolete 5 (formerly part of Trail 19)	Existing informal trail	• Existing Informal Trail (now Fire containment line) • 98 steps	222
Net increase/decrease vegetation impact (metres of trail)				-5m

Figure 4. Coalmine Creek West Realignment – Ground-truthed Route 2

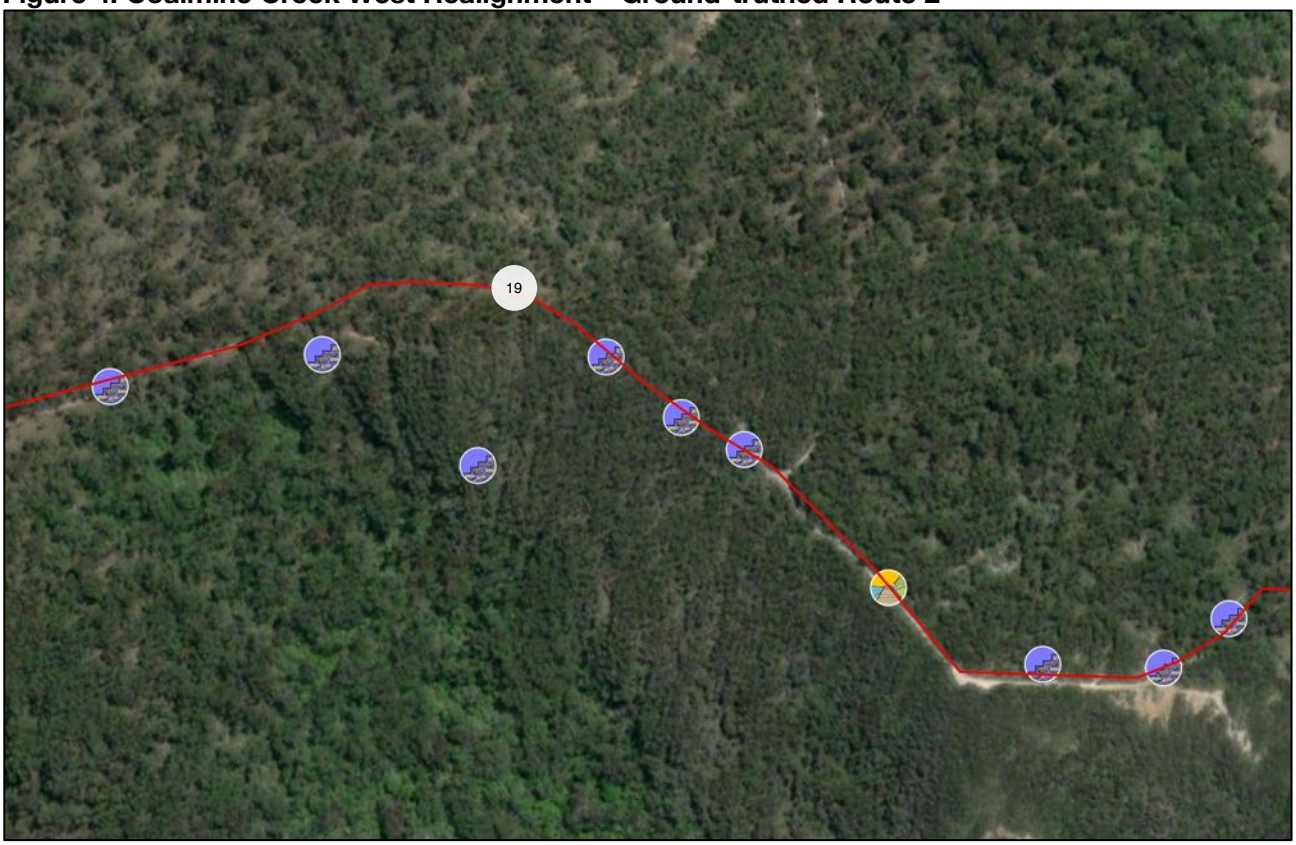


Figure 5. Coalmine Creek West Realignment – Ground-truthed Route 3

3.1.3 Reedy Creek East (Trail 41)

Issue

As identified in the Phytophthora Dieback Management Report, Trail 41 alignment passes through high-quality uninfected remnant vegetation dominated by grass trees. To reduce the risk of infection, it is suggested to move the trail to the south, so any water runoff from the trail drains away from the uninfected area.

