REPORT

Great Ocean Road Coastal Trail

Geotechnical Risk Assessment

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Executive Summary

The proposed Great Ocean Road Coastal Trail is intended to traverse over 90 kilometers of iconic terrain between Fairhaven and Skenes Creek and attract up to 75,000 walkers per year. Following on from the Geotechnical Hazard Assessment completed in April 2022, WSP Golder has undertaken a quantitative geotechnical risk assessment of the proposed trail in order to provide input into the master plan and to support planning approvals.

To assist in this analysis, the proposed trail was delineated into a total of 21 segments; seven main trail segments, seven loops that link the trail at various points and seven branches that divert from the main trail. Each of these trail segments has been assessed for risk to life of the individual, societal risk (risk to life considering multiple people) and risk to property. The cumulative risk associated with traversing the entire trail has also been considered.

Risk to life and property has been assessed based on the methods described in the Australian Geomechanics Society (AGS 2007) guidelines. Evaluation of risk to the individual most at risk (the person who spends the most time on the trail and is therefore has the most hazard exposure) has been undertaken against the criteria set out in the Colac Otway Shire Schedule to the Erosion Management Overlay (EMO). The risk to the individual most at risk is very low and easily meets the criteria for risk to life set out in the Colac Otway EMO schedule. The assessment of societal risk which allows consideration of the overall numbers of people who use the track, in this case tens of thousands, is a more appropriate means of assessing risk to life than risk to the individual. Societal risk has been estimated for this project and evaluated against the New South Wales Parks and Wildlife Guidelines for rockfall risk assessment (NSW NPWS 2020), noting that the EMO schedule does not include a criteria for the assessment of societal risk. The NSW NPWS 2020 guidelines were specifically developed to consider risks associated with landslides and rockfalls in national parks and is therefore a relevant method of risk assessment for the proposed Great Ocean Trail.

The estimated societal risk has been evaluated as Acceptable, Tolerable or Not Acceptable while risk to property has been assessed qualitatively on a scale of Very Low to Very High. The assessment levels for societal risk adopted from the NSW NPWS 2020 guideline are explained with the descriptions set out in the following table.

Assessed Risk to Life	Risk to Property	Risk Evaluation	Description
Based on F-N criteria as set out in NSW Parks and Wildlife Rockfall guidelines.	High or Very High	Not Acceptable	Treatment is required. Investigation, planning and implementation of treatment options is required to reduce risk to a Tolerable level at a minimum, preferably lower where practical to do so. Immediate action may need to be considered to exclude people from the hazard.
	Medium	Tolerable	May be tolerated in certain circumstances (subject to regulators' approval) but requires investigation, planning and implementation of treatment options. Where practical, treatment options to reduce risk to Acceptable levels should be implemented as soon as possible. If risk treatment options are not practical, inspection and monitoring should be implemented. Reassess risks within 5 years.
	Low or Very Low	Acceptable	Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing inspection and maintenance is required. Reassessment of risks within 5 to 10 years may be required for risks in the higher end of this range.

Of the 21 segments delineated and assessed across the proposed trail, one trail segment, ‘CW’ from Cumberland River to Wye River, was identified as subject to a risk that is not acceptable, based on an assessment of societal risk to life. Risk mitigation measures are recommended within parts of this trail segment to reduce this risk to a tolerable or acceptable level. Of the remaining 20 segments, 12 have been assessed as a tolerable risk to life and eight are acceptable. Risk to life of the individual is considered acceptable and risk to property is assessed as very low across all segments, with it being assumed that trail damage can be repaired at relatively low cost.

Mitigative measures are recommended within four segments to reduce the overall risk across the proposed trail. These are:

- Cumberland River to Wye River, CW
- South Lorne to Cumberland River, LC
- Fairhaven to North Lorne, FL
- North Lorne to South Lorne, L

Areas of elevated risk are predominately related to rockfall originating from existing cuttings. Detailed design will be required to determine specific rockfall mitigations. However, the mitigations are expected to be localized and to include (for example) rockfall netting, trail diversions and rock fall catch fences.

It is estimated that after localized rock fall mitigation measures are implemented where required on existing trails, the overall risk to users of the proposed Great Ocean Road Coastal Trail can be reduced to a tolerable range, including with allowance for future growth in trail visitor numbers.

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1.0 ENGAGEMENT

Golder Associates Pty Ltd (WSP Golder) in conjunction with AS Miner Geotechnical Pty Ltd (ASMG) and Environmental GeoSurveys (EGS) has been engaged by World Trail Pty. Ltd. (World Trail) to undertake geotechnical hazard and risk assessment for the proposed Great Ocean Road Coastal Trail between Fairhaven and Skenes Creek along the coastline of south west Victoria.

Stage 1 of the geotechnical scope of the project sought to inform the master plan for the proposed trail by identifying areas along the proposed route that are subject to geotechnical hazards such as landslide and rockfall and to allow consideration to be given to geotechnical hazards as part of trail set out and route selection. Stage 1 was completed in April 2022 with the findings set out in the Great Ocean Road Coastal Trail Geotechnical Hazard Assessment (REF: 21468192-001-R-Rev0). Note that the geotechnical hazard assessment should be read in conjunction with this report.

This report sets out the findings of Stage 2 of the geotechnical scope which is to provide an assessment of the risk to life and property along the proposed alignment. This information is required to support a planning application for the trail and to inform subsequent detailed design stages.

The study has been undertaken in general accordance with WSP Golder proposal CX214568192-001-P-Rev0 dated 25 May 2021. Authorization to undertake the geotechnical hazard assessment was provided by World Trail via the execution of a sub-contract between WSP Golder and World Trail dated 17 September 2021.

2.0 BACKGROUND

The Department of Environment, Land, Water and Planning (DELWP) is preparing a master plan for a new walking trail between Fairhaven and Skenes Creek, near the iconic Great Ocean Road. A feasibility study for the proposed trail was undertaken in 2019, the results of which are presented in a report prepared by Ernst and Young[1]. The feasibility study includes a conceptual trail alignment (Concept Route 1) however after an iterative development of the original trail, a preferred alignment has been established and ground truthed by World Trail. This preferred alignment is subsequently referred to as Ground Truthed Route 2 which is presented in Figure 1.

Based on information provided to date we understand the following about the Ground Truthed Route 2 for the proposed trail:

- The trail passes through a number of coastal towns and villages, including Fairhaven, Moggs Creek, Big Hill, Lorne, Cumberland River, Wye River, Kennett River, Grey River, and Skenes Creek.
- The trail passes through varied terrain, including beaches, shore platforms and forested coastal ranges.
- The trail is proposed to be typically 1 m wide, but the width could range between 0.5 m and 1.5 m. It crosses the Great Ocean Road at several locations.
- A number of facilities will be incorporated into the trail, including lookouts, car parking, and amenities including public toilets.
- Suspension bridges are proposed to be incorporated into the proposed alignment at key water crossing points.

[1] Ernst and Young, Fairhaven to Skenes Creek Coastal Trail Feasibility Study, 2019.

Geotechnical hazard mapping across the trail area was presented in the Great Ocean Road Coastal Trail Geotechnical Hazard Assessment and included in the tasks set out in Figure 2, while remaining tasks will form this geotechnical risk assessment, the results of which are presented in this report. The study set out in this report is intended to inform trail designers and regulators of the geotechnical risk to which the proposed trail could be exposed, given the hazards identified in Stage 1.

Figure 1: Overview of Great Ocean Road Coastal Trail, Ground Truthed Route 2

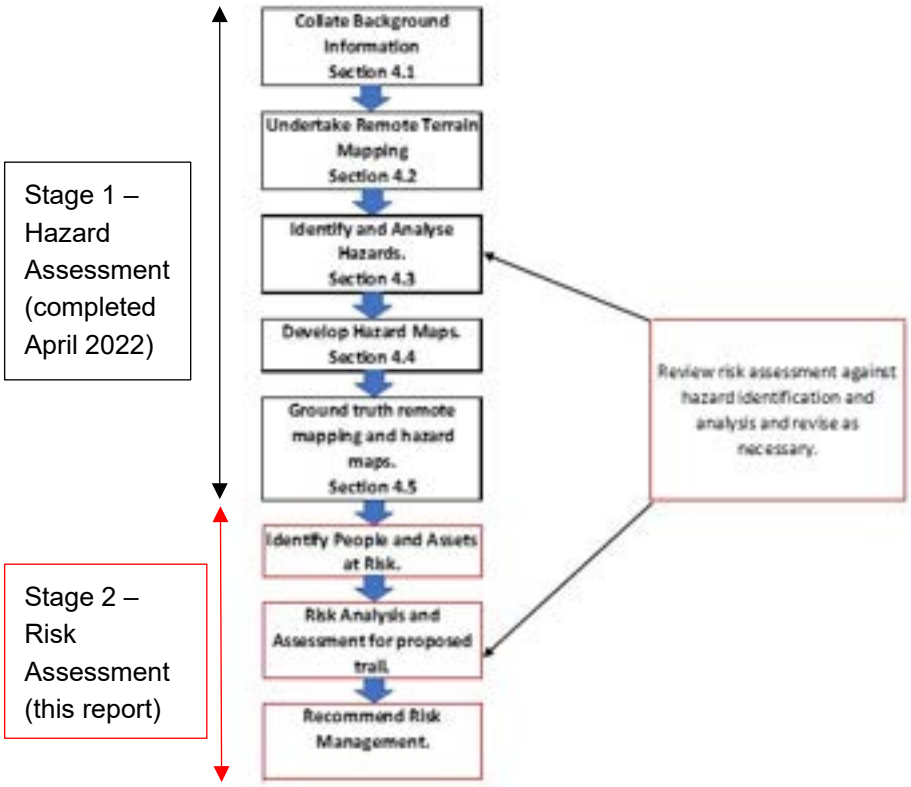

Figure 2: Outline of scope of work

In order to adequately assess risks associated with the proposed trail, the trail has been divided into segments to facilitate the assessment of each segment independently. A chainage has been established along the main trail, commencing in Fairhaven (at chainage = 0) and concluding in Skenes Creek (at chainage = 90290) for reference purposes. The trail has been nominally split into seven segments defined by key trail milestones. Along the proposed trail, several alternate loops and dead-end branches from the main trail have also been proposed. These additional features have been identified and are described in Table 1. Four bridges have been proposed along the trail as identified in Table 1 which have also be considered separately from the main trail. Each trail segment has been assigned an ID to assist in the analysis.

The location of the proposed trail and the segments utilized for the risk assessment have been shown in Drawing Set 1.

Table 1: Segments assessed along proposed along the Great Ocean Road Coastal Trail

Type	ID	Position	From	To	Chainage From	Chainage To	Distance (m)
Main Trail	FL		Fairhaven	North Lorne	0	25640	25640
Main Trail	L		North Lorne	South Lorne	25640	30000	4360
Main Trail	LC		South Lorne	Cumberland River	30000	41490	11490
Main Trail	CW		Cumberland River	Wye River	41490	57580	16090

Type	ID	Position	From	To	Chainage From	Chainage To	Distance (m)
Main Trail	WK		Wye River	Kennett River	57580	63080	5500
Main Trail	KSm		Kennett River	Smythe Creek	63080	84600	21520
Main Trail	KSk		Smythe Creek	Skenes Creek	84600	90290	5690
Loop	Loop1	Off Main Trail LC	LC_CH31385	LC_CH33615	0	2027	2027
Loop	Loop2	Off Main Trail LC	LC_CH35910	LC_CH39760	0	1948	1948
Loop	Loop3	Off Main Trail FL-L	FL_CH25580	L_CH26460	0	934	934
Loop	Loop4	Off Main Trail CW	CW_CH41550	CW_CH49070	0	4646	4646
Loop	Loop5	Connects Bridge4 to Loop4	Bridge4_CH1260	Loop4_CH2100	0	1090	1090
Loop	Loop6	Off Main Trail KSm	KSm_CH63080	KSm_CH65860	0	2540	2540
Loop	Loop7	Off Main Trail CW	CW_CH44290	CW_CH46305	0	1454	1284
Branch	Branch1	Off Loop1	Loop1_CH1265	End of branch	0	1017	1017
Branch	Branch2	Off Main Trail LC	LC_CH38345	End of branch	0	95	95
Branch	Branch3	Off Main Trail LC	LC_CH40480	End of branch	0	43	43
Branch	Branch4	Off Main Trail CW	CW_CH44195	End of branch	0	108	108
Branch	Branch5	Off Main Trail FL	FL_CH7475	End of branch	0	50	50
Branch	Branch6	Off Main Trail FL	FL_CH19487	End of branch	0	37	37
Branch	Branch7	Off Main Trail KSm	KSm_CH66720	Grey River	0	1635	1635
Bridge	Bridge0	Off Main Trail FL	FL_CH14193	FL_CH14810	0	176	176
Bridge	Bridge1	Off Main Trail FL	FL_CH18263	FL_CH18685	0	204	204
Bridge	Bridge2	Off Main Trail FL	FL_CH21270	FL_CH21645	0	107	107
Bridge	Bridge4	Within Loop 7	Loop7_CH240	Loop7_CH410	0	170	170

3.0 AIMS OF THE ASSESSMENT

The aims of the geotechnical risk assessment are as follows:

- To assign quantified risk outcomes to each hazard category and level identified throughout the hazard mapping process.
- To recommend risk mitigation measures where applicable.

4.0 SCOPE OF WORK AND METHOD OF ASSESSMENT

Stage 1 of this project involved the identification and definition of geotechnical hazards along and around the proposed trail using staged approach to generate hazard maps of the area surrounding the trail. Undertaking a desktop study of the geology, geomorphology and geotechnical setting of the local area and using remote terrain mapping, initial hazard maps were generated and expected hazards within the study area delineated. As part of the hazard identification process, a ground truthing exercise was undertaken to identify and describe hazards observed in the field and to assess the density and frequency of hazards.

Completion of Stage 1 saw the production of hazards maps for the following hazards around the trail area:

- Cut and fill failure.
- Rockfall.
- Landslides (including shallow soil landslides and deep rock slides).
- Debris flow.
- Erosion – episodic erosion, for example as might occur over a short time frame in a storm event.
- Erosion – progressive erosion, progressive erosion which might occur over a longer timeframe.

The hazard delineations adopted on the maps include an estimate of frequency, which is summarized in Table 2. Full details of the derivation of the hazard maps can be found in the Great Ocean Road Coastal Trail Geotechnical Hazard Assessment.

Table 2: Summary of Hazard Map Descriptors (adapted from AGS 2007a)

Hazard Descriptor	Rock falls from cliff or road batter (No. per annum/km of cliff or road batter assuming 1 m wide rockfall)	Road batter failures (cut or fill) (No. per annum/km of cliff or road batter assuming 10 m wide failure)	Small distributed hazards – Shallow landslides in soil (No. per km^2 per annum assuming 1000 m^2 average landslide size)	Individual, large hazards – deep rock slides, debris flows (Annual probability of active sliding)	Erosion and recession – coastal, riverine and estuarine erosion (Annual probability of erosion impacting an area)
Very High	>10	>1	>10	$>10^{-2}$	$>10^{-2}$
High	1 to 10	$>10^{-1}$ to 1	1 to 10	10^{-3} to 10^{-2}	10^{-3} to 10^{-2}
Moderate	10^{-1} to 1	10^{-2} to 10^{-1}	10^{-1} to 1	10^{-4} to 10^{-3}	10^{-4} to 10^{-3}
Low	10^{-2} to 10^{-1}	10^{-3} to 10^{-2}	10^{-2} to 10^{-1}	10^{-6} to 10^{-4}	10^{-6} to 10^{-4}
Very Low	$<10^{-2}$	$<10^{-3}$	$<10^{-2}$	$<10^{-6}$	$<10^{-6}$

Stage 2 of this project takes the outcomes from Stage 1, and quantitatively assesses the risk to life and risk to property associated with the Great Ocean Road Coastal Trail.

5.0 METHOD OF RISK ASSESSMENT

The method of assessing the risk associated with each hazard follows the general framework for landslide risk management as set out in AGS 2007[2]. This is reproduced in APPENDIX A with cross reference provided to the section of the report which addresses the relevant step in the landslide risk assessment.

The following progresses through each step in the risk assessment framework as set out in APPENDIX A and describes the approach taken.

[2] Australian Geomechanics Society, Guidelines for Landslide Risk Management, Australian Geomechanics, Vol 42, No. 1, March 2007.

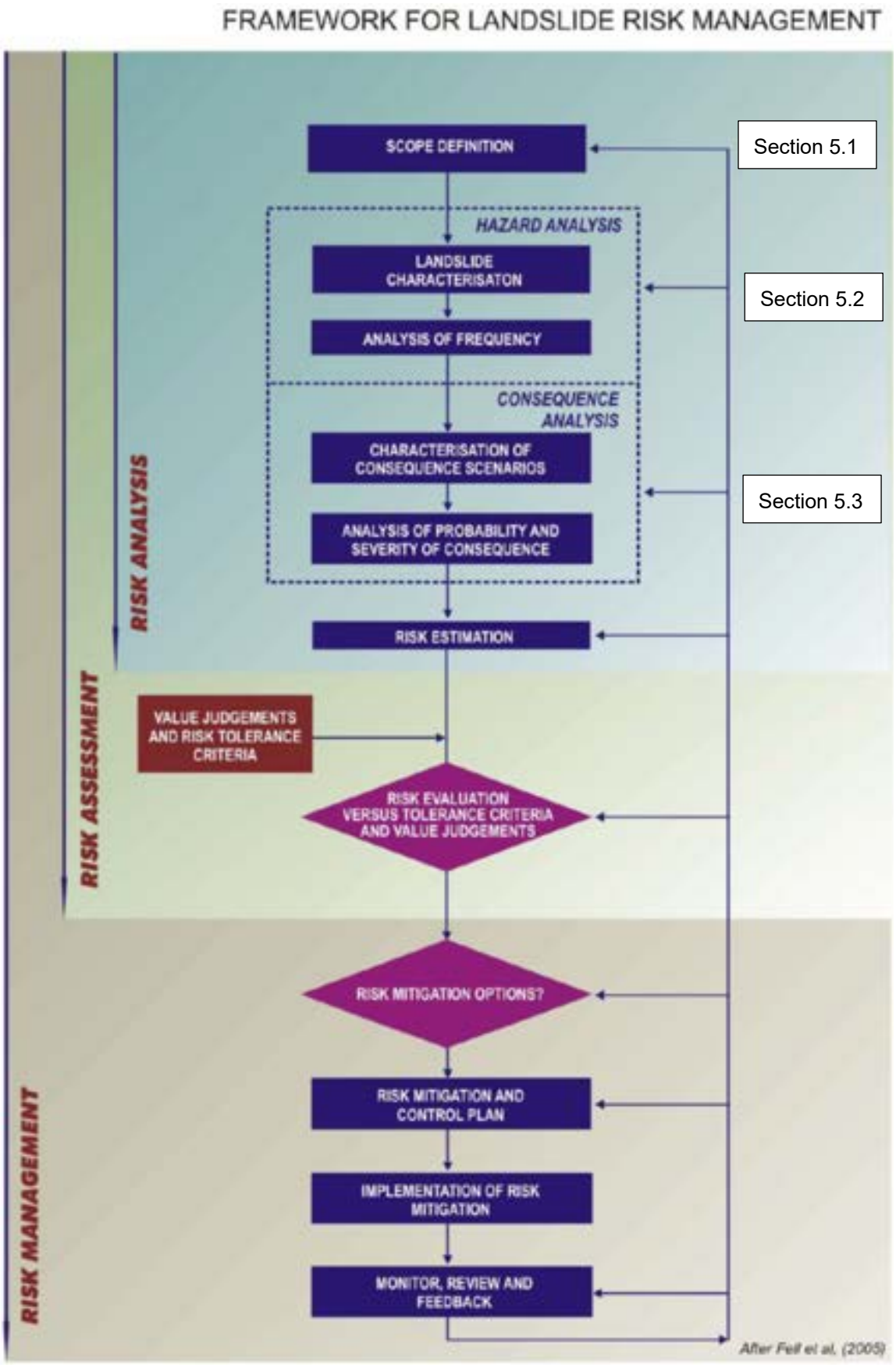

Figure 3: Framework for Landslide Risk Management (AGS 2007)

5.1 Scope Definition

The aims and scope of work are outlined in Sections 3.0 and 4.0.

5.2 Hazard Analysis

Assessment of whether a hazard could impact the public was informed by the outcomes of the Geotechnical Hazard Assessment completed at Stage 1 of this project. This included the assessment of 'run out distances, the size of debris that could impact the trail and the frequency at which landslides or rockfalls could occur.

Upon review of the revised trail alignment against the final hazard maps produced in the Geotechnical Hazard Assessment, the following hazards considered to present a risk to life or property have been included in the quantitative risk assessment:

- Shallow soil landslide causing the track to be undermined or impacted by debris.
- Rockfall causing impact to the track or walkers on the track.
- Debris flow impacting the track where it crosses gullies.
- Deep seated rock landslide causing the track to be undermined.
- Fill material falling on to trail, where the track is below fill embankments, for example below the fill embankment of the Great Ocean Road.
- Failure of a fill embankment where it undermines the trail.
- Rock or soil falling onto trail from an existing cutting.
- Soil falling onto trail from an existing cutting.
- Undermining of the trail due to the failure of a cutting in rock or soil, for example where the trail is near the crest of a road cutting.

5.2.1 Assumptions in Hazard Analysis

As described in Table 2, each hazard type has been assigned a hazard level (i.e. low, moderate, high) based on an estimated annual frequency and spatial distribution of each hazard. In order to assess the risk to a linear trail through an area delineated on the hazard map, these hazard levels which apply over a 2D area must be converted to allow estimation of their frequency along a linear trail.

Table 3 outlines the conversions that have been applied to the hazard levels shown on the map to develop likelihood inputs to the risk assessment.

Table 3: Frequency conversions to account for linear trail

Hazard	Hazard map description	Conversion
Shallow soil landslide	No. per km^2 per annum assuming 1000 m^2 average landslide size	Length of trail encountered divided by 1000^2 to give the annual landslide frequency per 1 m of trail.
Rockfall	No. per annum/km of cliff or road batter assuming 1 m wide rockfall	Length of trail encountered divided by 1000, to give the annual rockfall frequency for each 1 m of trail.
Debris flow	Annual probability of active sliding	No conversion
Deep seated rock landslides	Annual probability of active sliding	No conversion
Cut and fill hazards (all)	No. per annum/km of cliff or road batter assuming 10 m wide failure	Length of trail encountered divided by 1000, to give the annual probability of failure for each 1m of trail.

5.3 Consequence Analysis

Assessment of consequence was undertaken largely using the outcomes of the Geotechnical Hazard Assessment. The following key questions were considered to arrive at consequence levels for the assessment of risk to life:

- Are people moving, e.g. walking on a walking trail or static on a lookout?
- If a person is in the open, what is the probability of a person avoiding the hazard?
- How many people could be affected by the hazard? Typically, this would be the number of people who might occupy the part of the location that could be affected. For example, if multiple rocks were to fall from a cliff and the debris arising is only expected to impact a small section of a trail, only people in this part of the trail would be considered at risk, or within the 'exposed population' rather than all users of the trail.

The time over which people might be in the area at risk is also considered, for example the proportion of hours within a year that a trail might be occupied, or the time that a person might spend in an area exposed to a hazard. This is the temporal probability.

An assessment is made by the engineer as to whether a hazard is likely to cause death if it impacts a person or an asset in which a person is present. Considerations include:

- The volume and intensity of soil or rock when it impacts, including the height of debris that may impact a person or whether a person is likely to be buried.
- The form of construction of a lookout or trail and whether a landslide is likely to cause damage.

The following risk assessment inputs are estimated through the course of the consequence analysis:

- The annual probability that a person is present when the hazard occurs (temporal probability), which is contingent upon the hiker numbers.
- The probability that a person is killed if impact occurs (vulnerability).
- The number of people that could be impacted by the hazard.

For risk to property, the consequence level was assessed by considering the potential cost of remedial works should the asset be impacted by a landslide hazard, generally ranging from a negligible consequence with no repair work required to the complete destruction of the asset requiring replacement. Qualitative measures of consequences to property are taken from the Roads & Maritime Services Guide to Slope Stability (RMS 2014[3]). World Trail may wish to undertake their own evaluation of the consequences described for each hazard based on the descriptions provided in the methodology in APPENDIX A. The criteria provided here for risk evaluation should be considered a guide only.

5.3.1 Assumptions in the Consequence Analysis

Due to the inherent variability and uncertainty in people's movement, several assumptions have been made in this regard. These assumptions are summarised in this section and are generally used for each style of hazard, with some hazard specific exceptions. Further detail and explanation of the methodology can be found in APPENDIX A.

- Hazard maps generated in Stage 1 provided a range for the probability of a hazard occurring on an annual basis for each hazard level (i.e. *'0.1 to 1 rockfalls per km per year'*). The risk assessment has taken the logarithmic mean of each range provided as the probability of detachment, $P_{(H)}$, in completion of the risk assessment (e.g. for the example above 0.3 rockfalls per km per year is taken).
- For hazards anticipated to be triggered by wet weather, a reduction factor has been incorporated to account for the likelihood that fewer visitors would be using the trail during or immediately after wet weather. For shallow soil landslides, fill hazards and cut soil hazards this factor has been set at 0.1 while for rocks fall, deep seated rock landslides and cut rock hazards it has been set at 0.5.
- The average speed of movement of hikers is assumed to be 3 km/h.
- Generally, walkers walk in single file along the trail. While it is recognised there are sections of the trail where walkers are able to comfortably walk two abreast, much of the trail is proposed to be 1 m wide.
- Trail travel options considered in the risk assessment consider:
  - That each segment is traversed once, one-way as defined in Table 1 with each of these segments assessed individually.
  - The entire trail from Fairhaven to Skenes Creek is traversed once, one way. Note that if a proportion of the overall hiker numbers were assumed to walk along the trail in the other direction, this would not change the assessed risk.

5.3.2 Exposed Population

The exposed population used in societal risk calculations (described in Section 5.4) is based on the 'year 10' visitor projections and estimated proportion of trail users allocated to each section of trail provided by World Trail. These projections indicate that by year 10, 74,964 people will be utililising the trail with 59% of users allocated to Lorne to Wye River, 34%, Fairhaven to Lorne and 7% Wye River to Grey River. In the absence of additional information 7% has also been assumed for trails from Grey River to Skenes Creek. Table 4 summarises the exposed population numbers used for each segment assessed in this report.

[3] NSW Roads and Maritime Service, Slope Risk Analysis, Version 4, 2014

Table 4: Exposed population for each trail segment, hikers per year

Trail Segment	Exposed Population	Trail Segment	Exposed Population
FL	25488	Loop5	44229
L	44229	Loop6	5247
LC	44229	Loop7	44229
CW	44229	Branch1	44229
WK	5247	Branch2	44229
KSm	5247	Branch3	44229
KSk	5247	Branch4	44229
Loop1	25488	Branch5	25488
Loop2	25488	Branch6	25488
Loop3	44229	Branch7	5247
Loop4	44229		

5.4 Risk Estimation

Through the course of the hazard and consequence analysis, the following information is estimated:

- The type of hazard; e.g. rock fall, natural shallow landslide, etc.
- The likelihood of the hazard occurring, AND of it reaching an asset or location where a person could be located, being the product of the probability of the event occurring and the probability of debris reaching a person or asset (likelihood).
- The annual probability that a person is present when the hazard occurs (temporal probability).
- For risk to life:
  - The probability that a person is killed if impact occurs (vulnerability).
  - The number of people that could be impacted by the hazard (exposed population).
- For risk to property:
  - The anticipated effect on an asset (consequence).

These inputs are combined to arrive at an estimated risk to life. For risk to life the methods set out in the New South Wales National Parks and Wildlife Service Guidelines for Quantitative Risk to Life Calculations for Landslides (NSW NPWS 2020) have been used. These guidelines have been developed specifically for the assessment of risks to visitors in national parks and include specific methods for assessing risk to people on walking trails and lookouts.

These methods involve consideration of risk to the individual most at risk - the individual who has the greatest exposure to the hazard (usually person exposed over the greatest time). However, the risk to the individual most at risk in a walking trail scenario is almost always acceptable. Additionally, the societal risk is considered which takes into account the fact that many different people, in this case tens of thousands will be exposed to

the hazard along the trail each year. The assessment of societal risk involves the calculation of an 'F-N Pair', providing a single point based on the probability of an impact occurring and the estimated number of people killed if impact occurs. The guidelines also consider the potential for people to be exposed to multiple hazards on a single traverse along a walking trail, producing a cumulative risk from the individual hazards.

All risks discussed in this study fall into the 'walking trails' category for the purpose of risk calculations. The risk has been calculated quantitatively for:

- Risk to life for the individual most at risk (assuming moving element at risk, i.e. a hiker).
- Combined individual risks, i.e. the cumulative risk to the individual most at risk from all hazards to which they are exposed.
- Societal risk to life (assuming moving element at risk, i.e. a hiker).
- Combined risks to multiple persons, i.e. the cumulative risk to the individual most at risk from all hazards to which they are exposed.

There has been no account made for the calculation of risk at potential lookout locations at this stage of the study. Notwithstanding this, detailed risk assessment can be done during the detailed design stage of the proposed development and if required risk mitigation measures incorporated into the lookout design. More detail on the risk calculations and relevant inputs are provided in APPENDIX A.

5.5 Risk Evaluation

The Colac Otway Shire Erosion Management Overlay sets out criteria for landslide risk evaluation. For risk to life associated with new development the annual probability of loss of life of the individual most at risk must not exceed 10^{-5} / annum. This criteria is generally always met when assessing the risk to an individual using a walking trail.

Evaluation of societal risk, taking account of the many people who use the walking trail is undertaken using a different method and there is no criteria included in the Colac Otway planning scheme. The calculated societal risk has been assessed using the Australian National Committee on Large Dams Guidelines on Risk Assessment (ANCOLD 2003), which has been adopted by the NSW NPWS as the criteria against which rockfall risks in national parks are evaluated. The calculated F and N are combined to create an F-N pair which is shown on an F-N plot and compared to set limits of acceptance, shown in Appendix A of NSW NPWS 2020. This also results in a categorisation of risk(s) as Acceptable, Tolerable or Not Acceptable. The criteria on F-N chart are comparable to the individual risk criteria in terms of the magnitude of risk accepted.

Risk to property is assessed qualitatively using the tables in Appendix C of AGS 2007c. AGS 2007 c described the risks to property as follows:

- Very high and high risk are locations/hazards assessed as being associated with an unacceptable risk to property. Locations/hazards assessed as very high require urgent action to reduce risk.
- Moderate risk are locations/hazards assessed as having a tolerable risk to property. However, measures to reduce the risk to as low a level as practical are recommended and if the risk level is not reduced, the risk should be monitored and reassessed over time.
- Low and very low risk locations/hazards are assessed as having an acceptable risk to property. However, for low risk sites, ongoing monitoring and periodic reassessment is recommended.

The Colac Otway planning scheme nominates 'Moderate' as an acceptable risk to property, on the basis it is not an essential facility.

The levels described for risk to property assume only the trails themselves to be included in the scope of this study. No buildings or structures have been identified or assessed as part of the risk to property assessment conducted at this point in time. If buildings are placed in areas susceptible to landslide, further assessment may be required through the detailed design stage. Similarly, proposed lookout structures may require a more detailed assessment of geotechnical risk to property once designs have further progressed and more adequate assumptions of likelihood and consequence at these locations are possible.

5.6 Risk Mitigation

Based on the outcomes of the risk assessment, feasible options for risk mitigation are then identified. There are numerous ways to reduce the risk:

- Accept the risk: an option subject to the criteria of the regulator. Where a risk is not acceptable then risk mitigation measures are required.
- Avoid the risk: for example, realigning the trail away from an unstable clifftop or providing a physical exclusion zone at the base of a slope.
- Reduce the frequency of landsliding: stabilising a slope through various methods such as reprofiling, improved drainage, retaining structures.
- Reduce the consequences: provision of defensive stabilization or protective measures such as a catch fence, or a reduction in the number of trail users.
- Manage the risk by establishing monitoring and warning systems: regular reviews of slopes to observe instability, such that further measures can be undertaken if instability looks to be increasing, for example a slope crest regressing towards a lookout. This may also include signage to reduce the temporal probability of trail users gathering near unstable cliffs. Trigger-action-response-plans (TARPS) can also be considered whereby actions are taken to reduce risk if certain events or 'triggers' are observed. For example trail closure in the event of an extreme rainfall event.

6.0 RISK ASSESSMENT OUTCOMES

6.1 Summary of Hazards Assessed

The hazards described in Section 5.2 have been assessed along each trail segment set out in Table 1.

Not all hazards are present at each trail segment, and different risk categories (i.e. low, high) are encountered in varying proportions along each segment. In order to determine the hazards along each segment of trail, the proposed alignment was reviewed against each hazard map generated during the Geotechnical Hazard Assessment and the length of trail intersecting low, moderate, high etc. mapped hazards for each hazard type were calculated.

6.2 Summary of Risk Assessment Results

The detailed risk assessment results, including risk outcomes, assessed annual probability of fatalities and the F-N charts used to evaluate societal risk for each segment assessed have been collated in APPENDIX B. To

summarise these results, Table 5 shows the cumulative risk of each hazard for each trail segment as well as the total cumulative risk for that segment. The accompanying F-N pairs are shown in Figure 4 and demonstrate that only one trail segment, 'CW' from Cumberland River to Wye River, falls into the not acceptable range for societal risk to life. Of the remaining 20 segments, 12 have been assessed as a tolerable risk to life and eight are acceptable.

The acceptable, tolerable and not acceptable zones are based on the guidelines adopted by ANCOLD (2003) and NSW NPWS (2020) and are provided as a guide only. The level of acceptance of risk must be confirmed by the regulator, however it is noted that the societal risk criteria adopted is analogous to the individual risk criteria adopted in the Colac Otway planning scheme.

Select trail segments that fall within the not acceptable or upper bounds of the tolerable range have been highlighted throughout this section of the report where further discussion of the risk outcomes is required.

It is noted that risk to the individual most as risk, falls within acceptable limits across every segment of the trail. Given these results, risk to the individual is not the most suitable criteria for assessing risk associated with the proposed Great Ocean Road Coastal Trail. Societal risk, which accounts for the number of people expected to be exposed to hazards along the trail per year, is the critical risk associated with this project and as such will be the focal point of discussion throughout this report and means by which the need for mitigation measures is identified. For the calculated outcomes for risk to the individual most at risk, refer to APPENDIX B.

Risk to property has also been assessed for each trail segment based on the AGS (2007c) guidelines with the outcomes summarized in Table 6. Of the 21 trail segments assessed, all segments were estimated to have a very low risk to property, with consequences expected to comprise intermittent clean up of debris or minor trail re-routing.

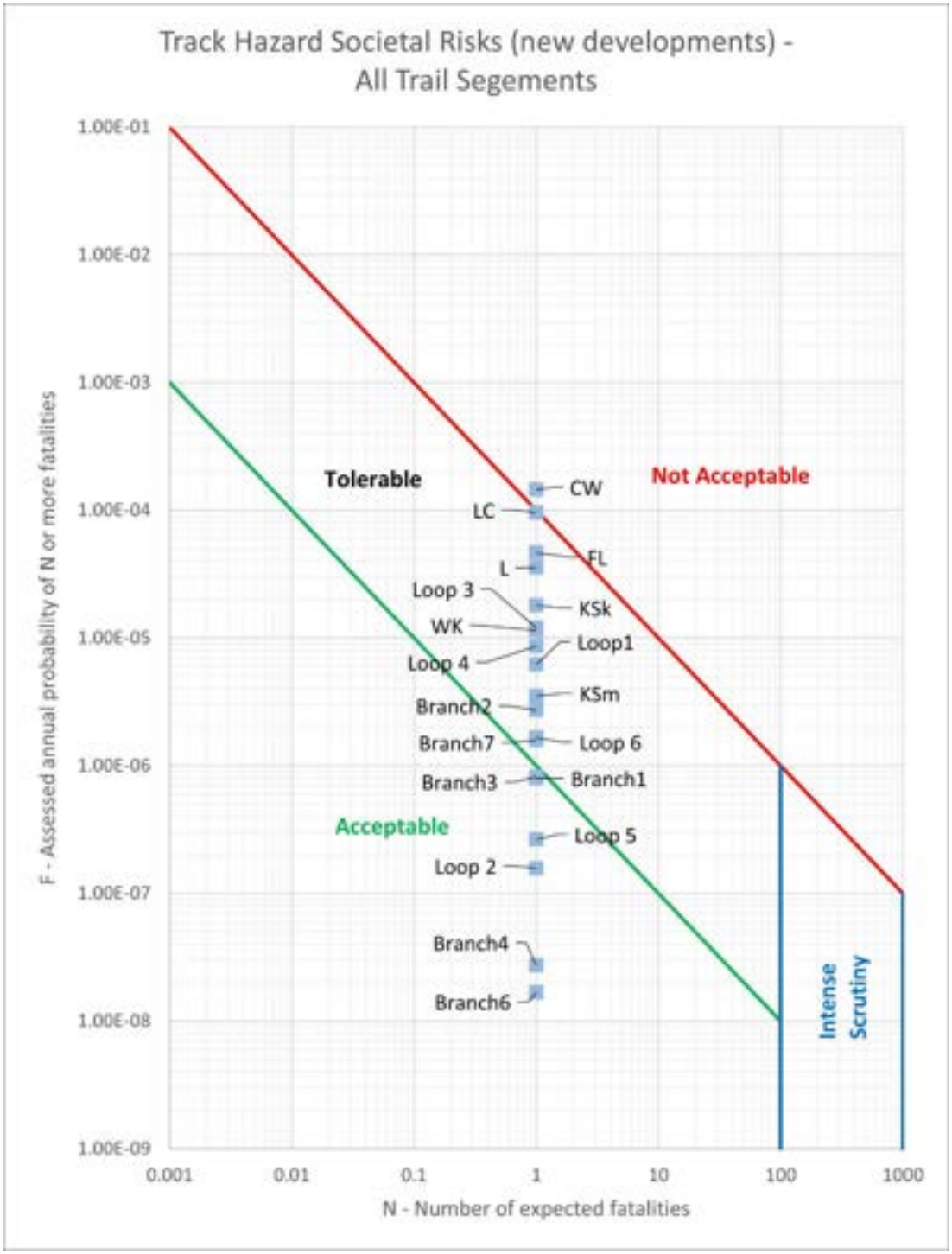

Figure 4: F-N pairs for all trail segments

Table 5: Summarised risk assessment results for Great Ocean Road Coastal Trail segments. Acceptable risks coloured green, Tolerable yellow and Not Acceptable risks red.

Trail Segment	Shallow Soil Landslide	Rockfall	Debris Flow	Deep Seated Rock Landslide	Fill Hazard onto Trail	Fill Hazard Undermining Trail	Cut Rock onto Trail	Cut Rock Undermining Trail	Cut Soil onto Trail	Cut Soil Undermining Trail	Segment Cumulative Risk
FL	1.04E-06	3.30E-05	4.32E-06	2.34E-08		3.51E-07	3.15E-06		4.70E-06		**4.66E-05**
L					3.56E-05						**3.56E-05**
LC	9.11E-07	5.33E-05	4.00E-06	1.91E-08		1.17E-06	1.85E-05	1.83E-09	1.85E-05	3.63E-10	**9.64E-05**
CW	9.99E-07	9.27E-05	7.33E-06	2.86E-08	4.99E-06	1.75E-06	1.44E-05	6.08E-09	2.35E-05	1.22E-07	**1.46E-04**
WK	4.54E-08	3.30E-06	3.45E-07	2.16E-09	5.08E-07	2.12E-07	3.42E-06		3.72E-06		**1.16E-05**
KSm	1.64E-07	2.73E-06	3.35E-07	4.52E-09	2.31E-07	1.73E-08		4.81E-08		9.62E-09	**3.54E-06**
KSk	2.16E-08	2.38E-06	4.08E-07	5.12E-09	3.49E-06	6.99E-07	5.78E-06		5.15E-06		**1.79E-05**
Branch1	5.10E-08	5.18E-07	2.26E-07								**7.96E-07**
Branch2	8.54E-09	3.54E-07	2.36E-06	1.22E-09							**2.72E-06**
Branch3	5.28E-09	6.64E-07	1.45E-07								**8.14E-07**
Branch4	1.47E-09	2.58E-08									**2.73E-08**
Branch5	1.41E-11	2.83E-12									**1.70E-11**
Branch6	3.32E-09	8.17E-09		5.19E-09							**1.67E-08**
Branch7	7.17E-09	1.86E-07	8.51E-07	3.75E-09		2.79E-08	1.84E-07		3.23E-07		**1.58E-06**
Loop1	1.22E-07	1.22E-07	1.61E-08	1.61E-08							**2.76E-07**

Trail Segment	Shallow Soil Landslide	Rockfall	Debris Flow	Deep Seated Rock Landslide	Fill Hazard onto Trail	Fill Hazard Undermining Trail	Cut Rock onto Trail	Cut Rock Undermining Trail	Cut Soil onto Trail	Cut Soil Undermining Trail	Segment Cumulative Risk
Loop2	1.17×10^{-8}		1.46×10^{-7}								**1.58×10^{-7}**
Loop3	7.08×10^{-8}	3.66×10^{-6}	7.30×10^{-7}				3.65×10^{-6}		3.96×10^{-6}		**1.21×10^{-5}**
Loop4	4.07×10^{-7}	2.31×10^{-6}	5.74×10^{-6}	1.51×10^{-7}							**8.61×10^{-6}**
Loop5	6.29×10^{-8}	1.98×10^{-7}		4.87×10^{-9}							**2.65×10^{-7}**
Loop 6	9.64×10^{-9}	1.29×10^{-6}	2.46×10^{-7}	4.87×10^{-9}			3.97×10^{-8}		7.94×10^{-8}		**1.67×10^{-6}**
Loop 7	4.30×10^{-8}	1.94×10^{-6}		8.51×10^{-9}							**2.00×10^{-6}**
										Entire Trail (all segments)*	**3.89×10^{-4}**

**The cumulative risk to society for the entire trail is considered to be significantly overestimated when the full visitor numbers are adopted. This risk outcome assumes ALL trail users will walk the entire trail, including loops and branches from Fairhaven to Skenes Creek. Refer to Section 6.2.6.*

Table 6: Summarised risk assessment results for risk to property for each trail segment

Trail Segment	Risk to Property	Trail Segment	Risk to Property
FL	Very Low	Branch5	Very Low
L	Very Low	Branch6	Very Low
LC	Very Low	Branch7	Very Low
CW	Very Low	Loop1	Very Low
WK	Very Low	Loop2	Very Low
KSm	Very Low	Loop3	Very Low
KSk	Very Low	Loop4	Very Low
Branch1	Very Low	Loop5	Very Low
Branch2	Very Low	Loop6	Very Low
Branch3	Very Low	Loop7	Very Low
Branch4	Very Low		

6.2.1 Cumberland River to Wye River, CW

The section of trail from Cumberland River to Wye River, when all hazard types are considered, has been assessed as subject to an unacceptable risk to life without risk mitigation. Several hazard types identified along this trail segment are contributing to this result however the most dominant hazards that should be the focus of mitigative measures are set out below. Also refer to appended figures for locations.

- Rockfall – a high hazard associated with rockfall is estimated to affect about a 55 m length of trail, a moderate hazard about 410 m length of trail (between CH41920 and CH43530, refer to drawings, Sheet 12) and a low hazard over approximately 2160 m of trail.
- Soil slumps – a high hazard from soil slumping on to the trail from an existing cut which we estimate affects about 1810 m of trail and a moderate hazard over approximately 410 m length of trail between (CH41920 and CH43530, refer to drawings, Sheet 12).

The majority of the hazard to which the trail is subject to are associated with rockfall or landslide at existing trail cuts across the following chainages: CH50920-CH51370 (Sheet 13), CH52350-CH52420 (Sheet 14), CH53990-CH56280 (Sheet 15) and CH56770-CH57480 (Sheet 16).

6.2.2 South Lorne to Cumberland River, LC

The section of trail from South Lorne to Cumberland River has a cumulative risk outcome that is considered tolerable, however is close to the not acceptable boundary and there may be a basis to provide risk mitigation over this section. The assessment over this section indicates that small changes to the trail walker numbers or hazard parameters could lead to the risk along this section of trail becoming unacceptable. Several hazard types identified along this trail segment are contributing to this result. However, the prevailing factors which should be the focus of mitigative measures include:

- Rockfall - 10 m of trail is estimated to be subject to high hazard from rockfall, 345 m subject to a moderate hazard and 1175 m to a low hazard. In addition to this natural rockfall hazard, 260 m of trail is estimated to be subject to a moderate hazard associated with rock falling onto the trail from an existing cutting.
- Soil slumps – 360 m of the trail is estimated to be subject to a very high risk associated with soil slumping on to the trail.

The majority of these elevated risk locations are located in two existing cuts between CH30340 and CH31310 (Sheet 11).

6.2.3 Fairhaven to North Lorne, FL

The trail between Fairhaven to Lorne is estimated to be subject to a risk to life within the upper-bound of the tolerable range. However, this section of trail may also benefit from mitigative measures to reduce the risk along this section of trail. Hazard types identified to be driving the elevated cumulative risk include:

- Rockfall – 5 m of trail subject to high rockfall hazard, 172 m of trail subject to moderate rockfall hazard and 3870 m of trail subject to low rockfall hazard. Approximately 600 m of trail is estimated to be subject to a low hazard associated with rockfall originating from an existing cutting.
- Soil slumps – 30 m of trail is estimated to be subject to a very high hazard associated with soil falling onto trail from an existing cut.

The majority of the locations set out above are within two existing trail cuts at CH17820-CH18440 and CH18280-CH18310 (Sheet 8). Note that the 172 m of moderate rockfall hazard and 3980 m of low rockfall hazard are not within these cuts. These risks are spread sporadically across the length of the trail which could make them more difficult to mitigate in the first instance.

6.2.4 North Lorne to South Lorne, L

The only geotechnical hazard identified along the trail from North Lorne to South Lorne is associated with fill material falling onto the trail from an existing fill embankment upslope of the trail. Of the 4357 m length of this trail segment, approximately 1175 m of trail intersects areas estimated as having a high hazard level, whilst 450 m is estimated as having a moderate hazard. The high-hazard areas, in particular, result in a tolerable risk to life however does present as one of the highest risk outcomes identified along the broader length of trail assessed. Notwithstanding this, this is an area that may benefit form additional risk mitigation measures or alternatively risk mitigation effected by positioning the trail at an offset from the fill embankments.

6.2.5 Proposed Bridges

There are four suspension bridges proposed along the length of the Great Ocean Road Coastal Trail. These proposed bridges have been discussed in detail as part of Stage 1 of this project and recommendations provided to position the bridge abutments outside of areas prone to geotechnical hazards. For the purposes of this risk assessment, it has been assumed that any length of trail along a bridge will pose no geotechnical hazard to trail users, given the bridge will separate people from the geotechnical hazards below.