Assessment

Trail 41 crosses a wide powerline easement that runs steeply to the south. Consideration was given to using this easement as the trail alignment to move it below the uninfected grass tree community, but it was decided the experience along the easement was not in keeping with the objectives of a world class walking experience.

An alternative alignment linking a couple existing vehicle tracks was a preferred alignment, as it provided a pleasant walking experience and delivers a net reduction of new trail. This alignment heads south along an old, well-vegetated vehicle track (Trail 41b) before branching off west through open forest (Trail 41c) to link with another narrow and suitably pleasant vehicle track (Trail 41d). The final section of the realignment (Trail 41e) is new trail that contours down to the Reedy Creek Bridge.

Realignment Details

	Trail name	Trail type	Construction treatments	Trail length (m)
New trail sections	Trail 41b	Existing MVO Track	• No works required.	153
	Trail 41c	New Walking Trail	• Standard bench construction	227
	Trail 41d	Existing MVO Track	• No works required.	279
	Trail 41e	New Walking Trail	• Standard bench construction. • One short (3m) low-level bridge	414
Removed trail section	Obsolete 6 (formerly part of Trail 41)	New Walking Trail	• Standard bench construction	711
Net increase/decrease vegetation impact (metres of trail)				-70m

Figure 6. Reedy Creek East Realignment – Ground-truthed Route 2

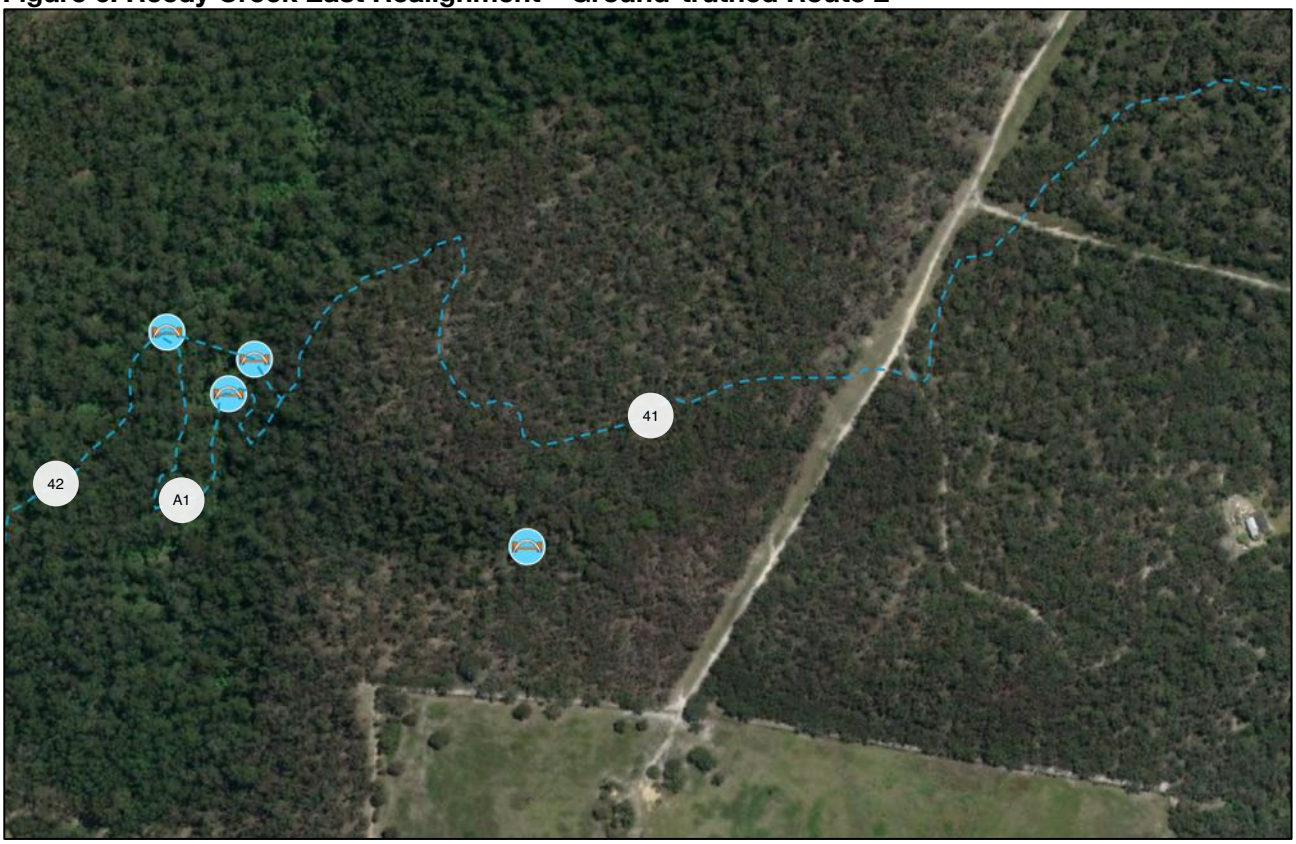


Figure 7. Reedy Creek East Realignment – Ground-truthed Route 3

3.2 OTHER REALIGNMENTS

3.2.1 Gentle Annie Realignment (Trail 7)

Issue

The start of the walk is currently along approximately 4km of management vehicle track before joining with dedicated walking trail. To improve this experience at the start of the walk a more direct conceptual trail alignment through private land had previously been explored. The landowner was not supportive at the time; however, discussions are ongoing and the landowner has since become more open to the possibility.

Assessment

A condition of the potential realignment was that it could start no sooner than near the end of Gentle Annie MVO track (Trail 6). The most direct alignment from this point through to the Dam View Walk (Trail 8) was walked and mapped, ensuring the gradient stayed below ten percent. This more direct trail alignment will remove approximately 830m from the indirect start to the walk, 500m of which is along MVO track that includes a steep climb.

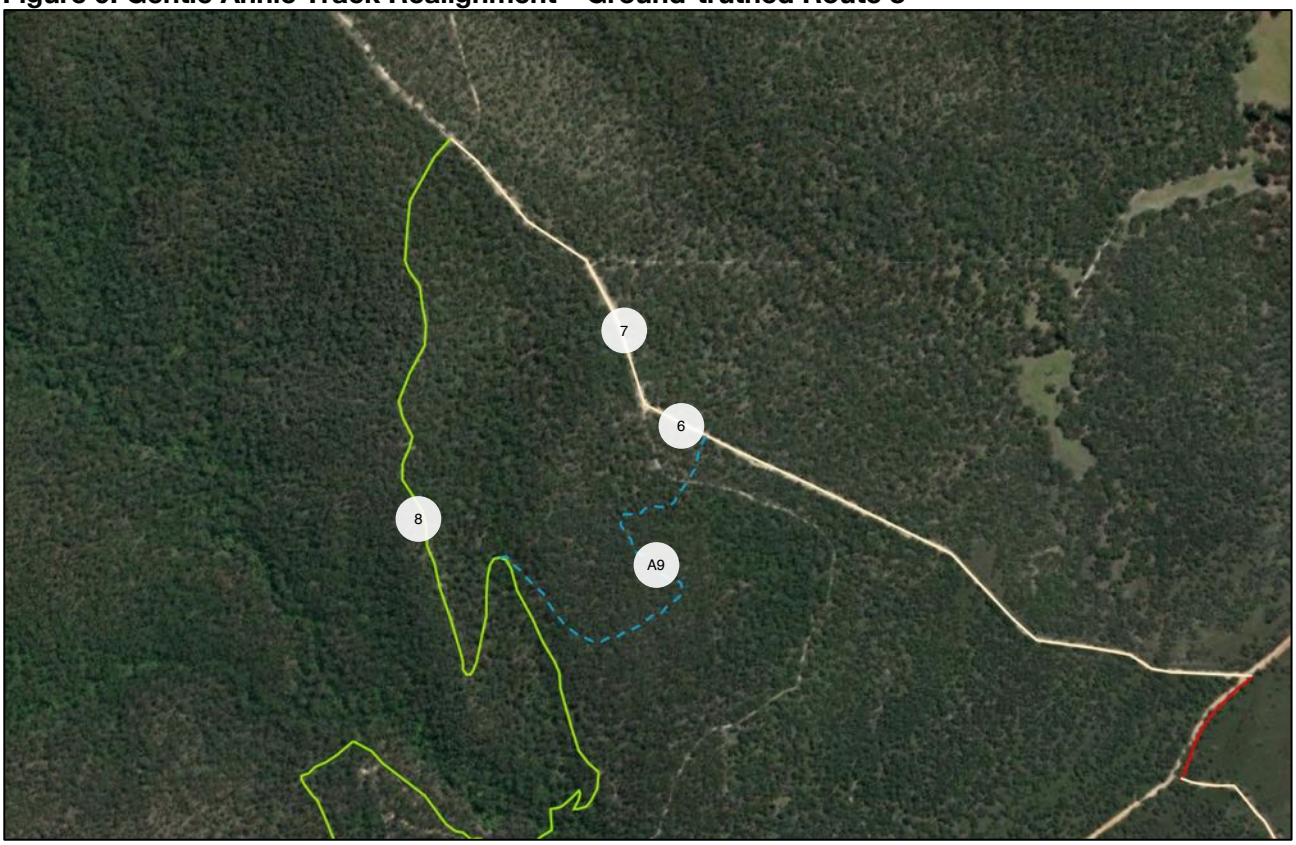
Note – this proposed realignment remains conceptual only. It is included in Ground-truthed Route 3 as an Alternate Trail for further investigation and consideration by DEECA, subject to discussions with the landowner.

Realignment Details

	Trail name	Trail type	Construction treatments	Trail length (m)
New trail section	Alternate Trail 9	New Walking Trail	• Standard bench construction.	724
Removed trail sections	Trail 7	Existing MVO Track	• No works required.	512
	Trail 8 (partial)	Existing Walking Trail	• No works required	1060
Net increase/decrease vegetation impact (metres of trail)				+724m

Figure 8. Gentle Annie Track Realignment – Ground-truthed Route 2

Figure 9. Gentle Annie Track Realignment – Ground-truthed Route 3



4 GEOTECHNICAL INVESTIGATIONS

The Geotechnical Risk Assessment (Golder, 2022 November) identified eleven discreet sites along four of the trail segments as being suitable for potential risk mitigation measures to reduce the cumulative geotechnical risk within their respective trail segments.

Eleven discreet sites were assessed for potential risk mitigation measures. The only section of trail that was just above the acceptable range for cumulative risk was between Cumberland River and Wye River. This section contained three high risk locations along the Cumberland River Walk—a popular existing trail—and another high risk location along the proposed new trail alignment leading from the river walk up to Langdale Pyke lookout. At the three high-risk areas along the trail the respective mitigation strategies were assessed as achievable and appropriate:

- Micro-rerouting of the trail to avoid the risk.
- Hazard signage to warn walkers of the risk and encourage that they move through the site without lingering.
- Physical removal of loose rock from above the trail (moved to downslope side).