Further detailed investigation is required at planned abutment sites to assist in detailed bridge design and a focus of this investigation and design should be to ensure the proposed bridges are free of geotechnical hazards.

6.2.6 Overall Trail, from Fairhaven to Skenes Creek

The estimated risk to life for persons walking the entire trail between Fairhaven and Skenes Creek has been estimated using the exposed population presented in Table 4. Based on this estimate of the exposed population, the risk is unacceptable. However, this outcome considers full utilization of the trail for all visitors (i.e. every person walking the entire trail length). This is an unrealistic assumption. It is our assumption that a relatively much smaller number of people will walk the full trail each year, therefore calculating a risk to life based on the entire exposed population presented in Table 4 is not appropriate.

Alternatively, we have assessed the risk to life for persons walking the full trail length with a reduced exposed population of 1000 people per year. This assessment results in a tolerable risk level (1.6×10^{-5} per annum). We have also assessed the risk to life of an individual who walks the entire trail (the individual most at risk). For an individual walking the entire trail, the assessed risk to life is acceptable (1.6×10^{-8}). These estimations are prior to any trail remediation. The F-N pair charts and summary tables for these results are presented in APPENDIX B.

6.3 Risk Mitigation

6.3.1 Recommended Mitigation

There are several lengths of existing cut within both soil and rock along the trail that are subject to the highest hazard levels. Compared to other hazards, these lengths present the greatest risk to the trail and trail users. It is often in these locations where both an increased risk of cut failure and rockfall have been identified. For example, Figure 5, shows just one example of a cut along the trail between Cumberland River and Wye River (CW) where both elevated cut failure and rockfall hazards are contributing to the overall cumulative risk being unacceptable.

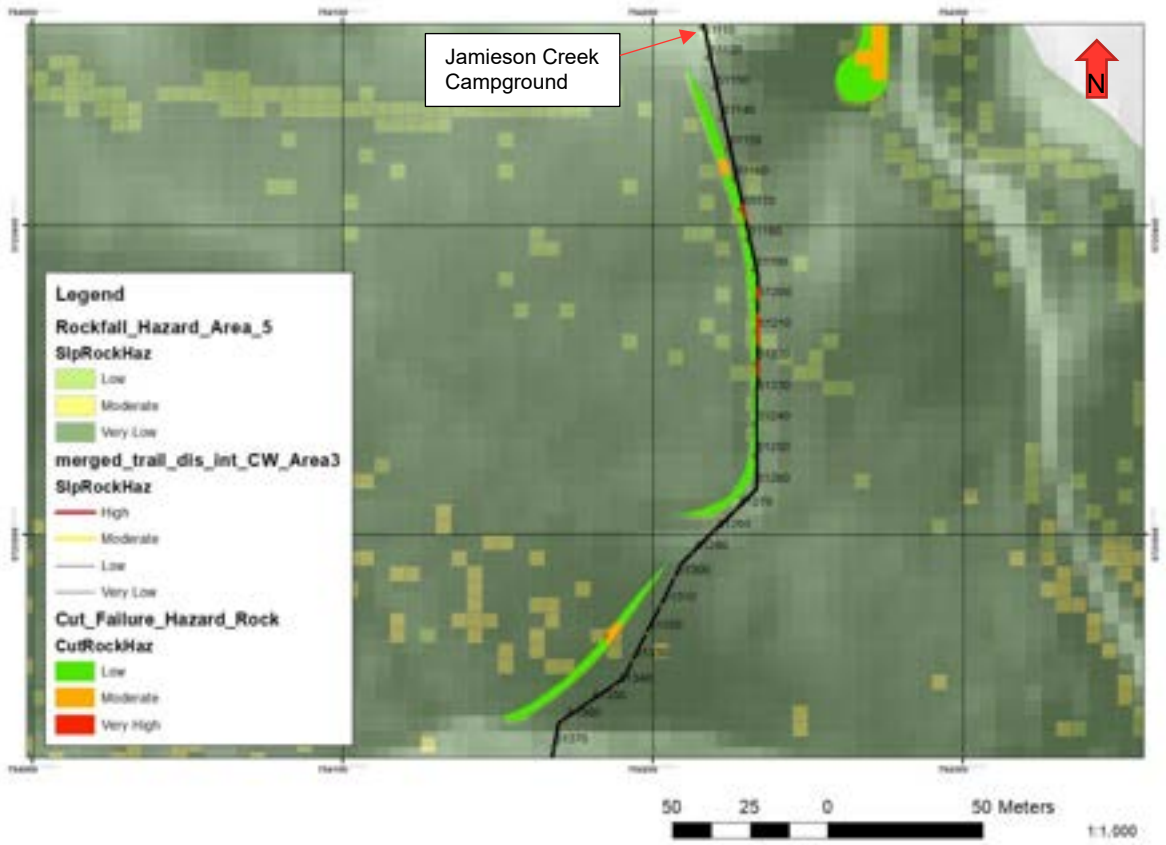

Figure 5: Section of trail from Cumberland River to Wye River showing how rockfall risk often correlates with cut failure risks (rock/soil). Jamieson Track, south from Jamieson Creek Campground.

As can be seen in Figure 5, small portions of this cut have been assessed as having a higher risk compared to other sections of the cut. Due to the resolution of the data used in the hazard mapping and risk evaluation process (both hazard classifications and the trail design itself), some margin of error is assumed in the risk assessment. Given areas of higher hazard has been identified within the cut, it is recommended that this and other existing similar cuts undergo a more detailed assessment to identify and quantify the risk along the cut and propose localized mitigation measures where appropriate. Cuts identified for detailed assessment have been highlighted in Drawing Set 1 and are set out in Table 7.

Mitigative measures that may be appropriate for application in the cuts after detailed investigation may include:

- Selective scaling of loose rock/material from the cut face.
- Ensuring the trail is an adequate distance from toe of the cut face.
- Installation of a catch fence/netting to protect the trail from falling material.
- Localised stabilisation of the rock/soil in the cut face using traditional surface support techniques (bolting, mesh, shotcrete).

A revised risk assessment assuming a detailed assessment and the implementation of appropriate mitigative measures is set out in Table 7.

Table 7: Impacts of mitigation along identified cuts

Trail	Hazard type	Hazard Level	Cuts for detailed review and mitigation	Benefit to trail
CW	Rockfall	High	CH50920-CH51370, CH52350-CH52420, CH53990-CH56280, CH56770-CH57480	55 m reduced to very low hazard
CW	Rockfall	Low		400 m reduced to very low hazard
CW	Soil Cut Failure onto Trail	Very High		30 m reduced to very low hazard
CW	Soil Cut Failure onto Trail	High		1810 m reduced to very low hazard
CW	Rock Cut Failure onto Trail	Low		2130 m reduced to very low hazard
LC	Rockfall	High	CH30340-CH31310	10 m reduced to very low hazard
LC	Rockfall	Moderate		145 m reduced to very low hazard
LC	Rockfall	Low		50 m reduced to very low hazard
LC	Soil Cut Failure onto Trail	Very High		360 m reduced to very low hazard
LC	Soil Cut Failure onto Trail	High		320 m reduced to very low hazard
LC	Rock Cut Failure onto Trail	Moderate		260 m reduced to very low hazard
FL	Rockfall	High	CH17820-CH18440, CH18280-CH18310	5 m reduced to very low hazard
FL	Rockfall	Low		90 m reduced to very low hazard
FL	Soil Cut Failure onto Trail	Very High		30 m reduced to very low hazard
FL	Soil Cut Failure onto Trail	High		570 m reduced to very low hazard

The trail is identified to intersect an area of moderate rockfall hazard between Cumberland River and Wye River at CH41920 to CH43530 (Figure 6). Undertaking micro-rerouting of the trail through this section to avoid the subject to moderate risk will enable the mitigation of approximately 250 m of rockfall risk and may avoid the need to provide mitigation measures. Micro routing or the requirement for engineered risk mitigation measures should be completed during the detail design stage of this trail section.

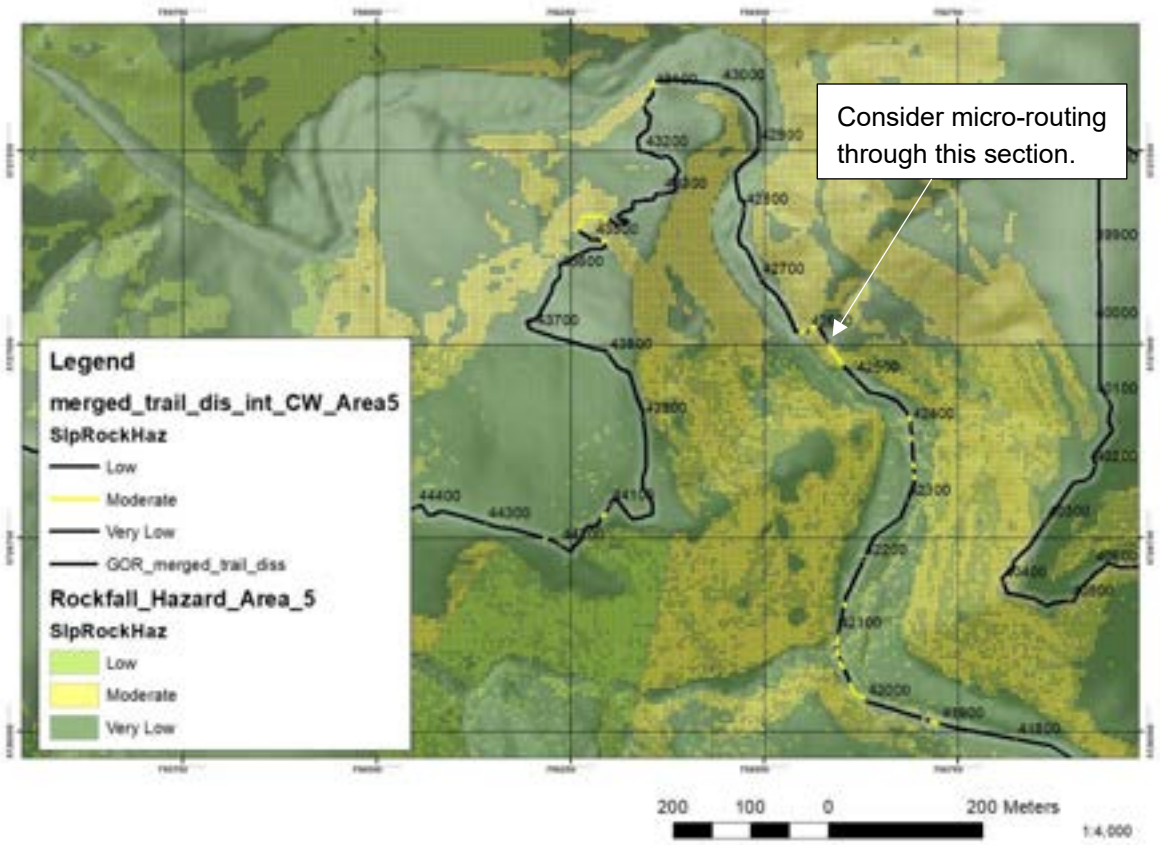

Figure 6: Section of trail from Cumberland River to Wye River where rerouting of the trail is an option to avoid a moderate risk of rockfall.

The trail between North Lorne and South Lorne is along the beach, and in places passes under the fill embankment forming the road above. It is recommended that the risk associated with fill failure along this section of trail be mitigated by ensuring the trail is an adequate distance from the adjacent fill embankment. If the trail route comprises walking on the beach, this is expected to be achieved.

While not all lengths of trail identified in Section 6.2 have had mitigative measures proposed, the areas that have been selected for mitigation are those expected to result in the greatest overall risk reduction, while also being the most practical to implement in the first instance.

6.3.2 Estimated Outcome of Mitigation

The following provides an estimation of the risk outcome for the Great Ocean Road Coastal Trail if the steps taken to mitigate the highest risks identified along the trail are taken as described in Section 6.3.1. It should be noted that these results are estimations on the risk outcomes only and the actual impact of mitigation measures is dependent on the specific design and construction of the mitigative measures which we anticipate will be undertaken during detailed design. However, this assessment indicates the level of risk reduction that could be achieved.

Table 8 shows the resultant estimated risk at each segment after mitigative measures have been implemented at the described locations, while Figure 7 shows the accompanying F-N pairs. It can be observed that post-mitigation the estimated risk associated with all trail segments sit inside the tolerable range. Of the 21 segments, twelve are assessed to have a tolerable risk post mitigation, whilst nine are assessed to have an

acceptable risk. For this assessment it should be noted that mitigative measures are assumed to have only been implemented across the four trail segments identified in Section 6.2.

Table 8: Estimated risk outcomes after mitigation measures are implemented. Hazards that have had mitigation applied are highlighted in bold.

Trail Segment	Shallow Soil Landslide	Rockfall	Debris Flow	Deep Seated Rock Landslide	Fill Hazard onto Trail	Fill Hazard Undermining Trail	Cut Rock onto Trail	Cut Rock Undermining Trail	Cut Soil onto Trail	Cut Soil Undermining Trail	Segment Cumulative Risk
FL	1.04×10^{-6}	***2.97×10^{-5}***	4.32×10^{-6}	2.34×10^{-8}		3.51×10^{-7}	***1.33×10^{-6}***		***4.00×10^{-6}***		***4.07×10^{-5}***
L					***0.00***						***0.00***
LC	9.11×10^{-7}	***3.31×10^{-5}***	4.00×10^{-6}	1.91×10^{-8}		1.17×10^{-6}	***2.95×10^{-6}***	1.83×10^{-9}	***3.94×10^{-6}***	3.63×10^{-10}	***4.60×10^{-5}***
CW	9.99×10^{-7}	***2.13×10^{-5}***	7.33×10^{-6}	2.86×10^{-8}	4.99×10^{-6}	1.75×10^{-6}	***1.93×10^{-6}***	6.08×10^{-9}	***1.24×10^{-7}***	1.22×10^{-7}	***3.86×10^{-5}***
WK	4.54×10^{-8}	3.30×10^{-6}	3.45×10^{-7}	2.16×10^{-9}	5.08×10^{-7}	2.12×10^{-7}	3.42×10^{-6}		3.72×10^{-6}		1.16×10^{-5}
KSm	1.64×10^{-7}	2.73×10^{-6}	3.35×10^{-7}	4.52×10^{-9}	2.31×10^{-7}	1.73×10^{-8}		4.81×10^{-8}		9.62×10^{-9}	3.54×10^{-6}
KSk	2.16×10^{-8}	2.38×10^{-6}	4.08×10^{-7}	5.12×10^{-9}	3.49×10^{-6}	6.99×10^{-7}	5.78×10^{-6}		5.15×10^{-6}		1.79×10^{-5}
Branch1	5.10×10^{-8}	5.18×10^{-7}	2.26×10^{-7}								7.96×10^{-7}
Branch2	8.54×10^{-9}	3.54×10^{-7}	2.36×10^{-6}	1.22×10^{-9}							2.72×10^{-6}
Branch3	5.28×10^{-9}	6.64×10^{-7}	1.45×10^{-7}								8.14×10^{-7}
Branch4	1.47×10^{-9}	2.58×10^{-8}									2.73×10^{-8}
Branch5	1.41×10^{-11}	2.83×10^{-12}									1.70×10^{-11}
Branch6	3.32×10^{-9}	8.17×10^{-9}		5.19×10^{-9}							1.67×10^{-8}
Branch7	7.17×10^{-9}	1.86×10^{-7}	8.51×10^{-7}	3.75×10^{-9}		2.79×10^{-8}	1.84×10^{-7}		3.23×10^{-7}		1.58×10^{-6}
Loop1	1.22×10^{-7}	1.22×10^{-7}	1.61×10^{-8}	1.61×10^{-8}							2.76×10^{-7}

Trail Segment	Shallow Soil Landslide	Rockfall	Debris Flow	Deep Seated Rock Landslide	Fill Hazard onto Trail	Fill Hazard Undermining Trail	Cut Rock onto Trail	Cut Rock Undermining Trail	Cut Soil onto Trail	Cut Soil Undermining Trail	Segment Cumulative Risk
Loop2	1.17×10^{-8}		1.46×10^{-7}								1.58×10^{-7}
Loop3	7.08×10^{-8}	3.66×10^{-6}	7.30×10^{-7}				3.65×10^{-6}		3.96×10^{-6}		1.21×10^{-5}
Loop4	4.07×10^{-7}	2.31×10^{-6}	5.74×10^{-6}	1.51×10^{-7}							8.61×10^{-6}
Loop5	6.29×10^{-8}	1.98×10^{-7}		4.87×10^{-9}							2.65×10^{-7}
Loop 6	9.64×10^{-9}	1.29×10^{-6}	2.46×10^{-7}	4.87×10^{-9}			3.97×10^{-8}		7.94×10^{-8}		1.67×10^{-6}
Loop 7	4.30×10^{-8}	1.94×10^{-6}		8.51×10^{-9}							2.00×10^{-6}

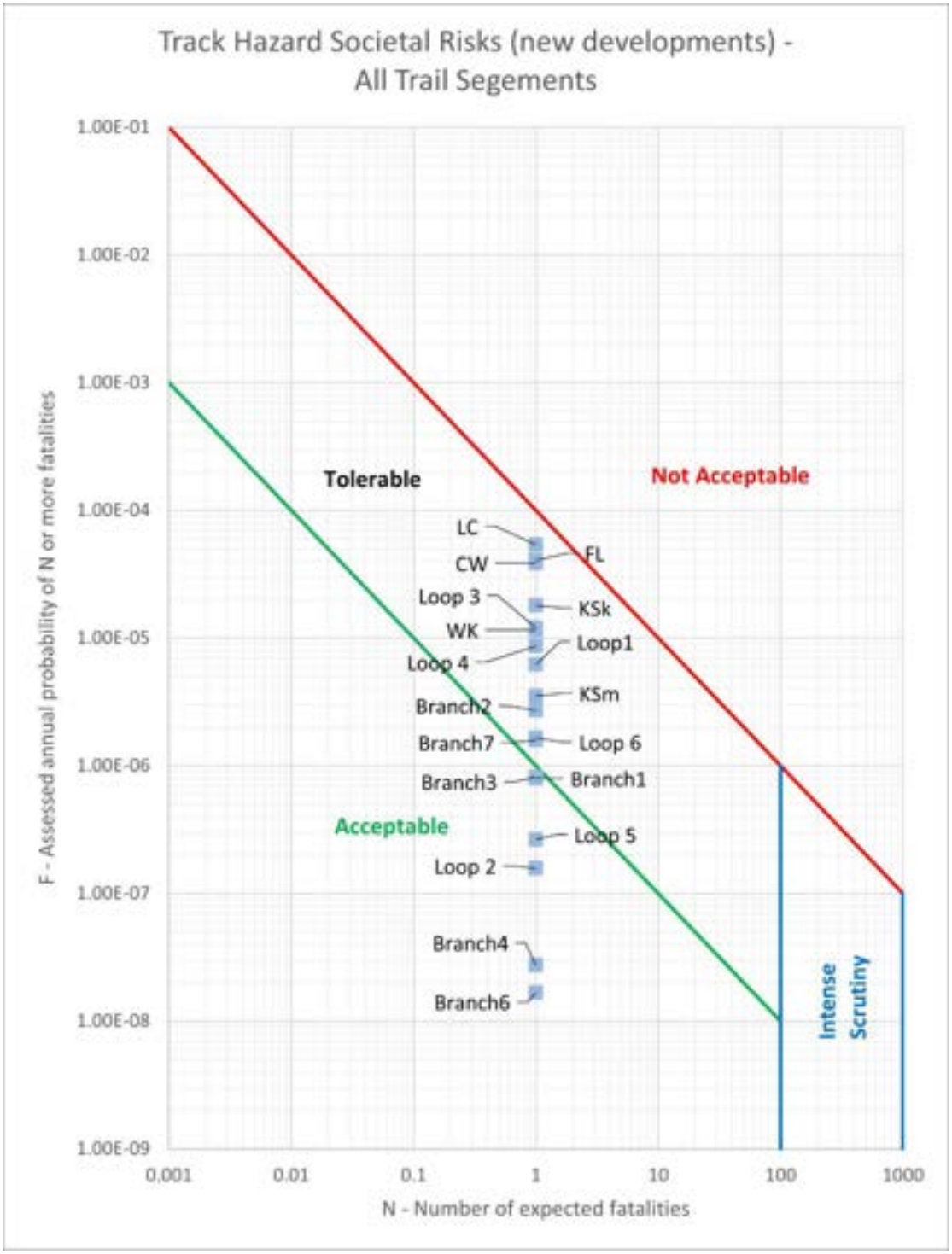

Figure 7: F-N pairs for all trail segments after mitigation measures are implemented.

7.0 SUMMARY AND CONCLUSIONS

As identified in the Geotechnical Hazard Assessment conducted in April 2022, several geotechnical hazards are expected to impact the proposed Great Ocean Road Coastal Trail . The type of hazard, expected frequency of hazard and the number of people exposed to the hazard each year are key factors used to estimate the risk to those utilizing the trail. Of the 21 segments delineated across the proposed trail, one trail

segment, ‘CW’ from Cumberland River to Wye River, was identified as posing a risk that is not acceptable for societal risk to life. Of the remaining 20 segments, 12 have been assessed as subject to a tolerable risk to life and eight are acceptable.

Trail segments that had a cumulative risk outcome of not acceptable or within the upper reaches of tolerable were identified as areas that would benefit from rock fall mitigation. These trail segments included:

- Cumberland River to Wye River, CW
- South Lorne to Cumberland River, LC
- Fairhaven to North Lorne, FL
- North Lorne to South Lorne, L

Select locations along each of these trail segments are recommended for additional detailed assessment in order to determine the most appropriate mitigative measures in each scenario. Given many of the identified hazards are associated with existing cuts in the natural surface detailed hazard assessment is recommended for existing cuttings along the sections identified. One of the existing cuts is the old tramway, where a detailed assessment is recommended to review the localised geotechnical conditions and recommend site-specific mitigative measures. Localised mitigative measures may include adjustments to the trail alignment, scaling of existing cut faces, construction of catch fences or netting and/or the stabilization of the cut faces. It is expected that with detailed assessment and localized risk mitigation, the risk to life can be reduced to a tolerable level.

Other areas where risk along the trail has been flagged for mitigation include sections where elevated rockfall risk is encountered, for example the section of trail along the banks of the Cumberland River. In these locations, micro-re-routing of the trail as part of the detailed design stage will likely enable much of this hazard to be avoided. Additional mitigative measures, for example rock fall barriers may be required if this is not possible.

It is estimated, that if the appropriate mitigative measures, such as those discussed in throughout this report, are implemented appropriately in the highlighted areas during the detailed design stage, the cumulative risk along the trail can be significantly reduced, with no trail segments subject to an unacceptable risk, and those in the tolerable range plotting towards the lower end of that range, thus allowing for future growth in trail users numbers.

8.0 IMPORTANT INFORMATION

Your attention is drawn to the document ‘Important information relating to this report’ which is included in APPENDIX C of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. This document is not intended to reduce the level of responsibility accepted by WSP Golder, but rather to ensure that all parties who rely on this report are aware of the responsibilities each assumes in so doing. We would be pleased to answer any questions the reader may have regarding this document.