All eleven sites were assessed for practical mitigation strategies, with the corresponding recommendations reducing the cumulative risk along all four segments of trail to a more tolerable level. Many of the mitigation recommendations require pre and post construction input and assessment from a qualified geotechnical specialist to ensure the mitigation works are appropriately delivered.

The Geotechnical Investigations Report provides the full detail of the assessments and recommendations, along with map, however a summary table is provided on the following page.

Trail No.#	Sector#	Location Coordinates (Start/End)#	Trail Segment	Chainage	Location	Hazard	Length	Drawing Sheet	Mitigation Measures	Geotechnical Input/Assessment	
										Pre-construction	Post-construction
Trail 34	2. Spout Creek to Lily Pond Reserve	-38.492615, 144.009969 -38.496739, 144.008672	Fairhaven to North Lorne (FL)	CH17820 - CH18440	Big Hill	Cut Batter	620 m	1	Rock scaling, local trimming where slope angles are vertical or overhanging, selected vegetation removal, construction of a rock catch ditch.	Yes. Geotechnical engineer to identify select rocks to be scaled, select areas of slope to be trimmed and select vegetation to be removed.	Yes. Inspection of completed works to ensure risk has been reduced.
Trail 45 & 46a	3. Lily Pond Reserve to Cumberland River	-38.520939, 143.988454-38.533361, 143.977768	North Lorne to South Lorne (L)	CH25620 - CH27320	Lorne Foreshore	Fill Batter	1700 m	2	Hazard removed if high-tide route is utilised. Provide signage to warn walkers of the hazard during low tide.	No	No
Trail 46c	3. Lily Pond Reserve to Cumberland River	-38.544929, 143.981346 -38.546247, 143.983374	North Lorne to South Lorne (L)	CH28920 - CH29150	Shipwreck Trail	Fill Batter	230 m	3	Development of alternative inland route out of Lorne reduces the number of walkers exposed to hazard.	No	No
Trail 47	3. Lily Pond Reserve to Cumberland River	-38.553765, 143.982204 -38.551961, 143.973836	South Lorne to Cumberland River (LC)	CH30330 - CH31310	Old Tramway	Cut Batter	980 m	4	1) Scaling of loose rock from cut face. 2) Development of alternative inland route out of Lorne reduces the number of walkers exposed to hazard. 3) Micro-rerouting to avoid a section of the geotechnical hazard. 4) Rock netting. Options 1 and 2 combined reduce risk to a tolerable range. If preferred, the risk may be further reduced by implementing options 3 and 4.	1) Yes. Geotechnical engineer to identify select rocks to be scaled. 2) No. 3) Yes. Geotechnical engineer to ensure hazard is avoided. 4) N/A detailed design required.	1) Yes. Inspection of completed works to ensure risk has been reduced. 2) No. 3) Yes. Inspection of completed works to ensure risk has been reduced. 4) N/A detailed design required.
Trail 55	4. Cumberland River to Jamieson Creek	-38.572787, 143.946772 -38.572133, 143.945399	Cumberland River to Wye River (CW)	CH41900 - CH42050	Cumberland Campground	Rockfall	150 m	5	Micro-rerouting of trail to avoid geotechnical hazard.	Yes. Geotechnical engineer to ensure adequate setback distance from hazard.	Yes. Inspection of completed works to ensure risk has been reduced.