9.0 REFERENCES

- Australian Geomechanics Society, ‘Practice Note Guidelines for Landslide Risk Management 2007,’ Journal and News of the Australian Geomechanics Society, Vol. 42, No. 1, March 2007 (AGS 2007c)

- Australian Geomechanics Society, ‘Commentary on Practice Note Guidelines for Landslide Risk Management 2007,’ Journal and News of the Australian Geomechanics Society, Vol. 42, No. 1, March 2007 (AGS 2007d)
- New South Wales National Parks and Wildlife Services, ‘Guidelines for Quantitative Risk to Life Calculations for Landslides,’ 16 January 2020 (NSW NPWS 2020)

Signature Page

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https://golderassociates.sharepoint.com/sites/147439/project files/6 deliverables/002-r/21468192-002-r-rev1.docx

LEGEND

Major Roads

Risk Level

- Portions of the trail segment are not acceptable
- Trails Aceeptable
- Trails Tolerable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 1,500 3,000 4,500 6,000

Scale @ A3 1:155,000 METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-10-03
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL – GEOTECHNICAL HAZARD ASSESSMENT

TITLE
GREAT OCEAN ROAD COASTAL TRAIL RISK ASSESSMENT AND MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Reference Map 1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3

25mm

0

BARONGAROOK WEST
CORAM
YEODENE
BARONGAROOK
PENNYROYAL
BOONAH
MURROON
COLAC - FORREST RD
BIRREGURRA - FORREST RD
GREAT OCEAN RD
GERANGAMETE
BARWON DOWNS
MOGGS CREEK
AIREYS INLET
EASTERN VIEW
MEMORIAL ARCH
FAIRHAVEN
BENWERRIN
Sheet 1
KAWARREN
WYMBOOLIEL
BIG HILL (LORNE)
LOVAT
YAUGHER
GOR Loop 3
GELLIBRAND
FORREST
Sheet 2
GOR Branch 1
LORNE
ALLENVALE
GOR Branch 2
GOR Loop 2
UPPER GELLIBRAND
GOR Loop 1
GOR Loop 5
BARRAMUNGA
Sheet 3
GOR Loop 4
CHARLEYS CREEK
WIMBA
Sheet 4
DINMONT
MOUNT SABINE
WYE RIVER
SEPARATION CREEK
FERGUSON
OLANGOLAH EAST
PILE SIDING
WEEAPROINAH
BEECH FOREST
GOR Loop 6
Sheet 5
TANYBRYN
GOR Branch 7
KENNETT RIVER
Sheet 6
GREY RIVER
SKENES CREEK NORTH
AIRE VALLEY
SUGARLOAF
WONGARRA
PETTICOAT CREEK
SKENES CREEK
Sheet 7
CAPE HORN
KILLALA
GREAT OCEAN RD
APOLLO BAY

LEGEND

Major Roads

Risk Level

- Portions of the trail segment are not acceptable
- Trails Acceptable
- Trails Tolerable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 3,300 6,600

1:185,500 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-21
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL – GEOTECHNICAL HAZARD ASSESSMENT

TITLE
DRAWING SET 1- GREAT OCEAN ROAD COASTAL TRAIL RISK ASSESSMENT AND MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Reference Map 1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3

25mm

0

LEGEND

- Major Roads

Risk Level

- Portions of the trail segment are not acceptable
- Trails Acceptable
- Trails Tolerable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 880 1,760

1:49,400 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-21
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL – GEOTECHNICAL HAZARD ASSESSMENT

TITLE
DRAWING SET 1- GREAT OCEAN ROAD COASTAL TRAIL RISK ASSESSMENT AND MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3

25mm

0

PATH: \\golder.gbl\gap\Melbourne\Geomatics\World_Trail\Great_Ocean_Road\99_PROJECTS\21468192_Great Ocean Road Trail\21468192_Geotechnical Hazard Assessment\02_PRODUCTION\MXD\20220920_World Trail\Rev-0\21468192-001-R-Rev0_Drawing_1A.mxd PRINTED ON: 2022-11-21 AT: 3:43:08 PM

DEANS MARSH - LORNE RD
GOR Loop 3
OCEAN RD
DEANS MARSH RD
LORNE
MOUNTJOY PDE
GOR Branch 1
ALLENVALE
GOR Loop 1
GOR Loop 2
GREAT OCEAN RD

LEGEND

Major Roads

Risk Level

Portions of the trail segment are not acceptable

Trails Acceptable

Trails Tolerable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 380 760

1:20,880 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-21
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL – GEOTECHNICAL HAZARD ASSESSMENT

TITLE
DRAWING SET 1- GREAT OCEAN ROAD COASTAL TRAIL RISK ASSESSMENT AND MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3

25mm

0

ALLENVALE
GOR Branch 1
GOR Loop 1
GOR Loop 2
GOR Branch 2
GOR Branch 3
GOR Branch 4
GOR Loop 7
GOR Loop 5
GOR Loop 4
GREAT OCEAN RD

LEGEND

Major Roads

Risk Level

Portions of the trail segment are not acceptable

Trails Acceptable

Trails Tolerable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 340 680

1:18,690 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL – GEOTECHNICAL HAZARD ASSESSMENT

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-21
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

TITLE
DRAWING SET 1- GREAT OCEAN ROAD COASTAL TRAIL RISK ASSESSMENT AND MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3

25mm

0

LEGEND

- Major Roads

Risk Level

- Portions of the trail segment are not acceptable
- Trails Acceptable
- Trails Tolerable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 870 1,740

1:48,460 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-21
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL – GEOTECHNICAL HAZARD ASSESSMENT

TITLE
DRAWING SET 1- GREAT OCEAN ROAD COASTAL TRAIL RISK ASSESSMENT AND MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 4

LEGEND

Major Roads

Risk Level

Portions of the trail segment are not acceptable

Trails Acceptable

Trails Tolerable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 380 760

1:20,830 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL – GEOTECHNICAL HAZARD ASSESSMENT

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-21
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

TITLE
DRAWING SET 1- GREAT OCEAN ROAD COASTAL TRAIL RISK ASSESSMENT AND MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3

25mm

0

PATH: \\golder.gds\gas\Melbourne\Graphics\World_Trail\Great_Ocean_Road\9b_PROJECTS\21468192_Great Ocean Road Trail\21468192_Geotechnical Hazard Assessment\02_PRODUCTION\MXD\20220920_World Trail\Rev-0\21468192-001-R-Rev0_Drawing_1A.mxd PRINTED ON: 2022-11-21 AT: 3:43:28 PM

LEGEND

- Major Roads

Risk Level

- Portions of the trail segment are not acceptable
- Trails Acceptable
- Trails Tolerable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 710 1,420

1:39,630 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-21
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL – GEOTECHNICAL HAZARD ASSESSMENT

TITLE
DRAWING SET 1- GREAT OCEAN ROAD COASTAL TRAIL RISK ASSESSMENT AND MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3

25mm

0

PATH: \\golder.gds\gap\Melbourne\Geomatics\World_Trail\Great_Ocean_Road\99_PROJECTS\21468192_Great Ocean Road Trail\21468192_Geotechnical Hazard Assessment\02_PRODUCTION\MXD\20220920_World Trail\Rev.0\21468192-001-R-Rev0_Drawing_1A.mxd PRINTED ON: 2022-11-21 AT: 3:43:32 PM

LEGEND

Major Roads

Risk Level

Portions of the trail segment are not acceptable

Trails Acceptable

Trails Tolerable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 380 760

1:20,830 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-21
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL – GEOTECHNICAL HAZARD ASSESSMENT

TITLE
DRAWING SET 1- GREAT OCEAN ROAD COASTAL TRAIL RISK ASSESSMENT AND MITIGATION MEASURES

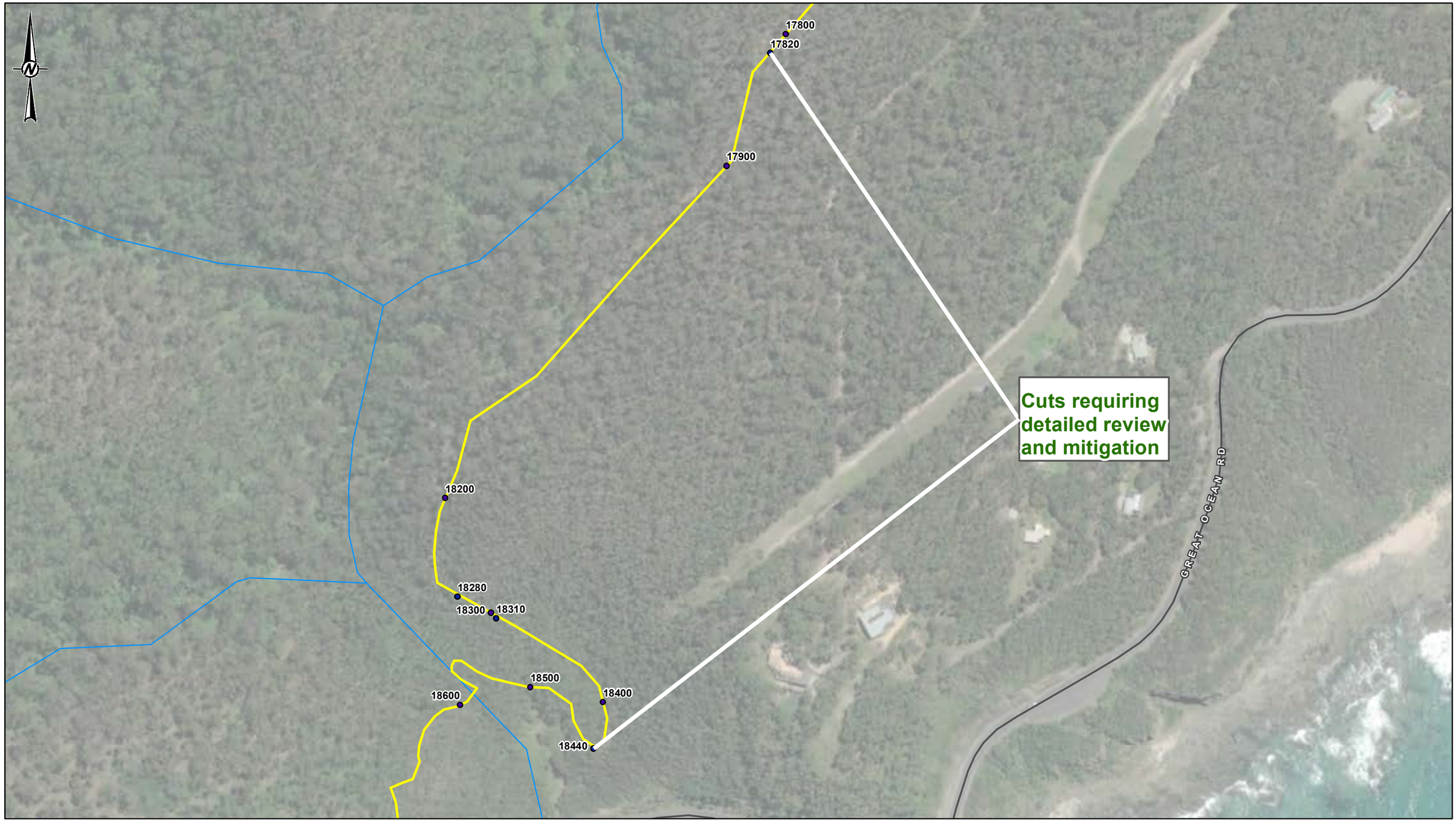
PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A1

29mm

0

PATH: \\golder.gds\gap\Melbourne\Geomatics\World_Trail\Great_Ocean_Road\99_PROJECTS\21468192_Great Ocean Road Trail\21468192_Geotechnical Hazard Assessment\02_PRODUCTION\MXD\20220920_World Trail\Rev.0\21468192-001-R-Rev0_Drawing_1A.mxd PRINTED ON: 2022-11-21 AT: 3:43:37 PM



LEGEND

- Major Roads
- Watercourse

Risk Level

- Trails Tolerable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 30 60 90

1:2,500 Scale @ A3 METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-22
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL - GEOTECHNICAL HAZARD ASSESSMENT

TITLE
MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 8

LEGEND

- Major Roads
- Watercourse

Risk Level

- Trails Tolerable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 110 220

1:6,000 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-22
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL - GEOTECHNICAL HAZARD ASSESSMENT

TITLE
GREAT OCEAN ROAD TRAIL RISK ASSESSMENT AND MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 9

LEGEND

— Major Roads

Risk Level

— Trails Tolerable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 9 18 27 36

1:1,000 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-22
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL - GEOTECHNICAL HAZARD ASSESSMENT

TITLE
MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 10

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25mm

0

PATH: \\golder.gds\gap\Melbourne\Geomatics\World_Trail\Great_Ocean_Road\99_PROJECTS\21468192_Great Ocean Road Trail\21468192_Geotechnical Hazard Assessment\02_PRODUCTION\MXD\20220920_WorldTrailRev-0\21468192-001-R-Rev0_Sheet10.mxd PRINTED ON: 2022-11-22 AT: 11:18:39 AM

LEGEND

Major Roads
Watercourse

Risk Level

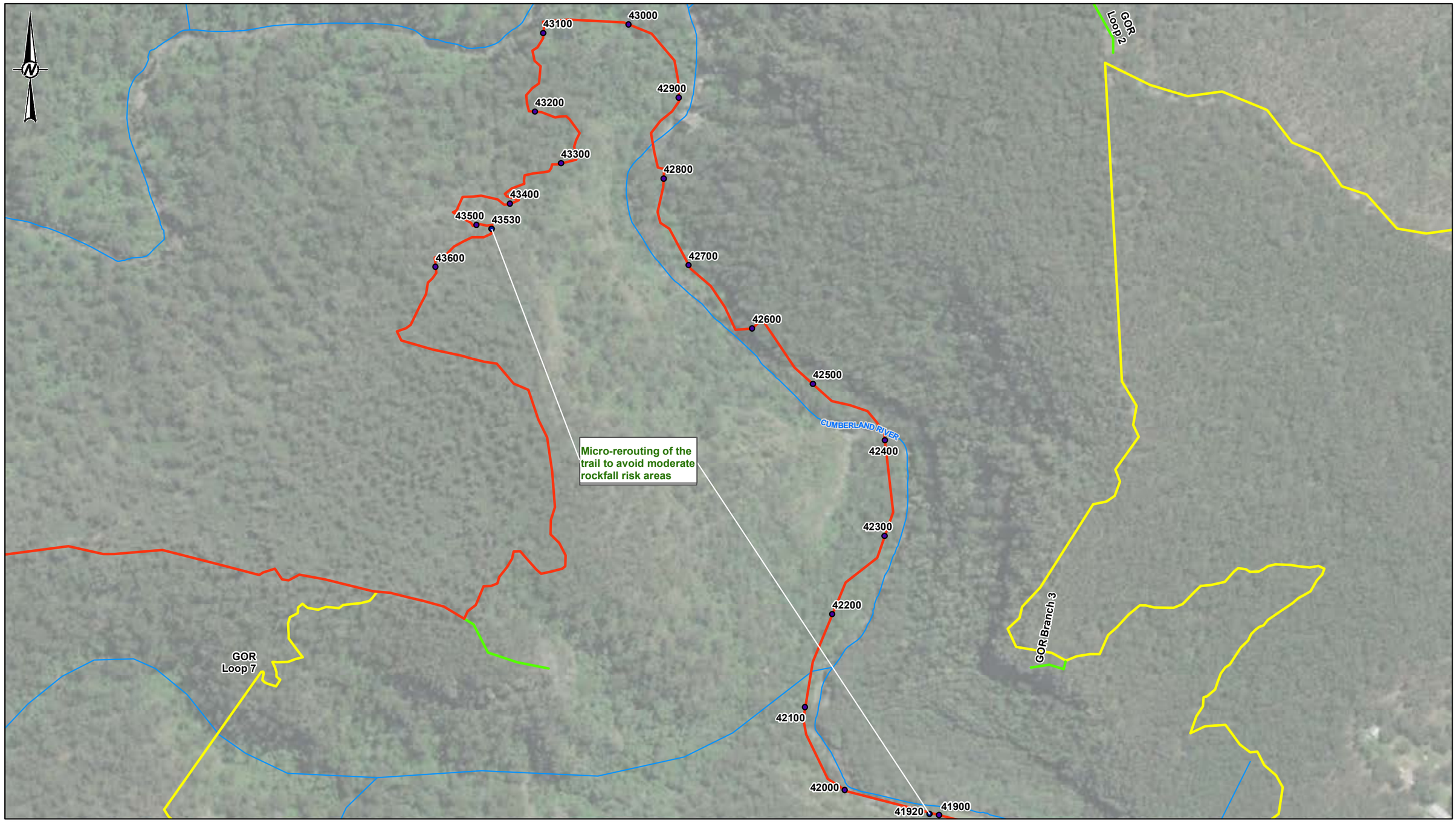
Portions of the trail segment are not acceptable
Portions of the trail segment are Acceptable
Portions of the trail segment are Tolerable

REFERENCE(S)
1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 40 80
1:2,200 Scale @ A3 METRES

CLIENT WORLD TRAIL		PROJECT GREAT OCEAN ROAD COASTAL TRAIL - GEOTECHNICAL HAZARD ASSESSMENT	
CONSULTANT WSP GOLDER	YYYY-MM-DD	2022-11-22	TITLE **GREAT OCEAN ROAD TRAIL RISK ASSESSMENT AND MITIGATION MEASURES**
	DESIGNED	-	
	PREPARED	AN	
	REVIEWED	DRP	PROJECT NO. 21468192 — CONTROL 001-R — REV. 0 — FIGURE Sheet 11
	APPROVED	DRP	

25mm



LEGEND

Watercourse

Risk Level

- Portions of the trail segment are not acceptable
- Trail Acceptable
- Trail Tolerable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 60 120

1:3,800 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-22
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL - GEOTECHNICAL HAZARD ASSESSMENT

TITLE
MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 12

PATH: \\golder.gds\gas\Melbourne\Geomatics\World_Trail\Great_Ocean_Road\9b_PROJECTS\21468192_Great Ocean Road Trail\21468192_Geotechnical Hazard Assessment\02_PRODUCTION\MXD\20220920_World Trail\Rev-0\21468192-001-R-Rev0_Sheet12.mxd PRINTED ON: 2022-11-22 AT: 12:31:20 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25mm

0

LEGEND

— Major Roads

Risk Level

— Portions of the trail segment are not acceptable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 40 80

1:2,600 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-22
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL - GEOTECHNICAL HAZARD ASSESSMENT

TITLE
MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 13

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3

25mm

0

PATH: \\gdsler.gds\gan\Melbourne\Geomatics\World_Trail\Great_Ocean_Road\99_PROJECTS\21468192_Great Ocean Road Trail\21468192_Geotechnical Hazard Assessment\02_PRODUCTION\MXD\20220920_World Trail\Rev-0\21468192-001-R-Rev0_Sheet13.mxd PRINTED ON: 2022-11-22 AT: 12:09:40 PM

LEGEND

- Major Roads
- Watercourse

Risk Level

- Portions of the trail segment are not acceptable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 20 40

1:1,250 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-22
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL - GEOTECHNICAL HAZARD ASSESSMENT

TITLE
MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 14

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3

25mm

0

PATH: \\golder.gds\gap\Melbourne\Geomatics\World_Trail\Great_Ocean_Road\99_PROJECTS\21468192_Great Ocean Road Trail\21468192_Geotechnical Hazard Assessment\02_PRODUCTION\MXD\20220920_WorldTrailRev-0\21468192-001-R-Rev0_Sheet14.mxd PRINTED ON: 2022-11-22 AT: 12:30:33 PM

LEGEND

- Major Roads
- Watercourse

Risk Level

- Portions of the trail segment are not acceptable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 125 250

1:6,800 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-22
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL - GEOTECHNICAL HAZARD ASSESSMENT

TITLE
MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 15

PATH: \\golder.gds\gap\Melbourne\Geomatics\World_Trail\Great_Ocean_Road\99_PROJECTS\21468192_Great Ocean Road Trail\21468192_Geotechnical Hazard Assessment\02_PRODUCTION\MXD\20220920_World Trail\Rev-0\21468192-001-R-Rev0_Sheet15.mxd PRINTED ON: 2022-11-22 AT: 12:32:10 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3

25mm

0

LEGEND

- Major Roads
- Watercourse

Risk Level

- Portions of the trail segment are not acceptable

REFERENCE(S)

1. PROJECTION: GDA 1994 VICGRID94
2. AERIAL IMAGERY SOURCED FROM ESRI.
3. VICMAP AND DATA.VIC DATA DISPLAYED IN THIS MAP.

0 30 60

1:2,000 **Scale @ A3** METRES

CLIENT
WORLD TRAIL

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-22
DESIGNED	-
PREPARED	AN
REVIEWED	DRP
APPROVED	DRP

PROJECT
GREAT OCEAN ROAD COASTAL TRAIL - GEOTECHNICAL HAZARD ASSESSMENT

TITLE
MITIGATION MEASURES

PROJECT NO.	CONTROL	REV.	FIGURE
21468192	001-R	0	Sheet 16

PATH: \\golder.gds\gap\Melbourne\Geomatics\World_Trail\Great_Ocean_Road\99_PROJECTS\21468192_Great Ocean Road Trail\21468192_Geotechnical Hazard Assessment\02_PRODUCTION\MXD\20220920_World Trail\Rev-0\21468192-001-R-Rev0_Sheet16.mxd PRINTED ON: 2022-11-22 AT: 12:15:44 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A1

0 25mm

APPENDIX A

Method of Risk Assessment

INTRODUCTION

The following sets out the method used to estimate risk. This method is based on NSW NPWS 2020. Methods of calculation and estimation have been set out for:

- Risk to life in a static scenario, which relates to a case where people are static and could be impacted by a hazard. This has been applied to people on lookouts.
- Risk to life in a mobile scenario, which relates to the case where people move past a hazard and could be impacted. This has been applied to all walking trails.

The risk calculation methodology is described briefly, for further detail see NSW NPWS 2020. General descriptions and reasoning for the inputs are then described.

RISK TO LIFE – STATIC SCENARIO

Not used in this risk assessment, to be applied if proposed lookouts are assessed in future

The risk to life of the individual most at risk in a static case may be calculated using Equation 1 (listed as Equation 5 in NSW NPWS 2020):

$$R_{(LOL)} = P_{(H)} \times P_{(S:H)} \times P_{(T:S)} \times V_{(D:T)} \qquad \text{(Eq. 1)}$$

Where:

$R_{(LOL)}$ = the risk or annual probability of loss of life of the individual most at risk. This is usually the individual who is exposed to the hazard for the greatest length of time.

$P_{(H)}$ = the annual probability that a landslide or rock fall occurs.

$P_{(S:H)}$ = the probability of impact to the element at risk taking into account the travel distance, direction of the landslide or rock fall and proportion of the element at risk impacted.

$P_{(T:S)}$ = the temporal spatial probability (e.g. of an individual being in in the path of the rock fall) given a rock fall or landslide reaches the location. In this situation this refers to the person who spends the most time exposed to the hazard each year.

$V_{(D:T)}$ = is the vulnerability of the individual given they are in the path of the rock fall when it occurs.

Societal risk is the risk of multiple fatalities or injuries in society as a whole. Where greater than ten people are exposed to a hazard (over a year), this risk is calculated in addition to the risk to the individual. Assessing the societal risk involves using many of the same inputs. This requires the calculation of an F-N pair.

F – The probability of impact to the static element at risk (person at the lookout).

F is calculated using Equation 2:

$$F = P_{(H)} \times P_{(S:H)} \qquad \text{(Eq. 2)}$$

N – The theoretical number of people expected to be killed if impact occurs.

N is calculated using Equation 3:

$$N = e_s P_{(T:S)} V_{(D:T)} \qquad \text{(Eq. 3)}$$

Where:

e_s = the exposed population. This is the annual visitation at the element at risk.

$P_{(T:S)}$ = this is the same as in Equation 1, except now it refers to the time spent exposed to the hazard by the average person, rather than the individual most at risk.

$V_{(D:T)}$ = this is as in Equation 1.

For the static case this value is the exposed population, e_s. The other values are the same as above. Note that if the estimated visitation changes the risk assessment will also change.

RISK TO LIFE – MOBILE SCENARIO

The risk to life of an individual in a mobile case may be calculated using Equation 4, the equation for mobile risk to life is set out as Equation 1 in NSW NPWS (2020):

$$R_{(LOL)} = P_{(H)} V_{(D:T)} n_i w f d \times 1.1 \times 10^{-7} / s_i \qquad \text{(Eq. 4)}$$

Where:

$R_{(LOL)}$ = the risk or annual probability of loss of life of the individual most at risk. This is usually the individual who is exposed to the hazard for the greatest length of time.

$P_{(H)}$ = the annual probability that a landslide or rock fall occurs.

$V_{(D:T)}$ = is the vulnerability of the individual given they are in the path of the landslide or rock fall when it occurs.

n_i = the number of traverses the individual most at risk makes within a year.

w = the proportion of the width of the road or trail affected by the landslide and ranges between 0 (none of the trail affected) to 1 (full width of trail affected).

f = a reduction factor of between 0 and 1 that relates to the probability of a person being present when the landslide is triggered. For example, if a landslide is expected to be triggered during heavy rain then the individual may be assumed to be half as likely to be present when the landslide occurs, so f = 0.5. If unsure, or the event may occur at any time, then f = 1.

d = the length of the trail that could be impacted by the landslide.

s_i = the speed in km/hr that the individual most at risk moves through the area subject to the hazard.

Calculating the societal risk for the mobile situation again involves an F-N pair, although the method of calculation is slightly different than for the static case.

N – the number of people comprising each mobile element.

For a walking trail each individual is usually considered a mobile element at risk, so N = 1. A wider walking trail where people usually walk in pairs could result in N = 2.

F – the probability of impact to the element at risk.

For mobile elements at risk, F is estimated using Equation 5. For each walking trail, it is assumed that the individual most at risk is the same as the average individual, i.e. individuals visit once a year.

$$F = 1 - (1 - AvR_{(LOL)})^n \qquad \text{(Eq. 5)}$$

Where:

$AvR_{(LOL)}$ = the risk or annual probability of loss of life of the average individual. If the average individual is the same as the individual most at risk, then this is the same as $R_{(LOL)}$ calculated using Equation 4.

n = the total number of traverses made annually through the area at risk by the mobile element.

A person walking along the trail trail is exposed to multiple hazards. Therefore, the risk to life for the individual most at risk is calculated for each hazard and then the risk to life of an individual exposed to the hazards can be estimated using Equation 6.

$$R_{(LOLC)} = 1 - \left[\left(1 - R_{LOLH1)}\right) \times \left(1 - R_{(LOLH2)}\right) \times \left(1 - R_{(LOLH3)}\right) \ldots \left(1 - R_{(LOLHX)}\right)\right] \qquad \text{(Eq.4)}$$

Where:

$R_{(LOLC)}$ = the combined risk of loss of lie to the individual from multiple hazards.

$R_{(LOLH1)}$ = the risk of loss of life from hazard 1.

Similarly, the combined risk to life to multiple persons (societal risk) exposed to multiple hazards can be estimated using the F-N pairs calculated for each hazard. In the case of trails in which lookout are present, the N is not the same for each hazard. Therefore, the cumulative probability is estimated. This is undertaken as indicated in Table A1, noting that $N_{H1} < N_{H2} < N_{H3}$ etc.

Table A1: Calculation of Cumulative Probability

Hazard	N	F	F_c, N or more fatalities
1	N_{H1}	F_{H1}	F_C = 1-[(1-F_{H1}) x (1-F_{H2}) x (1-F_{H3})……(1-F_{HX})]
2	N_{H2}	F_{H2}	F_C = 1-[(1-F_{H2}) x (1-F_{H3}) ……(1-F_{HX})]
3	N_{H3}	F_{H3}	F_C = 1-[(1-F_{H3}) ……(1-F_{HX})]
X	N_{HX}	F_{HX}	F_C = 1-[(1-F_{HX})]

Each F_C-N pair is assessed in the same way as individual F-N pairs.

RISK TO PROPERTY

Risk to property has been estimated using the qualitative methods set out in AGS 2007c Appendix C. Table A2 shows the relationship between Likelihood and Consequence to produce a risk to property, where:

- VH is Very High
- H is High
- M is Medium
- L is Low
- VL is Very Low

Table A2: Qualitative Risk Analysis Matrix - Level of Risk to Property (AGS 2007c)

LIKELIHOOD		CONSEQUENCES TO PROPERTY				
	Indicative Value of Approximate Annual Probability	**Catastrophic**	**Major**	**Medium**	**Minor**	**Insignificant**
Almost Certain	10^{-1}	VH	VH	VH	H	M
Likely	10^{-2}	VH	VH	H	M	L
Possible	10^{-3}	VH	H	M	M	VL
Unlikely	10^{-4}	H	M	L	L	VL
Rare	10^{-5}	M	L	L	VL	VL
Barely Credible	10^{-6}	L	VL	VL	VL	VL

EXPLANATION OF INPUTS

This section explains the various inputs used to calculate risk for the hazards identified in this project. It uses the assumptions described in Section 6.3.1 and relates them to the inputs required to estimate risk.

P(H) – the annual probability of a landslide or rock fall occurring

The general methodology for estimating the probability of a landslide or rock fall occurring is described in Section 6.2. Based on observations made in the field, the baseline probability of 0.01, or a 1 in 100 year event is adjusted up or down to reflect the conditions. This has then been increased based on observations of the items set out in Table A3.

For the purposed of this risk assessment, P(H) inputs have been directly derived from the hazard maps generated in 21468192-001-R-Rev0 with some additional spatial adjustments performed as described in Section 5.2.1.

Table A3: Information Used to Inform Estimation of P(H)

Category	Examples	Effect on P(H)
Evidence of past or current instability	• Debris fans or fresh rocks at base of slope or cliff • Visible scarps or tension cracks • Known recent rock falls or landslides	Increase
Geology	Highly weathered rock or loose alluvium	Increase
Structure	Cracking or jointing in rock cliff	Increase
Erosion	Undercutting at base of cliff from wave attack	Increase
Morphology	• Overhangs in cliffs • Oversteep sections of slope	Increase
Drainage	• Water seepage from face • Evidence of poor drainage	Increase
Vegetation	Dense vegetation on slope	Decrease

P(S:H) – the probability of impact to the element at risk

Considers the ability of a rockfall or landslide to reach or impact the trail or lookout. The slope angle, distance of trail from cliff/slope, observed vegetation and type or rock will influence the probability of impact to the trail.

P(T:S) – the temporal spatial probability

It has been assumed that a person walking the trail will have an average walking speed of 3km/h.

V(D:T) – vulnerability

Vulnerability has generally been estimated using the suggested values in Appendix F of AGS 2007c. This has then been altered if appropriate by considering the size of potential falling rocks, the volume of landslide debris and potential warning signs that may alert persons in the path of the hazard.

e_s – the exposed population

The exposed population takes into account the estimates for annual visitation to each site provided by World Trail and reported in Section 5.3.2.

n_i – number of traverses (of a walking trail)

For each segment assessed a single traverse has been assumed, so the value is 1.

w – proportion of trail width affected

The trail is generally narrow so it has been assumed that each hazard will affect the full width of the trail, so w = 1.

f – reduction factor for weather

For the geotechnical hazards identified to be triggered by heavy rainfall, a reduction factor has been applied depending on the strength of the correlation between rainfall and the event type. The following factors have been applied across this study:

- For shallow soil landslide, debris flow, soil cut/fill failure, f=0.1
- For rockfall, deep seated rock landslide, rock cut/fill failure, f=0.5

d – length of trail affected

This has been estimated for each hazard based on the expected size of the landslide event and the distance from the current slope crest to the walking trail. The inputs generated and used for each hazard type are summarised in Table A4.

Table A4: Length of trail affected

Hazard Type	Length (m)	
Shallow Soil Landslide	31.62	Assumes 1000m^2 area impacted, so rationalised for a linear value
Rockfall	1	1m boulder size
Debris Flow	Average debris flow size encountered for each hazard level within each segment	

Hazard Type	Length (m)	
Deep Seated Rock Landslide	Average deep seated landslide size encountered for each hazard level within each segment	
Cut/Fill Hazards	10	10m failure of cut/fill assumed

s_i – speed of movement

This has been assumed to be 3 km/hr.

N – the number of people comprising each mobile element

As the trails are generally narrow, it has been assumed that N = 1.

$A_vR_{(LOL)}$ – risk to life for the average individual

It is assumed that the average individual is the same as the individual most at risk for this trail. Parks Victoria employees walking along the trail multiple times a year have been assumed to be at negligible risk compared to the public usage due to the significantly larger number of individuals.

n – the total number of traverses made annually through the area at risk by the mobile element

As single traversed have been considered, this is equal to the exposed population (e_s), the annual visitation of the walking trail.

LIKELIHOOD (for risk to property)

The product of P(H) and P(S:H) to produce the probability of a landslide event occurring and affecting the element at risk.

CONSEQUENCE (for risk to property)

The definitions of the consequence categories in AGS 2007c refer more appropriately to buildings such as a residential house. For this purpose, the categories defined in Table 26 of the Roads and Maritime Services Guide to Slope Risk Analysis (RMS 2014) are used. These categories have been slightly adapted as references to road closures are not relevant here and are shown in Table A5.

Table A5: Estimation of Consequence to Property (adapted from RMS 2014 Table 26)

Consequence Rating	Description
Catastrophic	Total direct and indirect costs > $15M: ■ Major infrastructure or property damage ■ Very high repair costs
Major	Total direct and indirect costs > $3M and < $15M: ■ Substantial infrastructure or property damage ■ High repair costs
Medium	Total direct and indirect costs > $0.8M and < $3M: ■ Moderate infrastructure or property damage ■ Moderate repair costs
Minor	Total direct and indirect costs > $0.2M and < $0.8M: ■ Minor infrastructure or property damage ■ Low repair costs

Consequence Rating	Description
Insignificant	Total direct and indirect costs < $0.2M: ■ Negligible infrastructure or property damage ■ Very low to no repair costs

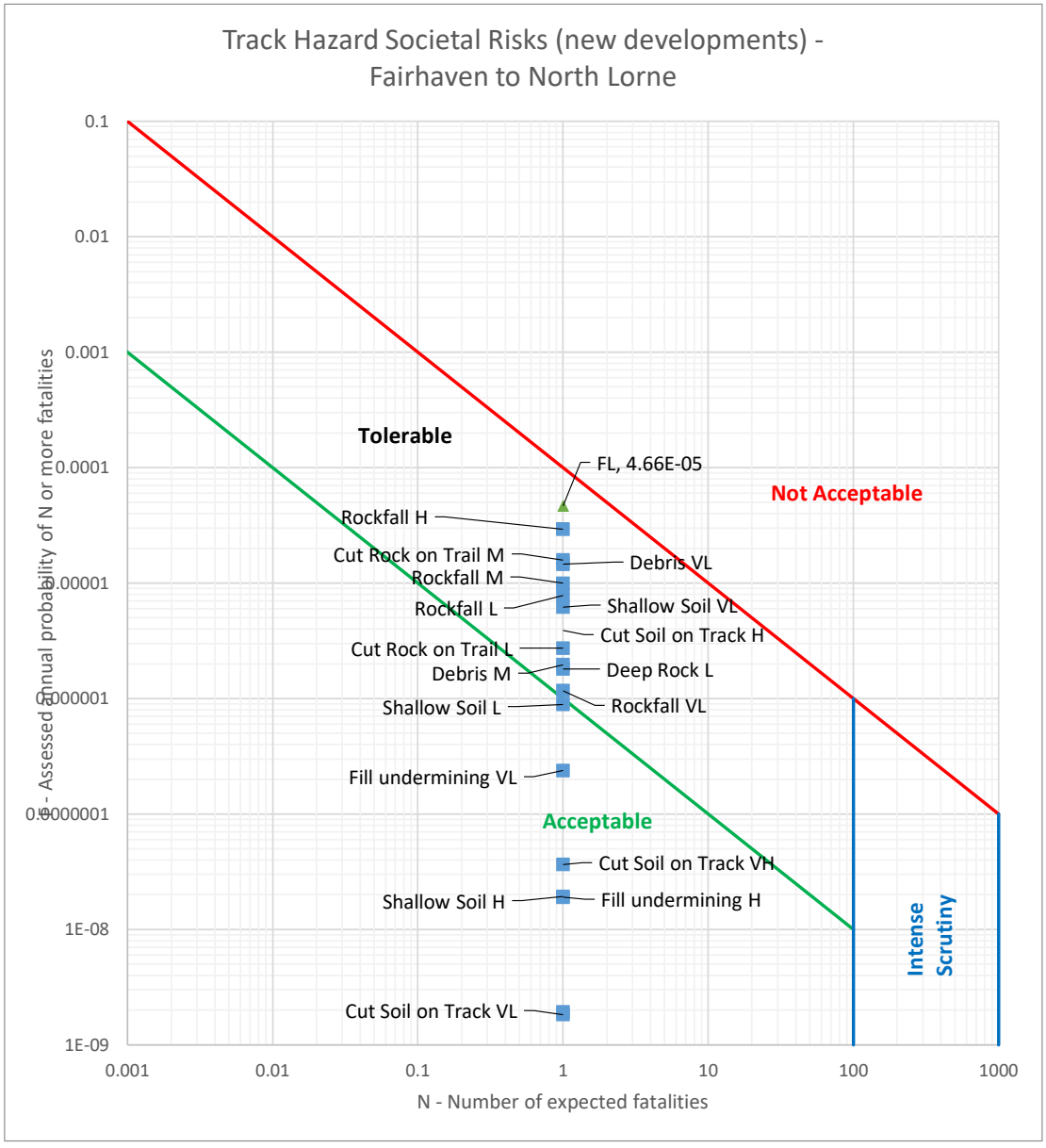
The trail infrastructure assessed in this study have been assumed to be relatively low value. Therefore, with reference to Tables A4 and A5, damage has been considered Insignificant.

APPENDIX B

Risk Calculation Summary Tables and F-N Charts

FL, Fairhaven to North Lorne - F-N Pairs

Notes: Assumes 25488 visitors per year. Cumulitive risk along this segement is tolerable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	FL, Fairhaven to North Lorne - F-N Pairs
	REVIEWED	DRP		

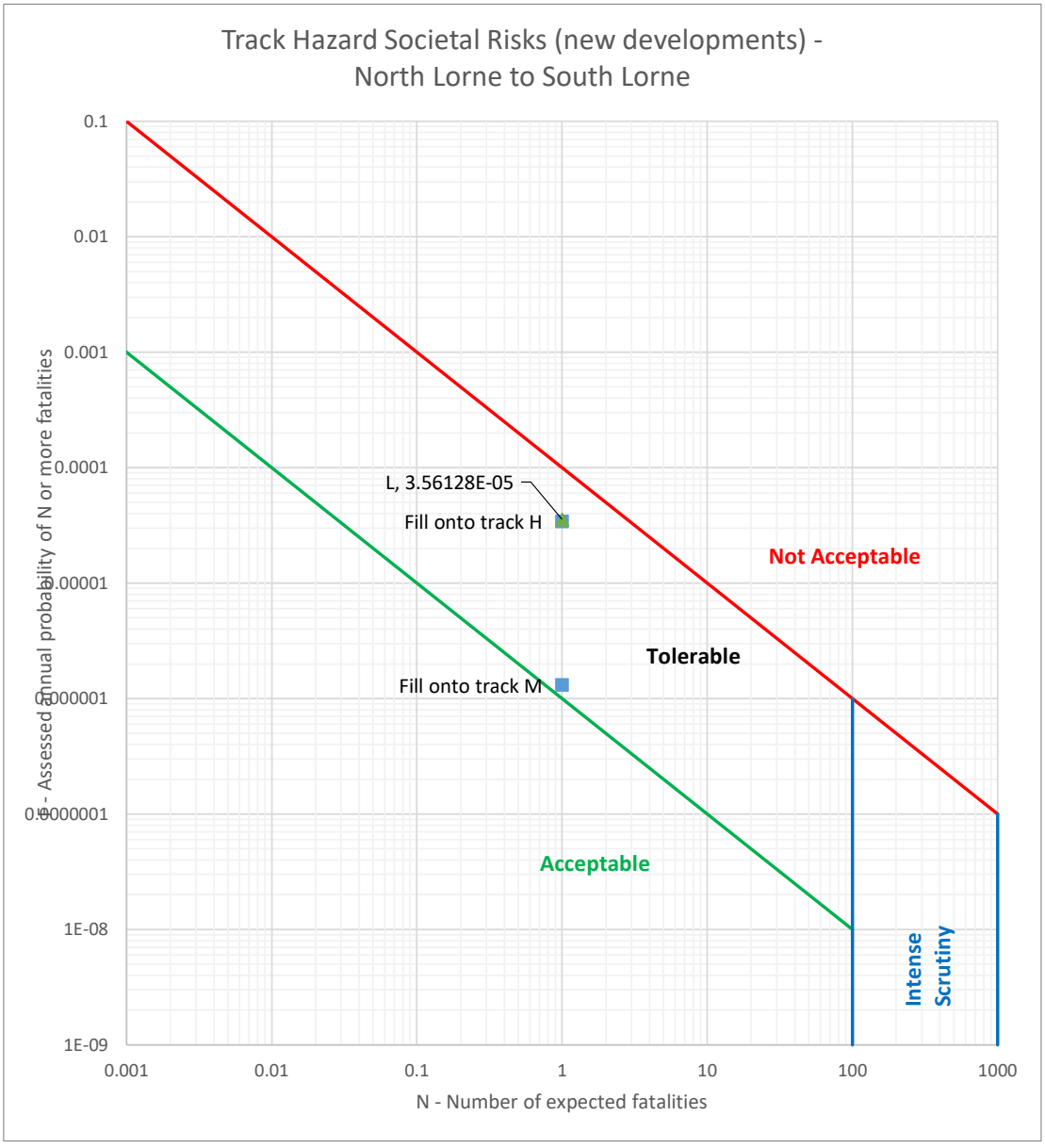
FL, Fairhaven to North Lorne - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
FL	Cut Rock on Trail L	0.0018	0.5	1	0.5	0.5	10	3	8.25E-11	Acceptable	25488.1	2.10277E-06	1	Tolerable
FL	Cut Rock on Trail M	0.0009	0.5	1	0.5	0.5	10	3	4.13E-11	Acceptable	25488.1	1.05138E-06	1	Tolerable
FL	Cut Soil on Track VL	0.00003	0.05	1	0.5	0.1	10	3	2.75E-14	Acceptable	25488.1	7.01777E-10	1	Acceptable
FL	Cut Soil on Track H	0.171	0.05	1	0.5	0.1	10	3	1.57E-10	Acceptable	25488.1	3.99525E-06	1	Tolerable
FL	Cut Soil on Track VH	0.03	0.05	1	0.5	0.1	10	3	2.75E-11	Acceptable	25488.1	7.00923E-07	1	Acceptable
FL	Debris VL	0.00001	0.7	1	1	0.1	353.16	3	9.06E-12	Acceptable	25488.1	2.31035E-07	1	Acceptable
FL	Debris L	0.00003	0.7	1	1	0.1	1042.6	3	8.03E-11	Acceptable	25488.1	2.04617E-06	1	Tolerable
FL	Debris M	0.0003	0.7	1	1	0.1	103.87	3	8E-11	Acceptable	25488.1	2.03858E-06	1	Tolerable
FL	Deep Rock L	0.00003	0.01	1	1	0.5	166.71	3	9.17E-13	Acceptable	25488.1	2.33709E-08	1	Acceptable
FL	Fill undermining VL	0.00007	0.01	1	0.5	0.1	10	3	1.28E-14	Acceptable	25488.1	3.28251E-10	1	Acceptable
FL	Fill undermining H	0.075	0.01	1	0.5	0.1	10	3	1.38E-11	Acceptable	25488.1	3.50461E-07	1	Acceptable
FL	Rockfall VL	0.03956673	0.2	1	0.7	0.5	1	3	1.02E-10	Acceptable	25488.1	2.58843E-06	1	Tolerable
FL	Rockfall L	0.11615236	0.5	1	0.7	0.5	1	3	7.45E-10	Acceptable	25488.1	1.89964E-05	1	Tolerable
FL	Rockfall M	0.05177264	0.5	1	0.7	0.5	1	3	3.32E-10	Acceptable	25488.1	8.46731E-06	1	Tolerable
FL	Rockfall H	0.01800642	0.5	1	0.7	0.5	1	3	1.16E-10	Acceptable	25488.1	2.94492E-06	1	Tolerable
FL	Shallow Soil VL	9.1304E-05	0.01	1	1	0.1	31.623	3	1.06E-13	Acceptable	25488.1	2.69958E-09	1	Acceptable
FL	Shallow Soil L	3.3107E-05	0.01	1	1	0.1	31.623	3	3.84E-14	Acceptable	25488.1	9.79093E-10	1	Acceptable
FL	Shallow Soil M	0.00125095	0.01	1	1	0.1	31.623	3	1.45E-12	Acceptable	25488.1	3.69707E-08	1	Acceptable
FL	Shallow Soil H	0.03371458	0.01	1	1	0.1	31.623	3	3.91E-11	Acceptable	25488.1	9.96382E-07	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	FL, Fairhaven to North Lorne - Risk to Life Summary Table
	REVIEWED	DRP		

L, North Lorne to South Lorne - F-N Pairs

Notes: Assumes 44229 visitors per year. Cumulitive risk along this segement is tolerable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	L, North Lorne to South Lorne - F-N Pairs
	REVIEWED	DRP		