Trail 55	4. Cumberland River to Jamieson Creek	-38.568752, 143.945377 -38.568299, 143.944616	Cumberland River to Wye River (CW)	CH42520 - CH42620	Cumberland River	Rockfall	100 m	5	Provide signage to warn walkers of the hazard. Signage alone does not reduce risk of hazard, but the overall trail segment risk is decreased from mitigation measures at other hazards.	No	No
Trail 56	4. Cumberland River to Jamieson Creek	-38.566829, 143.942263 -38.567345, 143.9417	Cumberland River to Wye River (CW)	CH43350 - CH43450	Cumberland Hill	Rockfall	100 m	5	Scaling of loose rock from the slope above the track. Placing natural protection, such as existing fallen trees, to catch rock.	Yes. Geotechnical engineer to identify areas where loose rocks should be removed and advice where to locate natural protection.	Yes. Inspection of completed works to ensure risk has been reduced.
Trail 66	4. Cumberland River to Jamieson Creek	-38.597584, 143.918781 -38.601273, 143.918652	Cumberland River to Wye River (CW)	CH50920 - CH51370	Jaimeson Creek Campground	Cut Batter	450 m	6	Delineation of pedestrian pathway on far side of road to avoid walking under cut. Rock scaling, local trimming where slope angles are vertical or overhanging, selected vegetation removal.	Yes. Geotechnical engineer to identify select rocks to be scaled, select areas of slope to be trimmed, select vegetation to be removed.	Yes. Inspection of completed works to ensure risk has been reduced.
Trail 67a	5. Jamieson Creek to Wye River	-38.606929, 143.916371 -38.607318, 143.916961	Cumberland River to Wye River (CW)	CH52350 - CH52420	Godfrey Track	Cut Batter	70 m	7	Rock scaling, local trimming where slope angles are vertical or overhanging, selected vegetation removal, construction of a rock catch ditch.	Yes. Geotechnical engineer to identify select rocks to be scaled, select areas of slope to be trimmed, select vegetation to be removed.	Yes. Inspection of completed works to ensure risk has been reduced.
Trail 67a	5. Jamieson Creek to Wye River	-38.616217, 143.913348 -38.628933, 143.900645	Cumberland River to Wye River (CW)	CH53990 - CH56280	East of Separation Creek	Cut Batter	2290 m	8	Rock scaling, local trimming where slope angles are vertical or overhanging, selected vegetation removal, construction of a rock catch ditch.	Yes. Geotechnical engineer to identify select rocks to be scaled, select areas of slope to be trimmed, select vegetation to be removed.	Yes. Inspection of completed works to ensure risk has been reduced.
Trail 67c	5. Jamieson Creek to Wye River	-38.631095, 143.89748 -38.633761, 143.891107	Cumberland River to Wye River (CW)	CH56770 - CH57200	Paddy's Path	Cut Batter	430 m	9	Rock scaling and local trimming where slope angles are vertical or overhanging. Construction of a one-metre-high rock fence at the base of the cut.	Yes. Geotechnical engineer to identify select rocks to be scaled and to ensure adequate coverage of hazard is achieved by fence.	Yes. Inspection of completed works to ensure risk has been reduced.

5 CUMBERLAND RIVER STEPPING STONE CROSSINGS

Issue

The existing Cumberland River Walking Track (Trail 55) includes two stepping stone crossings on the approach to Jebbs Pool. These two crossings were investigated by project partners, Bligh Tanner Engineering, during the development of the masterplan and were subsequently recommended for upgrade in the GORCT Planning and Design Report. Design considerations and a basic construction methodology was provided in the report, which are detailed below.

To assist with the construction documentation, it has been requested to investigate these crossings further and provide a preferred detailed design.

Design Considerations

- *Stepping stone crossings should be aligned with the natural desire line at the crossing and be visually obvious to walkers as the intended crossing location to reduce impact to bank vegetation.*
- *Provide additional rock around the trail entry points to the waterway to reduce bank erosion in these high-traffic locations.*
- *Position rocks with spacings which generally allow for unimpeded water flow between the stepping stones, without causing localised scouring or excessive debris blockage. This will be highly site specific and require set-out of stepping stones on site during construction.*
- *Spacing to consider comfortable step length for range of trail users. Use larger boulders to provide larger platforms to pause and take photographs etc. with smaller boulders placed between to provide shorter steps. Set out to provide opportunities for walkers to comfortably pass.*
- *The proposed design approach is to place selected large boulders, sourced in-situ, which are large enough to resist movement.*
- *In some locations it may be feasible to more securely fix stepping stones using grouted stainless steel rods, fixed into the underside of stepping stones and grouted or driven into a suitable rock base. This is only likely to be suitable where there is existing rock slabs within the creek bed. Any proposed grout or rods to be suitable for use in aquatic environment.*