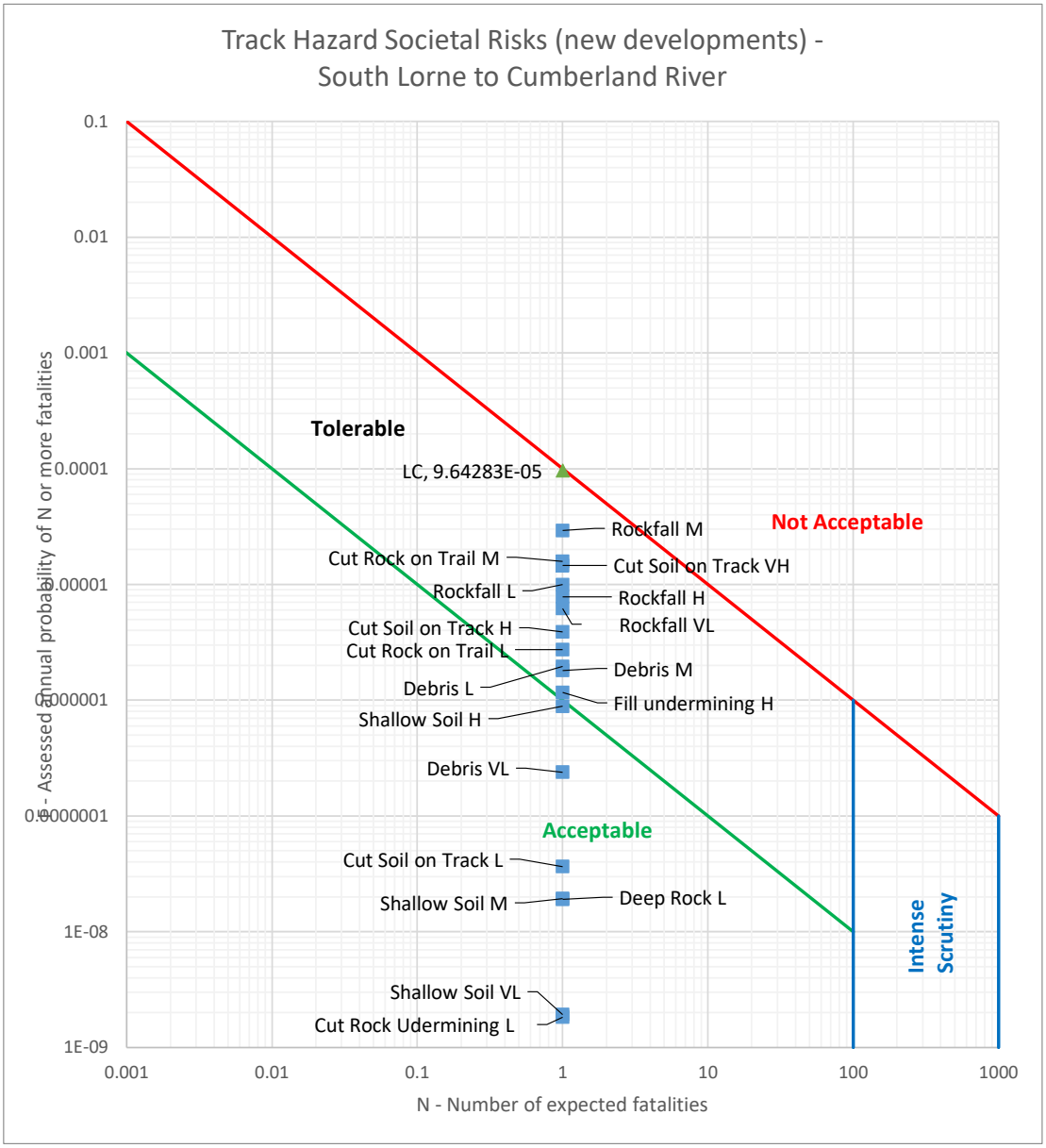
L, North Lorne to South Lorne - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
L	Fill onto track M	0.0135	0.3	1	0.2	0.1	10	3	2.97E-11	Acceptable	44229.35	1.31361E-06	1	Tolerable
L	Fill onto track H	0.3525	0.3	1	0.2	0.1	10	3	7.76E-10	Acceptable	44229.35	3.42993E-05	1	Tolerable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	L, North Lorne to South Lorne - Risk to Life Summary Table
	REVIEWED	DRP		

LC, South Lorne to Cumberland River - F-N Pairs

Notes: Assumes 44229 visitors per year. Cumulitive risk along this segement is tolerable, however reaching the upper bound.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	LC, South Lorne to Cumberland River - F-N Pairs
	REVIEWED	DRP		

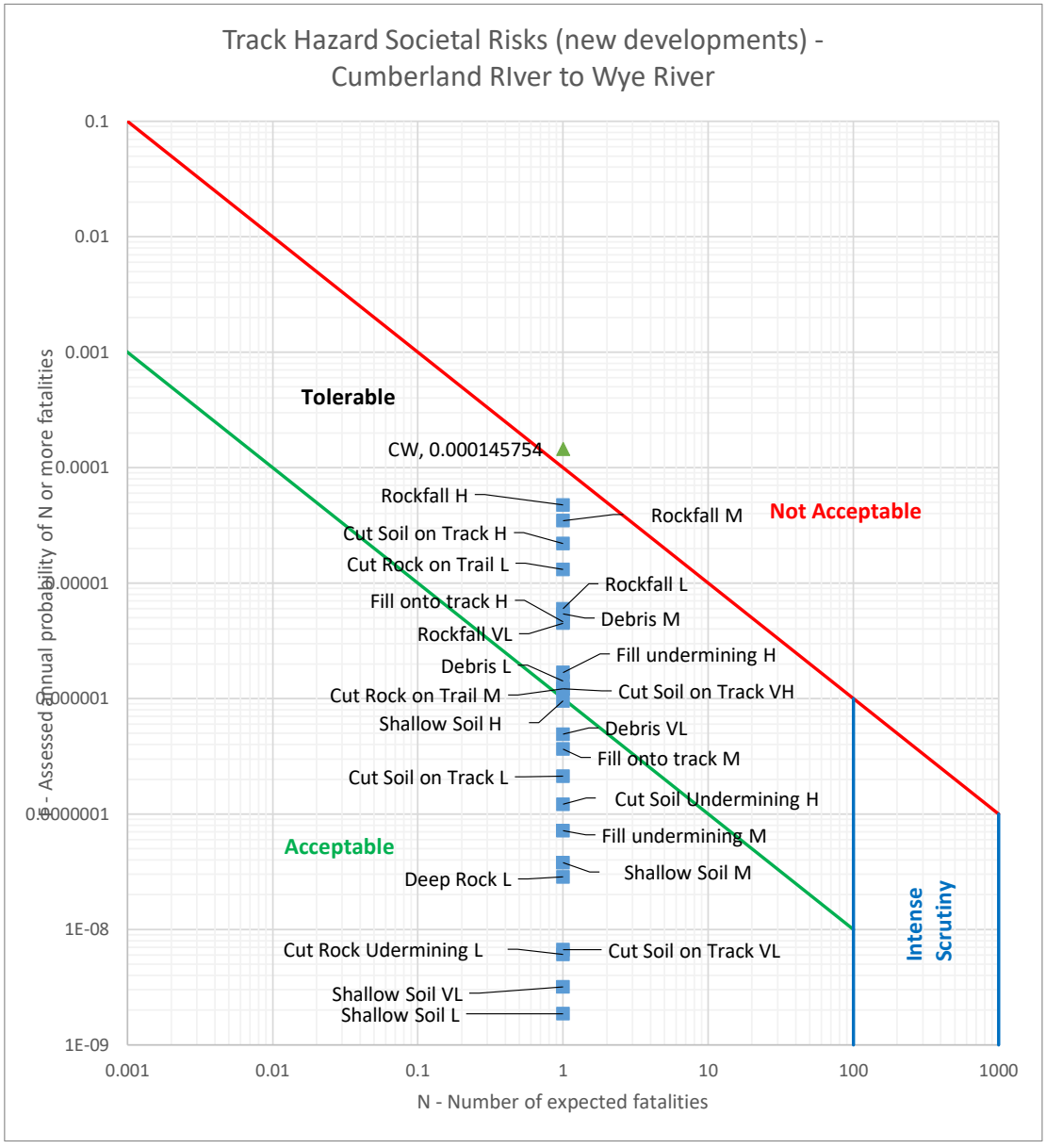
LC, South Lorne to Cumberland River - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
LC	Cut Rock on Trail L	0.00135	0.5	1	0.5	0.5	10	3	6.19E-11	Acceptable	44229.35	2.73669E-06	1	Tolerable
LC	Cut Rock on Trail M	0.0078	0.5	1	0.5	0.5	10	3	3.58E-10	Acceptable	44229.35	1.58119E-05	1	Tolerable
LC	Cut Rock Udermining L	0.000045	0.01	1	0.5	0.5	10	3	4.13E-14	Acceptable	44229.35	1.82669E-09	1	Acceptable
LC	Cut Soil on Track H	0.096	0.05	1	0.5	0.1	10	3	8.8E-11	Acceptable	44229.35	3.89218E-06	1	Tolerable
LC	Cut Soil on Track L	0.0009	0.05	1	0.5	0.1	10	3	8.25E-13	Acceptable	44229.35	3.64895E-08	1	Acceptable
LC	Cut Soil on Track VH	0.36	0.05	1	0.5	0.1	10	3	3.3E-10	Acceptable	44229.35	1.45956E-05	1	Tolerable
LC	Cut Soil Undermining L	0.000045	0.01	1	0.5	0.1	10	3	8.25E-15	Acceptable	44229.35	3.63373E-10	1	Acceptable
LC	Debris L	0.00003	0.7	1	1	0.1	575.46	3	4.43E-11	Acceptable	44229.35	1.95982E-06	1	Tolerable
LC	Debris M	0.0003	0.7	1	1	0.1	52.984	3	4.08E-11	Acceptable	44229.35	1.80446E-06	1	Tolerable
LC	Debris VL	0.00001	0.7	1	1	0.1	210.01	3	5.39E-12	Acceptable	44229.35	2.38402E-07	1	Acceptable
LC	Deep Rock L	0.00003	0.01	1	1	0.5	78.333	3	4.31E-13	Acceptable	44229.35	1.90574E-08	1	Acceptable
LC	Fill undermining H	0.144	0.01	1	0.5	0.1	10	3	2.64E-11	Acceptable	44229.35	1.16765E-06	1	Tolerable
LC	Rockfall H	0.02754156	0.5	1	0.7	0.5	1	3	1.77E-10	Acceptable	44229.35	7.8164E-06	1	Tolerable
LC	Rockfall L	0.03519889	0.5	1	0.7	0.5	1	3	2.26E-10	Acceptable	44229.35	9.98957E-06	1	Tolerable
LC	Rockfall M	0.10311282	0.5	1	0.7	0.5	1	3	6.62E-10	Acceptable	44229.35	2.92635E-05	1	Tolerable
LC	Rockfall VL	0.0545045	0.2	1	0.7	0.5	1	3	1.4E-10	Acceptable	44229.35	6.18744E-06	1	Tolerable
LC	Shallow Soil H	0.01733223	0.01	1	1	0.1	31.623	3	2.01E-11	Acceptable	44229.35	8.88864E-07	1	Acceptable
LC	Shallow Soil L	1.5376E-05	0.01	1	1	0.1	31.623	3	1.78E-14	Acceptable	44229.35	7.90581E-10	1	Acceptable
LC	Shallow Soil M	0.00037681	0.01	1	1	0.1	31.623	3	4.37E-13	Acceptable	44229.35	1.93226E-08	1	Acceptable
LC	Shallow Soil VL	3.7487E-05	0.01	1	1	0.1	31.623	3	4.35E-14	Acceptable	44229.35	1.92489E-09	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	LC, South Lorne to Cumberland River - Risk to Life Summary Table
	REVIEWED	DRP		

CW, Cumberland River to Wye River - F-N Pairs

Notes: Assumes 44229 visitors per year. Cumulitive risk along this segement is not acceptable. Mitigation is required to reduce geotechnical risk along this segment to a tolerable level.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	CW, Cumberland River to Wye River - F-N Pairs
	REVIEWED	DRP		

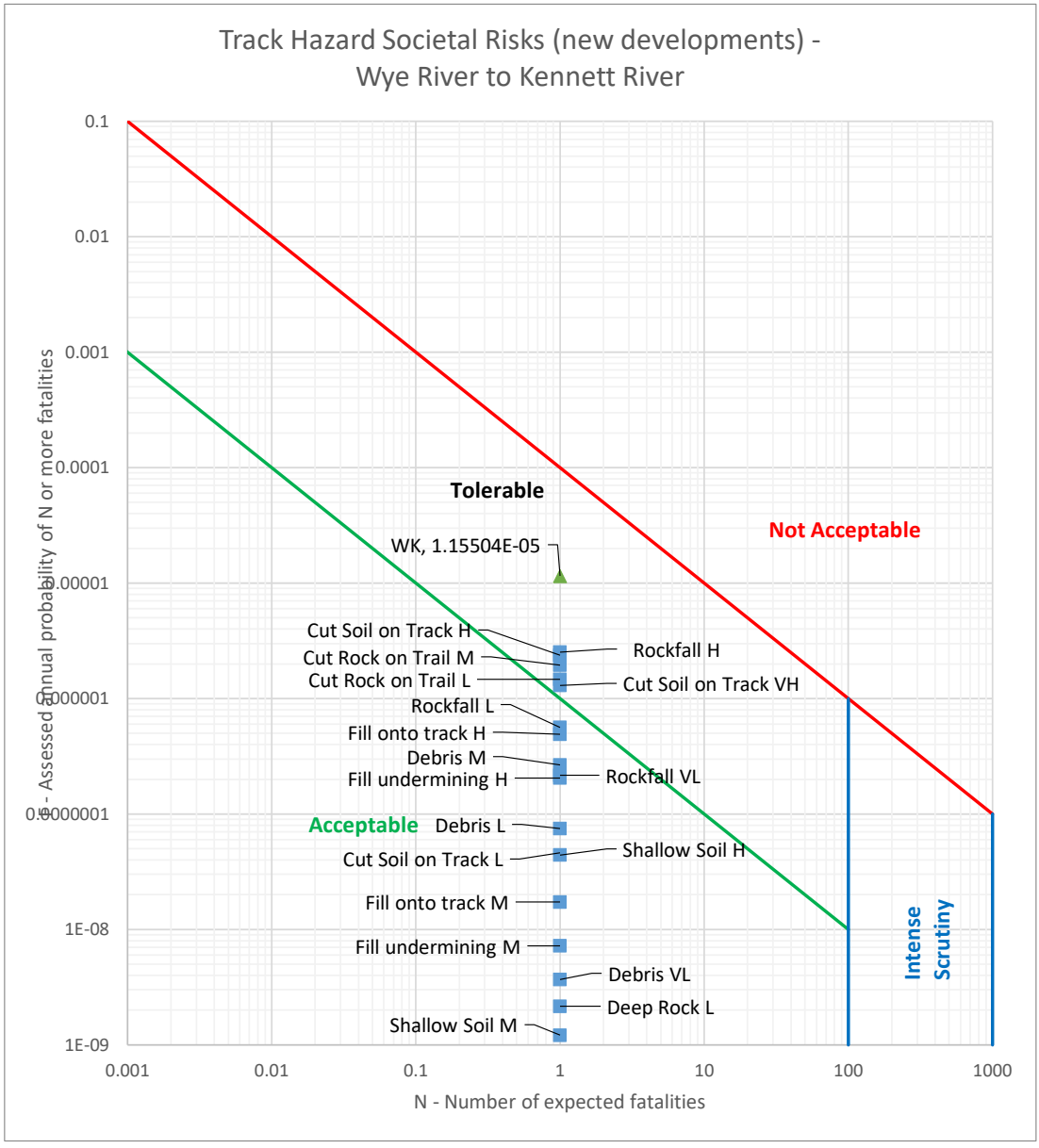
CW, Cumberland River to Wye River - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
CW	Cut Rock on Trail L	0.00648	0.5	1	0.5	0.5	10	3	2.97E-10	Acceptable	44229.35	1.3136E-05	1	Tolerable
CW	Cut Rock on Trail M	0.0006	0.5	1	0.5	0.5	10	3	2.75E-11	Acceptable	44229.35	1.21631E-06	1	Tolerable
CW	Cut Rock Undermining L	0.00015	0.01	1	0.5	0.5	10	3	1.38E-13	Acceptable	44229.35	6.07913E-09	1	Acceptable
CW	Cut Soil on Track VL	0.000165	0.05	1	0.5	0.1	10	3	1.51E-13	Acceptable	44229.35	6.68803E-09	1	Acceptable
CW	Cut Soil on Track L	0.00525	0.05	1	0.5	0.1	10	3	4.81E-12	Acceptable	44229.35	2.12853E-07	1	Acceptable
CW	Cut Soil on Track H	0.543	0.05	1	0.5	0.1	10	3	4.98E-10	Acceptable	44229.35	2.20149E-05	1	Tolerable
CW	Cut Soil on Track VH	0.03	0.05	1	0.5	0.1	10	3	2.75E-11	Acceptable	44229.35	1.21631E-06	1	Tolerable
CW	Cut Soil Undermining H	0.015	0.01	1	0.5	0.1	10	3	2.75E-12	Acceptable	44229.35	1.21632E-07	1	Acceptable
CW	Debris VL	0.00001	0.7	1	1	0.1	433.28	3	1.11E-11	Acceptable	44229.35	4.91874E-07	1	Acceptable
CW	Debris L	0.00003	0.7	1	1	0.1	416.42	3	3.21E-11	Acceptable	44229.35	1.41819E-06	1	Tolerable
CW	Debris M	0.0003	0.7	1	1	0.1	159.02	3	1.22E-10	Acceptable	44229.35	5.41565E-06	1	Tolerable
CW	Deep Rock L	0.00003	0.01	1	1	0.5	117.5	3	6.46E-13	Acceptable	44229.35	2.85837E-08	1	Acceptable
CW	Fill onto track M	0.00225	0.1	1	1	0.1	10	3	8.25E-12	Acceptable	44229.35	3.6489E-07	1	Acceptable
CW	Fill onto track H	0.0285	0.1	1	1	0.1	10	3	1.05E-10	Acceptable	44229.35	4.62195E-06	1	Tolerable
CW	Fill undermining VL	0.00011	0.01	1	0.5	0.1	10	3	2.02E-14	Acceptable	44229.35	8.93701E-10	1	Acceptable
CW	Fill undermining M	0.00885	0.01	1	0.5	0.1	10	3	1.62E-12	Acceptable	44229.35	7.17612E-08	1	Acceptable
CW	Fill undermining H	0.207	0.01	1	0.5	0.1	10	3	3.8E-11	Acceptable	44229.35	1.6785E-06	1	Tolerable
CW	Rockfall VL	0.0395118	0.2	1	0.7	0.5	1	3	1.01E-10	Acceptable	44229.35	4.48545E-06	1	Tolerable
CW	Rockfall L	0.0211518	0.5	1	0.7	0.5	1	3	1.36E-10	Acceptable	44229.35	6.00296E-06	1	Tolerable
CW	Rockfall M	0.12221	0.5	1	0.7	0.5	1	3	7.84E-10	Acceptable	44229.35	3.46832E-05	1	Tolerable
CW	Rockfall H	0.1676152	0.5	1	0.7	0.5	1	3	1.08E-09	Acceptable	44229.35	4.75689E-05	1	Tolerable
CW	Shallow Soil VL	6.2E-05	0.01	1	1	0.1	31.623	3	7.19E-14	Acceptable	44229.35	3.18197E-09	1	Acceptable
CW	Shallow Soil L	3.627E-05	0.01	1	1	0.1	31.623	3	4.21E-14	Acceptable	44229.35	1.86106E-09	1	Acceptable
CW	Shallow Soil M	0.0007398	0.01	1	1	0.1	31.623	3	8.58E-13	Acceptable	44229.35	3.7943E-08	1	Acceptable
CW	Shallow Soil H	0.0186435	0.01	1	1	0.1	31.623	3	2.16E-11	Acceptable	44229.35	9.56112E-07	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT: Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022	
	DESIGNED	AJD	TITLE: CW, Cumberland River to Wye River - Risk to Life Summary Table
	REVIEWED	DRP	

WK, Wye River to Kennett River - F-N Pairs

Notes: Assumes 5247 visitors per year. Cumulitive risk along this segement is tolerable.



wsp GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	WK, Wye River to Kennett River - F-N Pairs
	REVIEWED	DRP		

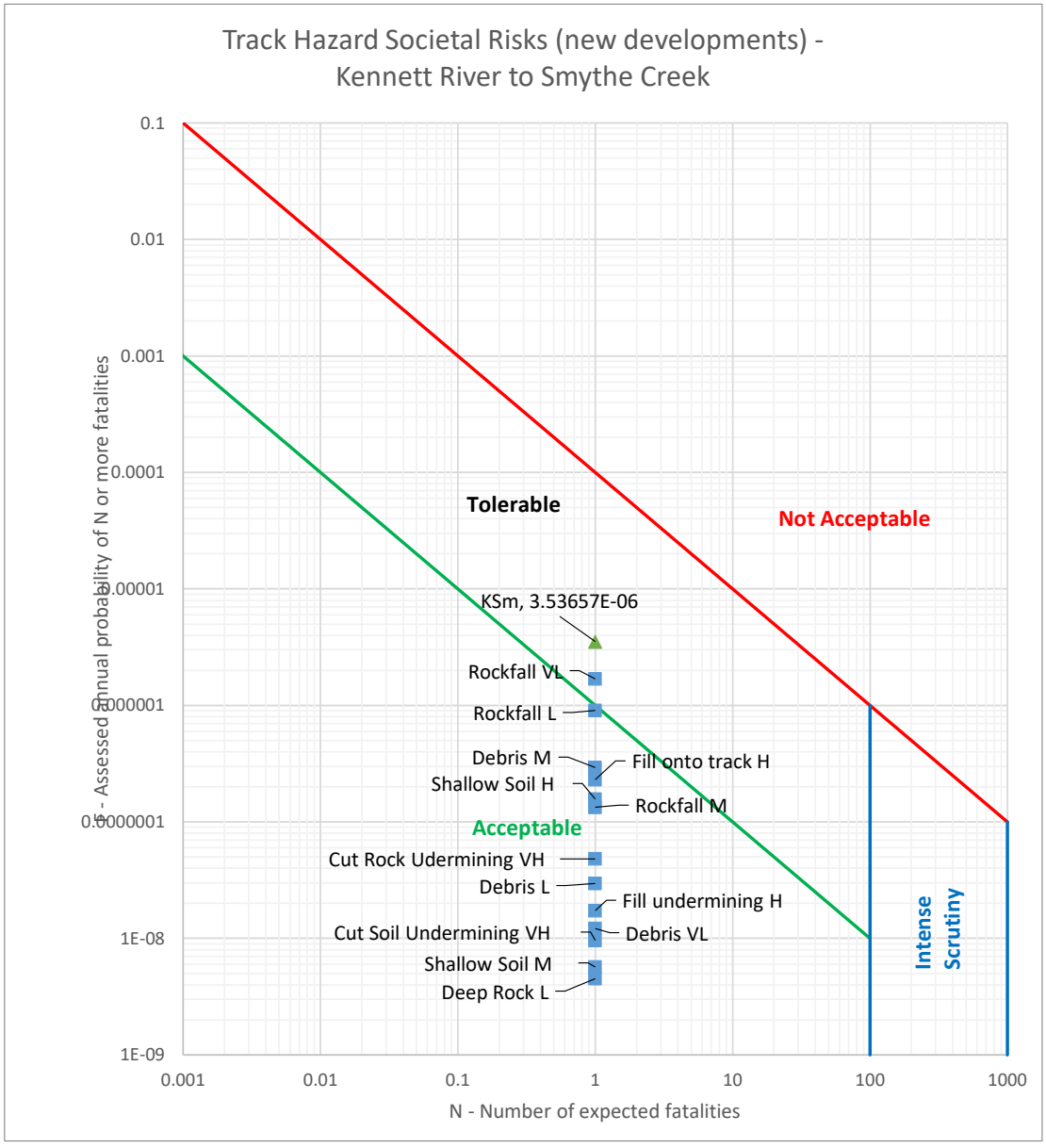
WK, Wye River to Kennett River - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
WK	Cut Rock on Trail L	0.006105	0.5	1	0.5	0.5	10	3	2.8E-10	Acceptable	5247.55	1.46833E-06	1	Tolerable
WK	Cut Rock on Trail M	0.0081	0.5	1	0.5	0.5	10	3	3.71E-10	Acceptable	5247.55	1.94815E-06	1	Tolerable
WK	Cut Soil on Track VL	0.00005	0.05	1	0.5	0.1	10	3	4.58E-14	Acceptable	5247.55	2.40612E-10	1	Acceptable
WK	Cut Soil on Track L	0.0096	0.05	1	0.5	0.1	10	3	8.8E-12	Acceptable	5247.55	4.61782E-08	1	Acceptable
WK	Cut Soil on Track H	0.4935	0.05	1	0.5	0.1	10	3	4.52E-10	Acceptable	5247.55	2.37386E-06	1	Tolerable
WK	Cut Soil on Track VH	0.27	0.05	1	0.5	0.1	10	3	2.48E-10	Acceptable	5247.55	1.29877E-06	1	Tolerable
WK	Debris VL	0.00001	0.7	1	1	0.1	27.373	3	7.03E-13	Acceptable	5247.55	3.68666E-09	1	Acceptable
WK	Debris L	0.00003	0.7	1	1	0.1	185.31	3	1.43E-11	Acceptable	5247.55	7.48774E-08	1	Acceptable
WK	Debris M	0.0003	0.7	1	1	0.1	65.9	3	5.07E-11	Acceptable	5247.55	2.66277E-07	1	Acceptable
WK	Deep Rock L	0.00003	0.01	1	1	0.5	75	3	4.13E-13	Acceptable	5247.55	2.16434E-09	1	Acceptable
WK	Fill onto track M	0.0009	0.1	1	1	0.1	10	3	3.3E-12	Acceptable	5247.55	1.73171E-08	1	Acceptable
WK	Fill onto track H	0.0255	0.1	1	1	0.1	10	3	9.35E-11	Acceptable	5247.55	4.90646E-07	1	Acceptable
WK	Fill undermining VL	0.000125	0.01	1	0.5	0.1	10	3	2.29E-14	Acceptable	5247.55	1.20015E-10	1	Acceptable
WK	Fill undermining M	0.0075	0.01	1	0.5	0.1	10	3	1.38E-12	Acceptable	5247.55	7.21544E-09	1	Acceptable
WK	Fill undermining H	0.213	0.01	1	0.5	0.1	10	3	3.91E-11	Acceptable	5247.55	2.04917E-07	1	Acceptable
WK	Rockfall VL	0.01609179	0.2	1	0.7	0.5	1	3	4.13E-11	Acceptable	5247.55	2.16736E-07	1	Acceptable
WK	Rockfall L	0.01670321	0.5	1	0.7	0.5	1	3	1.07E-10	Acceptable	5247.55	5.62427E-07	1	Acceptable
WK	Rockfall H	0.07493336	0.5	1	0.7	0.5	1	3	4.81E-10	Acceptable	5247.55	2.52314E-06	1	Tolerable
WK	Shallow Soil VL	2.2154E-05	0.01	1	1	0.1	31.623	3	2.57E-14	dcdcdcdcdcd	5247.55	1.34579E-10	1	Acceptable
WK	Shallow Soil L	5.9224E-06	0.01	1	1	0.1	31.623	3	6.87E-15	Acceptable	5247.55	3.61209E-11	1	Acceptable
WK	Shallow Soil M	0.00019998	0.01	1	1	0.1	31.623	3	2.32E-13	Acceptable	5247.55	1.21704E-09	1	Acceptable
WK	Shallow Soil H	0.00724042	0.01	1	1	0.1	31.623	3	8.4E-12	Acceptable	5247.55	4.40547E-08	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	WK, Wye River to Kennett River - Risk to Life Summary Table
	REVIEWED	DRP		