Construction Methodology

- *Construction access will only be feasible via the upgraded walking trail.*
- *Placement of stepping stones may be possible using rock-slings, crow bars, rock bars and wedges. Rock slings allows movement of rocks which can be lifted safely by up to 4 people.*
- *Alternative techniques such as winching or floating may be required for boulders that are not able to be safely lifted. Such techniques should be refined during the design stage to ensure safety and no impact to the surrounding environment.*
- *Strict environmental protection measures including control erosion and sediment control must be in place for any in-stream works or works within 10m of the bank.*

Assessment and recommendation

Time was spent on the trail to assess the recommended design approach and potential impact of flooding. With regard to flooding, other areas of the trail would also be inundated during high water, so elevating the river crossings to avoid high water is not a design requirement. Rather, the design intent is to consider how the stepping stone crossings might be formed with suitably large and flat stones that can withstand floodwaters.

Similar examples of stepping stone crossings on other walks were researched to see whether there were any engineering treatments that might be suitable for fixing the stepping stones in place. Some examples incorporated concrete footings/grouting (as described in the design considerations), and/or the stepping stones themselves were prefabricated concrete of a suitable design and size to avoid movement during flooding and allowing sufficient water flows between stones.
Figure 12 provides an example of large steeping stones used to cross the creek at McKenzie Falls, Grampians National Park, while Figure 13 shows grouted anchors to stabilise stepping stones on the Cascades Trail, Sydney.

Having discussed the above alternatives with Bligh Tanner Engineering it was considered that, in the first instance, the approach should be:

1. Utilise the approach as outlined in the Planning and Design Report, recognising the inherent trade-off that these stepping stones may require reinstatement if they become dislodged during larger flood events.
2. During construction, construction crew explore the possibility of securing the rocks using grouted anchors (grouting requires a shallow bedrock within the channel).

Should the above method prove ineffective during flooding and become a persisting maintenance issue then the following alternatives (all requiring formal designs) could be explored:

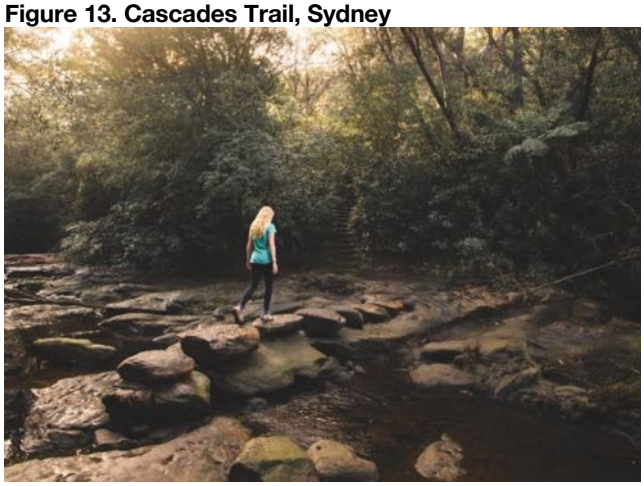
1. Cast (in-situ or pre-cast) concrete stones either gravity or anchored to the bedrock.
2. Excavating and pouring a strip footing across the channel to provide a better foundation for natural or constructed stepping stones. Note that this would be significantly more invasive and require consideration of fish passage, erosion/scour etc. as this would effectively act as a weir across the stream.
3. Corten steel foot pads anchored into bedrock. These would likely be more prone to flood damage.
4. Small suspension bridges above the high-water mark.

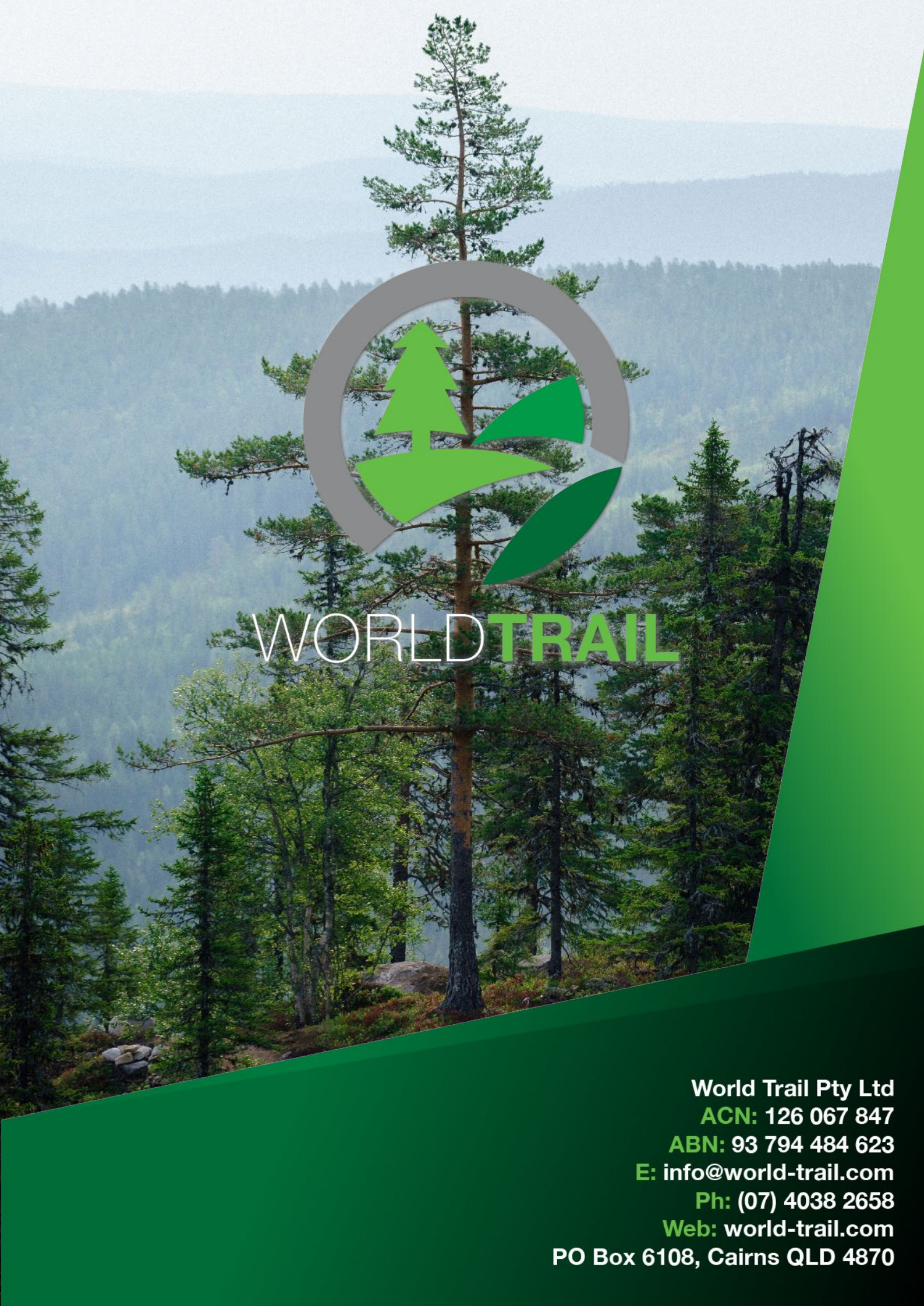
Figure 10. Site investigations along Cumberland River Walk

Figure 11. Cumberland River showing availability of natural stones

Figure 12. MacKenzie Falls, Grampians National Park

Figure 13. Cascades Trail, Sydney





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