KSm, Kennett River to Smythe Creek - F-N Pairs

Notes: Assumes 5247 visitors per year. Cumulitive risk along this segement is tolerable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	KSm, Kennett River to Smythe Creek - F-N Pairs
	REVIEWED	DRP		

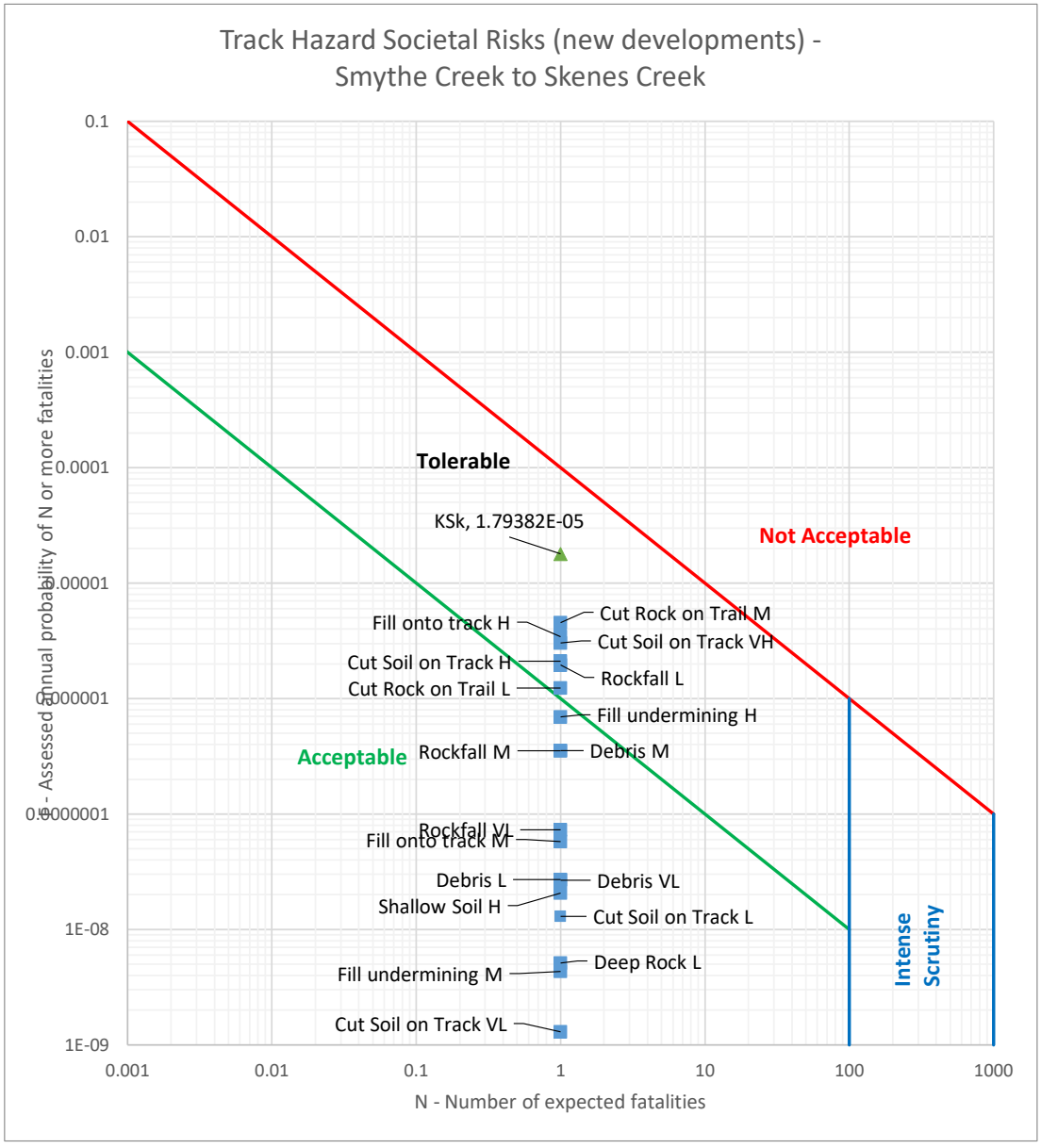
KSm, Kennett River to Smythe Creek - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
KSm	Cut Rock Udermining VH	0.01	0.01	1	0.5	0.5	10	3	9.17E-12	Acceptable	5247.55	4.81025E-08	1	Acceptable
KSm	Cut Soil Undermining VH	0.01	0.01	1	0.5	0.1	10	3	1.83E-12	Acceptable	5247.55	9.62039E-09	1	Acceptable
KSm	Debris VL	0.00001	0.7	1	1	0.1	90.304	3	2.32E-12	Acceptable	5247.55	1.21628E-08	1	Acceptable
KSm	Debris L	0.00003	0.7	1	1	0.1	73.331	3	5.65E-12	Acceptable	5247.55	2.96302E-08	1	Acceptable
KSm	Debris M	0.0003	0.7	1	1	0.1	72.535	3	5.59E-11	Acceptable	5247.55	2.93088E-07	1	Acceptable
KSm	Deep Rock L	0.00003	0.01	1	1	0.5	156.52	3	8.61E-13	Acceptable	5247.55	4.51744E-09	1	Acceptable
KSm	Fill onto track H	0.012	0.1	1	1	0.1	10	3	4.4E-11	Acceptable	5247.55	2.30892E-07	1	Acceptable
KSm	Fill undermining VL	0.00003	0.01	1	0.5	0.1	10	3	5.5E-15	Acceptable	5247.55	2.91298E-11	1	Acceptable
KSm	Fill undermining H	0.018	0.01	1	0.5	0.1	10	3	3.3E-12	Acceptable	5247.55	1.73171E-08	1	Acceptable
KSm	Rockfall VL	0.12533183	0.2	1	0.7	0.5	1	3	3.22E-10	Acceptable	5247.55	1.68806E-06	1	Tolerable
KSm	Rockfall L	0.02690407	0.5	1	0.7	0.5	1	3	1.73E-10	Acceptable	5247.55	9.05908E-07	1	Acceptable
KSm	Rockfall M	0.00396962	0.5	1	0.7	0.5	1	3	2.55E-11	Acceptable	5247.55	1.33664E-07	1	Acceptable
KSm	Shallow Soil VL	7.7686E-05	0.01	1	1	0.1	31.623	3	9.01E-14	Acceptable	5247.55	4.72485E-10	1	Acceptable
KSm	Shallow Soil L	6.1024E-05	0.01	1	1	0.1	31.623	3	7.08E-14	Acceptable	5247.55	3.71113E-10	1	Acceptable
KSm	Shallow Soil M	0.0009341	0.01	1	1	0.1	31.623	3	1.08E-12	Acceptable	5247.55	5.6838E-09	1	Acceptable
KSm	Shallow Soil H	0.02581215	0.01	1	1	0.1	31.623	3	2.99E-11	Acceptable	5247.55	1.57055E-07	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	KSm, Kennett River to Smythe Creek - Risk to Life Summary Table
	REVIEWED	DRP		

KSk, Smythe Creek Skenes Creek - F-N Pairs

Notes: Assumes 5247 visitors per year. Cumulitive risk along this segement is tolerable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	KSk, Smythe Creek Skenes Creek - F-N Pairs
	REVIEWED	DRP		

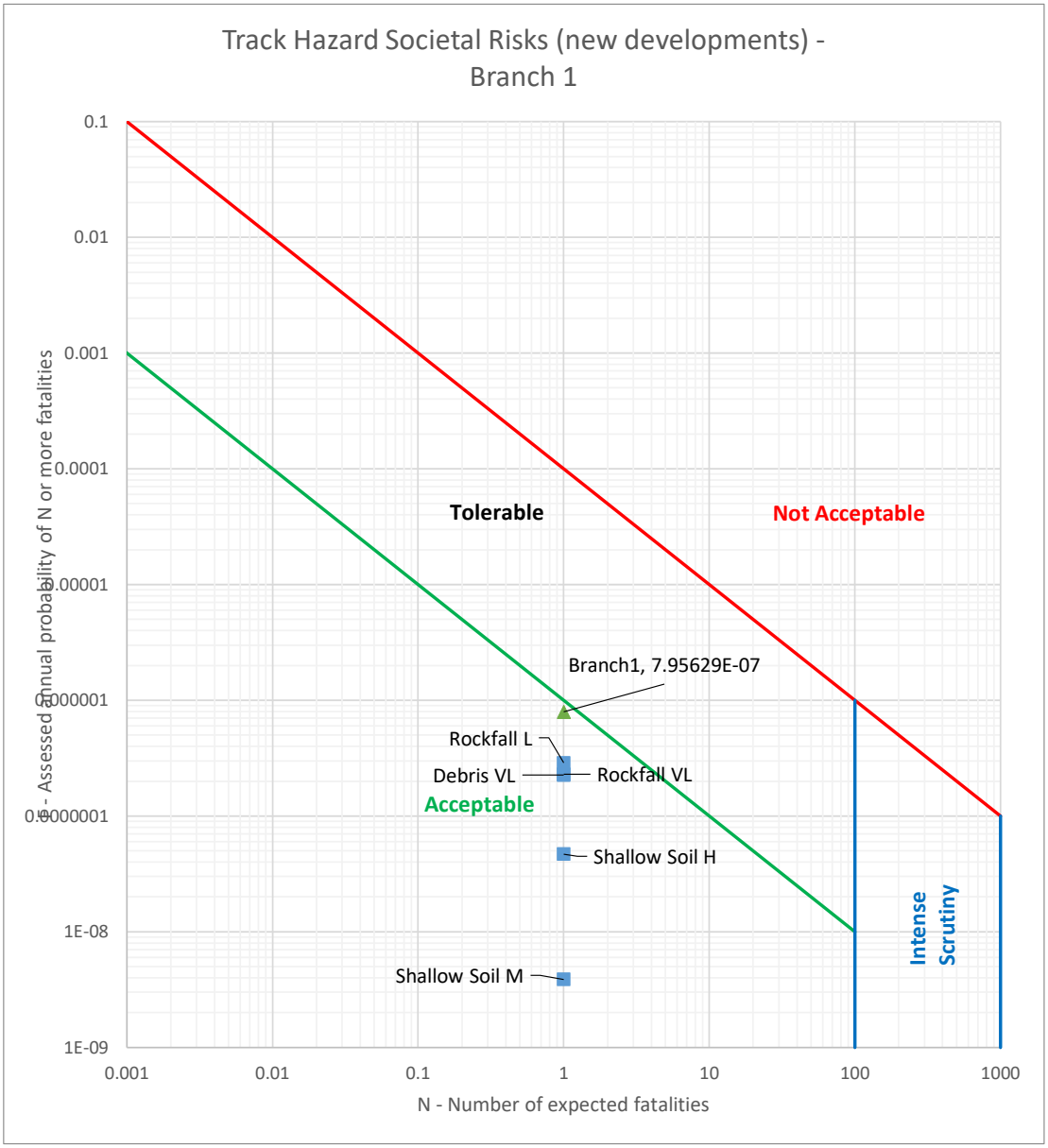
KSk, Smythe Creek Skenes Creek - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
KSk	Cut Rock on Trail L	0.00513	0.5	1	0.5	0.5	10	3	2.35E-10	Acceptable	5247.55	1.23383E-06	1	Tolerable
KSk	Cut Rock on Trail M	0.0189	0.5	1	0.5	0.5	10	3	8.66E-10	Acceptable	5247.55	4.54568E-06	1	Tolerable
KSk	Cut Soil on Track VL	0.00027	0.05	1	0.5	0.1	10	3	2.48E-13	Acceptable	5247.55	1.2986E-09	1	Acceptable
KSk	Cut Soil on Track L	0.0027	0.05	1	0.5	0.1	10	3	2.48E-12	Acceptable	5247.55	1.29878E-08	1	Acceptable
KSk	Cut Soil on Track H	0.438	0.05	1	0.5	0.1	10	3	4.02E-10	Acceptable	5247.55	2.10689E-06	1	Tolerable
KSk	Cut Soil on Track VH	0.63	0.05	1	0.5	0.1	10	3	5.78E-10	Acceptable	5247.55	3.03046E-06	1	Tolerable
KSk	Debris VL	0.00001	0.7	1	1	0.1	198.27	3	5.09E-12	Acceptable	5247.55	2.67038E-08	1	Acceptable
KSk	Debris L	0.00003	0.7	1	1	0.1	67.003	3	5.16E-12	Acceptable	5247.55	2.70732E-08	1	Acceptable
KSk	Debris M	0.0003	0.7	1	1	0.1	87.629	3	6.75E-11	Acceptable	5247.55	3.54073E-07	1	Acceptable
KSk	Deep Rock L	0.00003	0.01	1	1	0.5	177.5	3	9.76E-13	Acceptable	5247.55	5.12276E-09	1	Acceptable
KSk	Fill onto track M	0.003	0.1	1	1	0.1	10	3	1.1E-11	Acceptable	5247.55	5.77229E-08	1	Acceptable
KSk	Fill onto track H	0.1785	0.1	1	1	0.1	10	3	6.55E-10	Acceptable	5247.55	3.43452E-06	1	Tolerable
KSk	Fill undermining VL	0.000159	0.01	1	0.5	0.1	10	3	2.92E-14	Acceptable	5247.55	1.53223E-10	1	Acceptable
KSk	Fill undermining M	0.0045	0.01	1	0.5	0.1	10	3	8.25E-13	Acceptable	5247.55	4.32926E-09	1	Acceptable
KSk	Fill undermining H	0.7215	0.01	1	0.5	0.1	10	3	1.32E-10	Acceptable	5247.55	6.94119E-07	1	Acceptable
KSk	Rockfall VL	0.00542247	0.2	1	0.7	0.5	1	3	1.39E-11	Acceptable	5247.55	7.30335E-08	1	Acceptable
KSk	Rockfall L	0.05807539	0.5	1	0.7	0.5	1	3	3.73E-10	Acceptable	5247.55	1.9555E-06	1	Tolerable
KSk	Rockfall M	0.01049139	0.5	1	0.7	0.5	1	3	6.73E-11	Acceptable	5247.55	3.53263E-07	1	Acceptable
KSk	Shallow Soil VL	3.5993E-05	0.01	1	1	0.1	31.623	3	4.17E-14	Acceptable	5247.55	2.19056E-10	1	Acceptable
KSk	Shallow Soil L	2.5246E-06	0.01	1	1	0.1	31.623	3	2.93E-15	Acceptable	5247.55	1.51474E-11	1	Acceptable
KSk	Shallow Soil M	0.00010953	0.01	1	1	0.1	31.623	3	1.27E-13	Acceptable	5247.55	6.66489E-10	1	Acceptable
KSk	Shallow Soil H	0.00339498	0.01	1	1	0.1	31.623	3	3.94E-12	Acceptable	5247.55	2.06571E-08	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	KSk, Smythe Creek Skenes Creek - Risk to Life Summary Table
	REVIEWED	DRP		

Branch 1 - F-N Pairs

Notes: Assumes 44229 visitors per year. Cumulitive risk along this segement is acceptable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 1 - F-N Pairs
	REVIEWED	DRP		

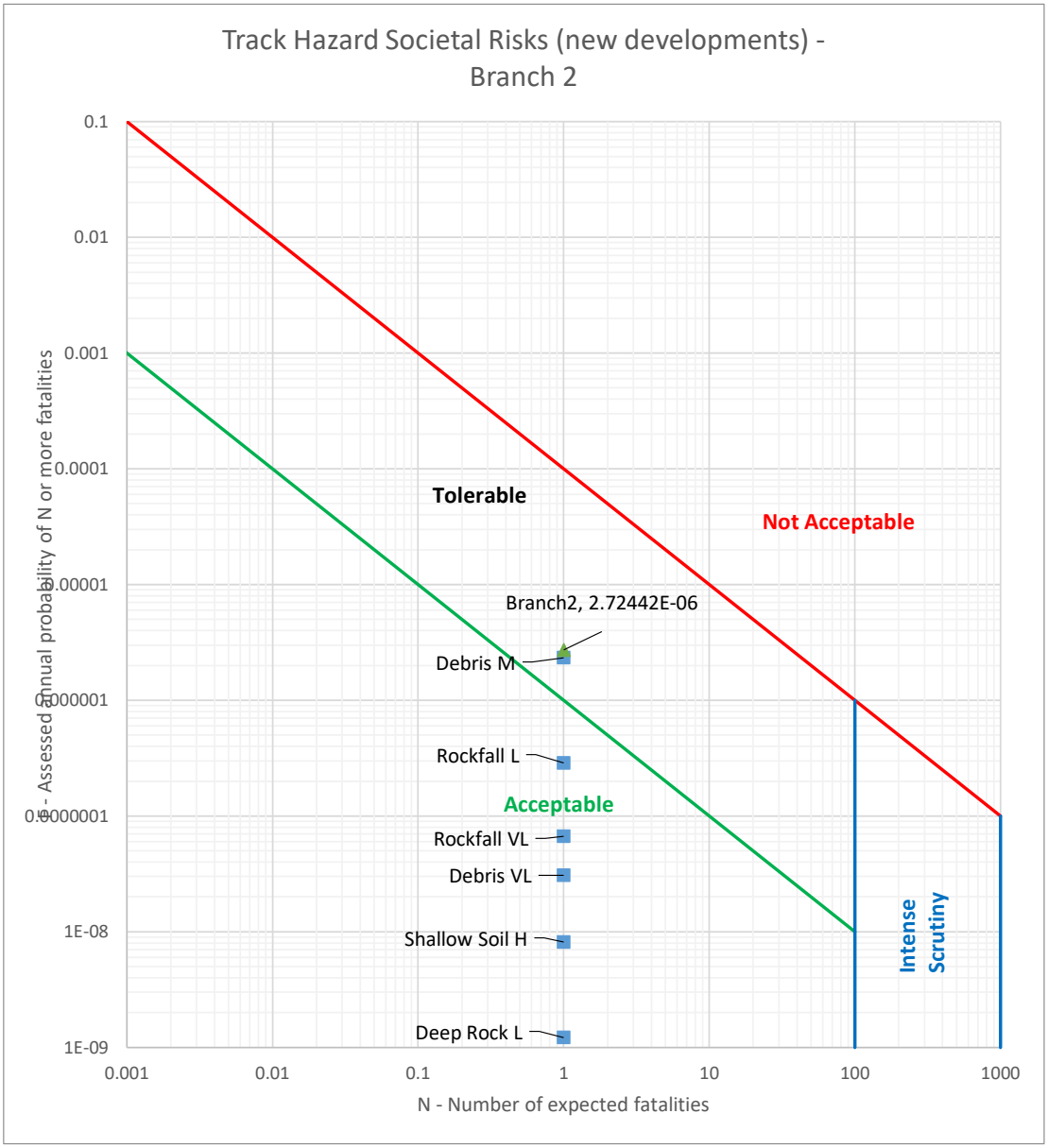
Branch 1 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Branch1	Debris VL	0.00001	0.7	1	1	0.1	199.3	3	5.12E-12	Acceptable	44229.35	2.26249E-07	1	Acceptable
Branch1	Rockfall VL	0.00202409	0.2	1	0.7	0.5	1	3	5.2E-12	Acceptable	44229.35	2.29779E-07	1	Acceptable
Branch1	Rockfall L	0.00101678	0.5	1	0.7	0.5	1	3	6.52E-12	Acceptable	44229.35	2.88567E-07	1	Acceptable
Branch1	Shallow Soil VL	3.3045E-06	0.01	1	1	0.1	31.623	3	3.83E-15	Acceptable	44229.35	1.71866E-10	1	Acceptable
Branch1	Shallow Soil L	3.9077E-06	0.01	1	1	0.1	31.623	3	4.53E-15	Acceptable	44229.35	2.01328E-10	1	Acceptable
Branch1	Shallow Soil M	7.5439E-05	0.01	1	1	0.1	31.623	3	8.75E-14	Acceptable	44229.35	3.86943E-09	1	Acceptable
Branch1	Shallow Soil H	0.00091239	0.01	1	1	0.1	31.623	3	1.06E-12	Acceptable	44229.35	4.67916E-08	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 1 - Risk to Life Summary Table
	REVIEWED	DRP		

Branch 2 - F-N Pairs

Notes: Assumes 44229 visitors per year. Cumulitive risk along this segement is acceptable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 2 - F-N Pairs
	REVIEWED	DRP		

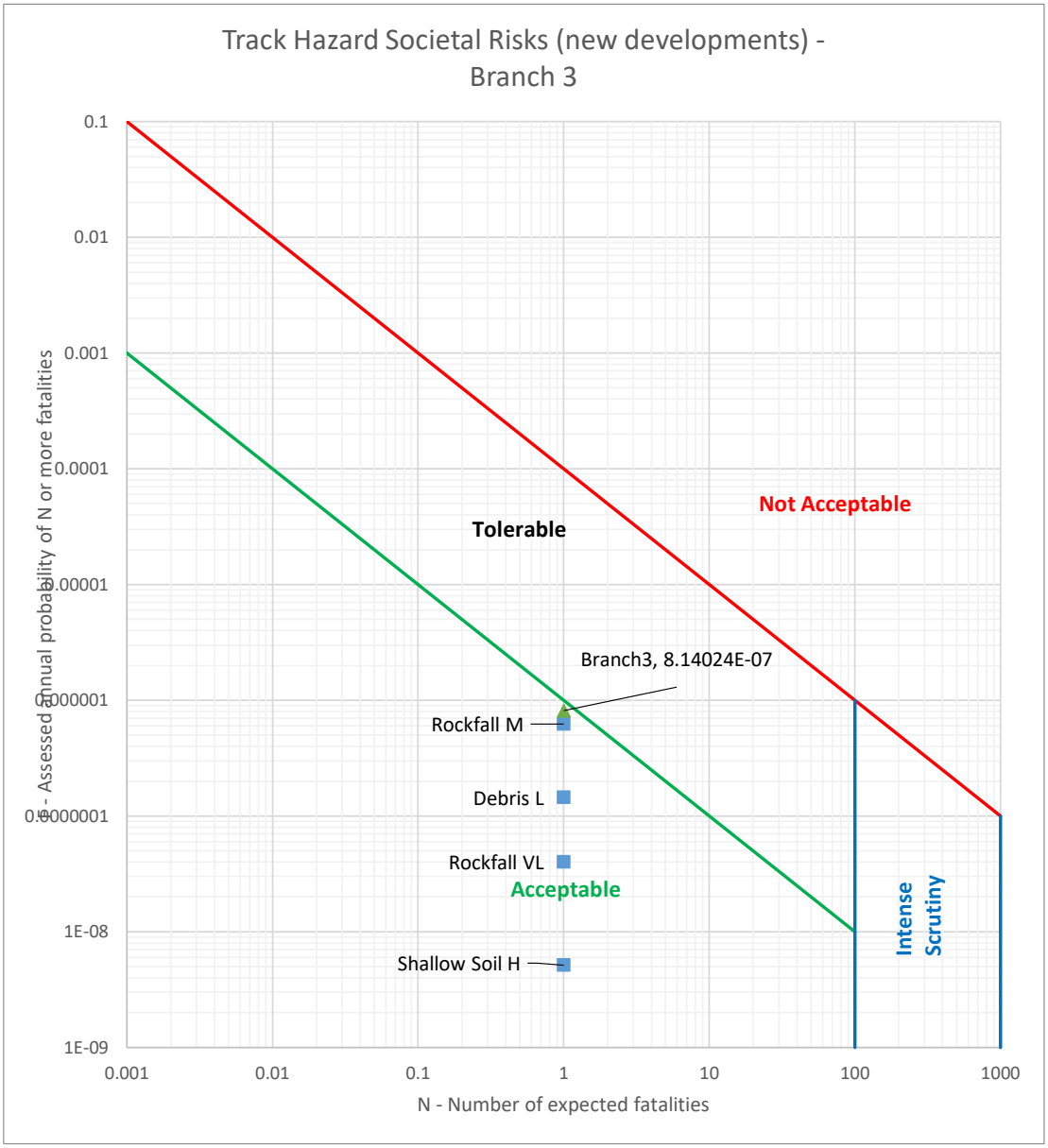
Branch 2 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Branch2	Debris VL	0.00001	0.7	1	1	0.1	27.081	3	6.95E-13	Acceptable	44229.35	3.07443E-08	1	Acceptable
Branch2	Debris M	0.0003	0.7	1	1	0.1	68.401	3	5.27E-11	Acceptable	44229.35	2.3295E-06	1	Tolerable
Branch2	Deep Rock L	0.00003	0.01	1	1	0.5	5	3	2.75E-14	Acceptable	44229.35	1.21779E-09	1	Acceptable
Branch2	Rockfall VL	0.00058867	0.2	1	0.7	0.5	1	3	1.51E-12	Acceptable	44229.35	6.68262E-08	1	Acceptable
Branch2	Rockfall L	0.00101337	0.5	1	0.7	0.5	1	3	6.5E-12	Acceptable	44229.35	2.876E-07	1	Acceptable
Branch2	Shallow Soil VL	1.4934E-07	0.01	1	1	0.1	31.623	3	1.73E-16	Acceptable	44229.35	9.82092E-12	1	Acceptable
Branch2	Shallow Soil M	7.2871E-06	0.01	1	1	0.1	31.623	3	8.45E-15	Acceptable	44229.35	3.73194E-10	1	Acceptable
Branch2	Shallow Soil H	0.00015906	0.01	1	1	0.1	31.623	3	1.84E-13	Acceptable	44229.35	8.15625E-09	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 2 - Risk to Life Summary Table
	REVIEWED	DRP		

Branch 3 - F-N Pairs

Notes: Assumes 44229 visitors per year. Cumulitive risk along this segement is acceptable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 3 - F-N Pairs
	REVIEWED	DRP		

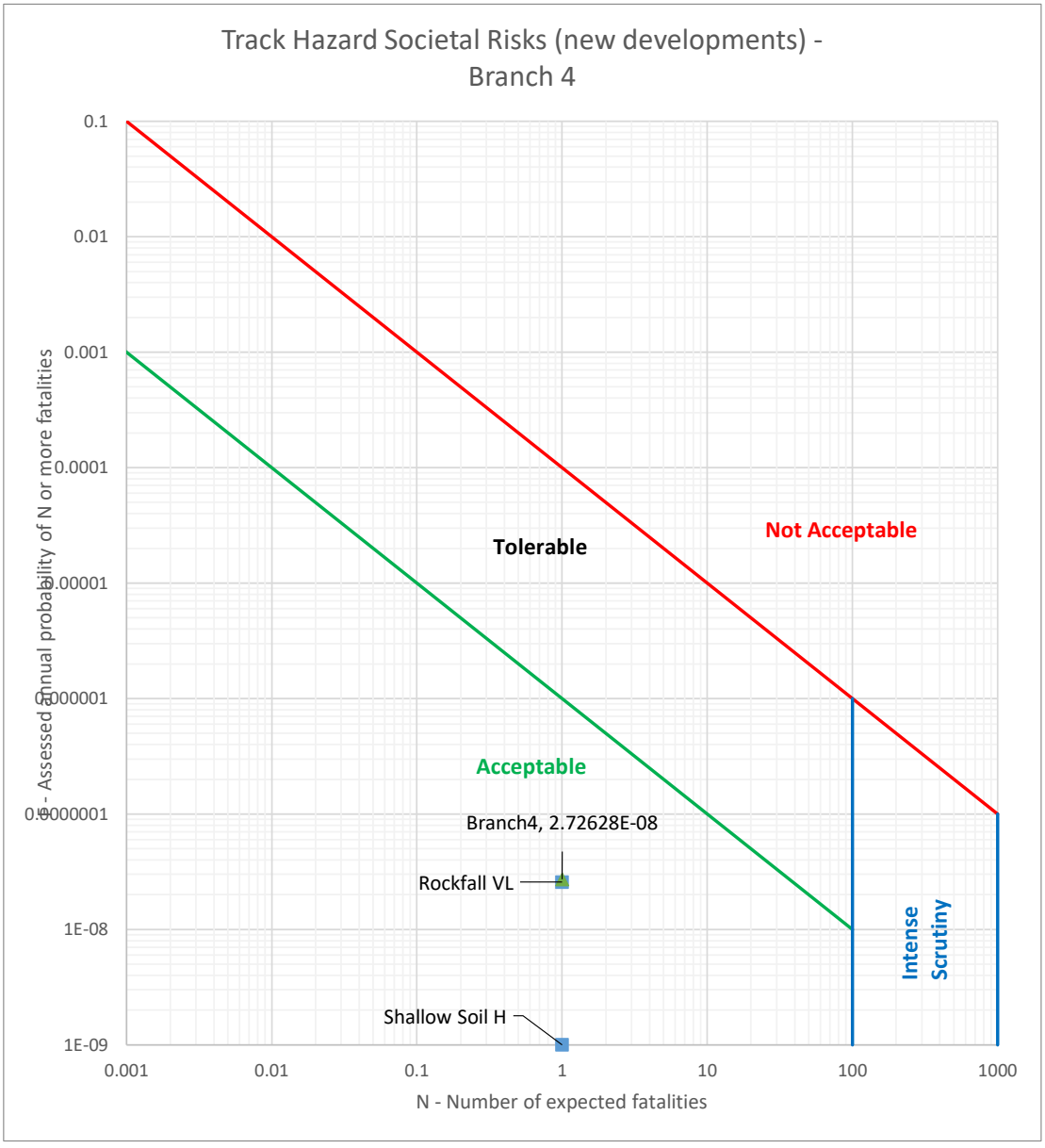
Branch 3 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Branch3	Debris L	0.00003	0.7	1	1	0.1	42.584	3	3.28E-12	Acceptable	44229.35	1.45025E-07	1	Acceptable
Branch3	Rockfall VL	0.00035511	0.2	1	0.7	0.5	1	3	9.11E-13	Acceptable	44229.35	4.03147E-08	1	Acceptable
Branch3	Rockfall M	0.00219659	0.5	1	0.7	0.5	1	3	1.41E-11	Acceptable	44229.35	6.23405E-07	1	Acceptable
Branch3	Shallow Soil VL	4.8542E-09	0.01	1	1	0.1	31.623	3	5.63E-18	Acceptable	44229.35	0	1	Acceptable
Branch3	Shallow Soil M	2.6744E-06	0.01	1	1	0.1	31.623	3	3.1E-15	Acceptable	44229.35	1.37492E-10	1	Acceptable
Branch3	Shallow Soil H	0.0001003	0.01	1	1	0.1	31.623	3	1.16E-13	Acceptable	44229.35	5.14124E-09	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 3 - Risk to Life Summary Table
	REVIEWED	DRP		

Branch 4 - F-N Pairs

Notes: Assumes 44229 visitors per year. Cumulitive risk along this segement is acceptable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 4 - F-N Pairs
	REVIEWED	DRP		

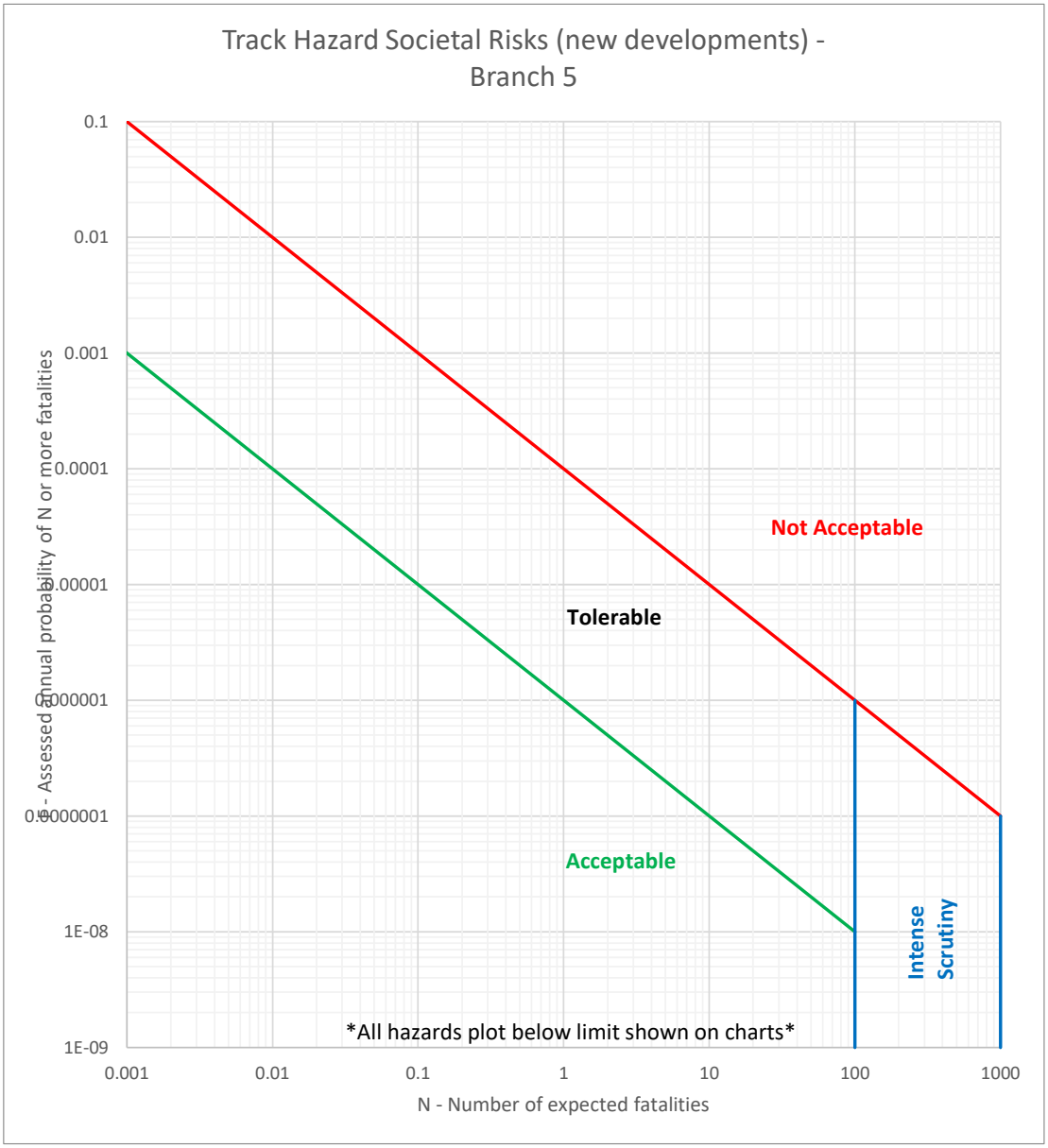
Branch 4 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Branch4	Rockfall VL	0.00022719	0.2	1	0.7	0.5	1	3	5.83E-13	Acceptable	44229.35	2.57897E-08	1	Acceptable
Branch4	Shallow Soil VL	7.3117E-07	0.01	1	1	0.1	31.623	3	8.48E-16	Acceptable	44229.35	3.92836E-11	1	Acceptable
Branch4	Shallow Soil M	8.4247E-06	0.01	1	1	0.1	31.623	3	9.77E-15	Acceptable	44229.35	4.32119E-10	1	Acceptable
Branch4	Shallow Soil H	1.956E-05	0.01	1	1	0.1	31.623	3	2.27E-14	Acceptable	44229.35	1.00173E-09	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 4 - Risk to Life Summary Table
	REVIEWED	DRP		

Branch 5 - F-N Pairs

ssumes 25488 visitors per year. Cumulitive risk along this segement is acceptable with all hazards ploting below the range visible on t



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 5 - F-N Pairs
	REVIEWED	DRP		

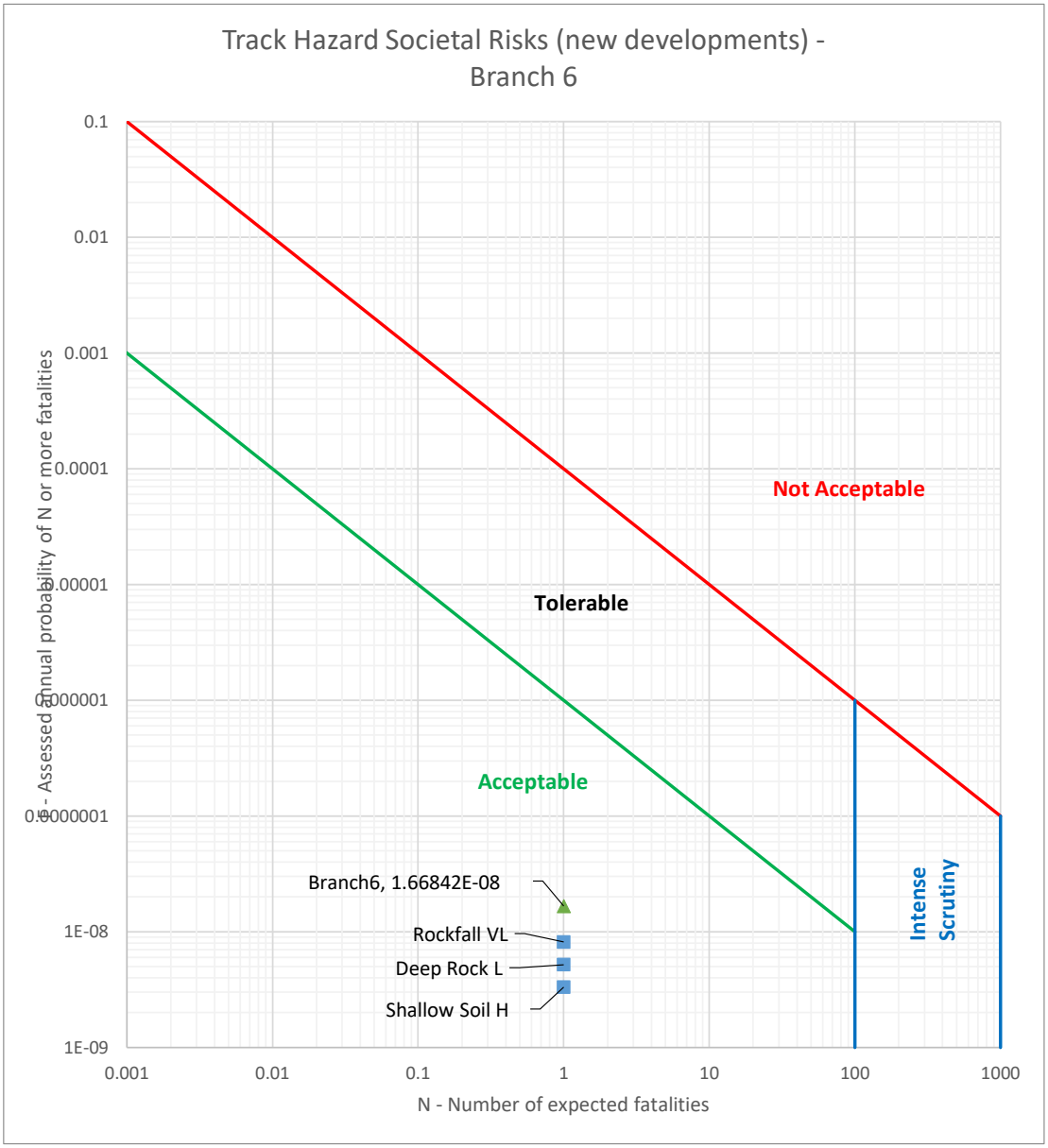
Branch 5 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Branch5	Rockfall VL	3.42E-08	0.2	1	0.7	0.5	1	3	8.78E-17	Acceptable	25488.1	2.82974E-12	1	Acceptable
Branch5	Shallow Soil VL	4.9693E-07	0.01	1	1	0.1	31.623	3	5.76E-16	Acceptable	25488.1	1.41487E-11	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 5 - Risk to Life Summary Table
	REVIEWED	DRP		

Branch 6 - F-N Pairs

Notes: Assumes 25488 visitors per year. Cumulitive risk along this segement is acceptable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 6 - F-N Pairs
	REVIEWED	DRP		

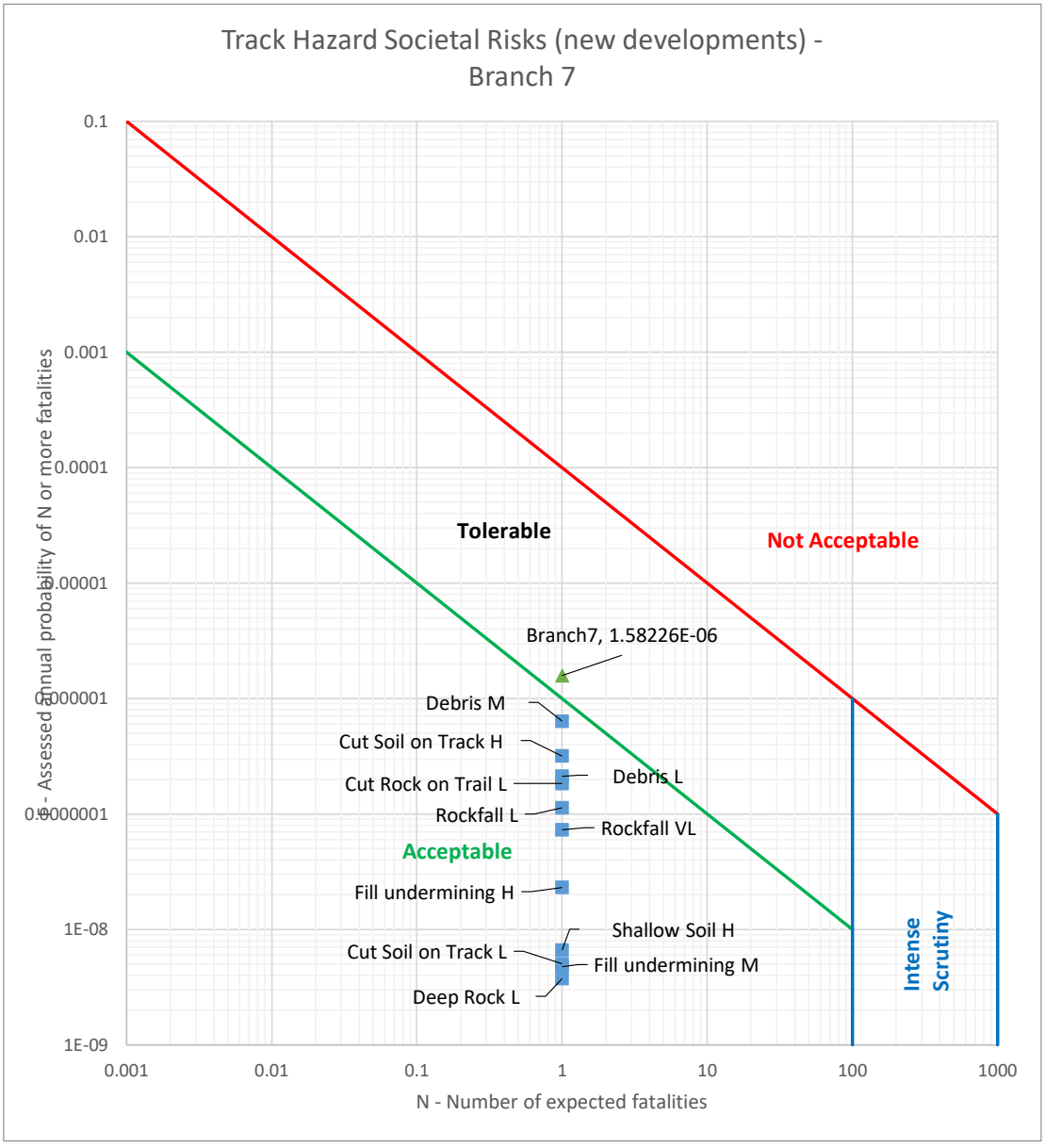
Branch 6 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Branch6	Deep Rock L	0.00003	0.01	1	1	0.5	37	3	2.04E-13	Acceptable	25488.1	5.18693E-09	1	Acceptable
Branch6	Rockfall VL	0.0001249	0.2	1	0.7	0.5	1	3	3.21E-13	Acceptable	25488.1	8.17231E-09	1	Acceptable
Branch6	Shallow Soil H	0.00011247	0.01	1	1	0.1	31.623	3	1.3E-13	Acceptable	25488.1	3.32495E-09	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 6 - Risk to Life Summary Table
	REVIEWED	DRP		

Branch 7 - F-N Pairs

Notes: Assumes 5247 visitors per year. Cumulitive risk along this segement is tolerable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 7 - F-N Pairs
	REVIEWED	DRP		

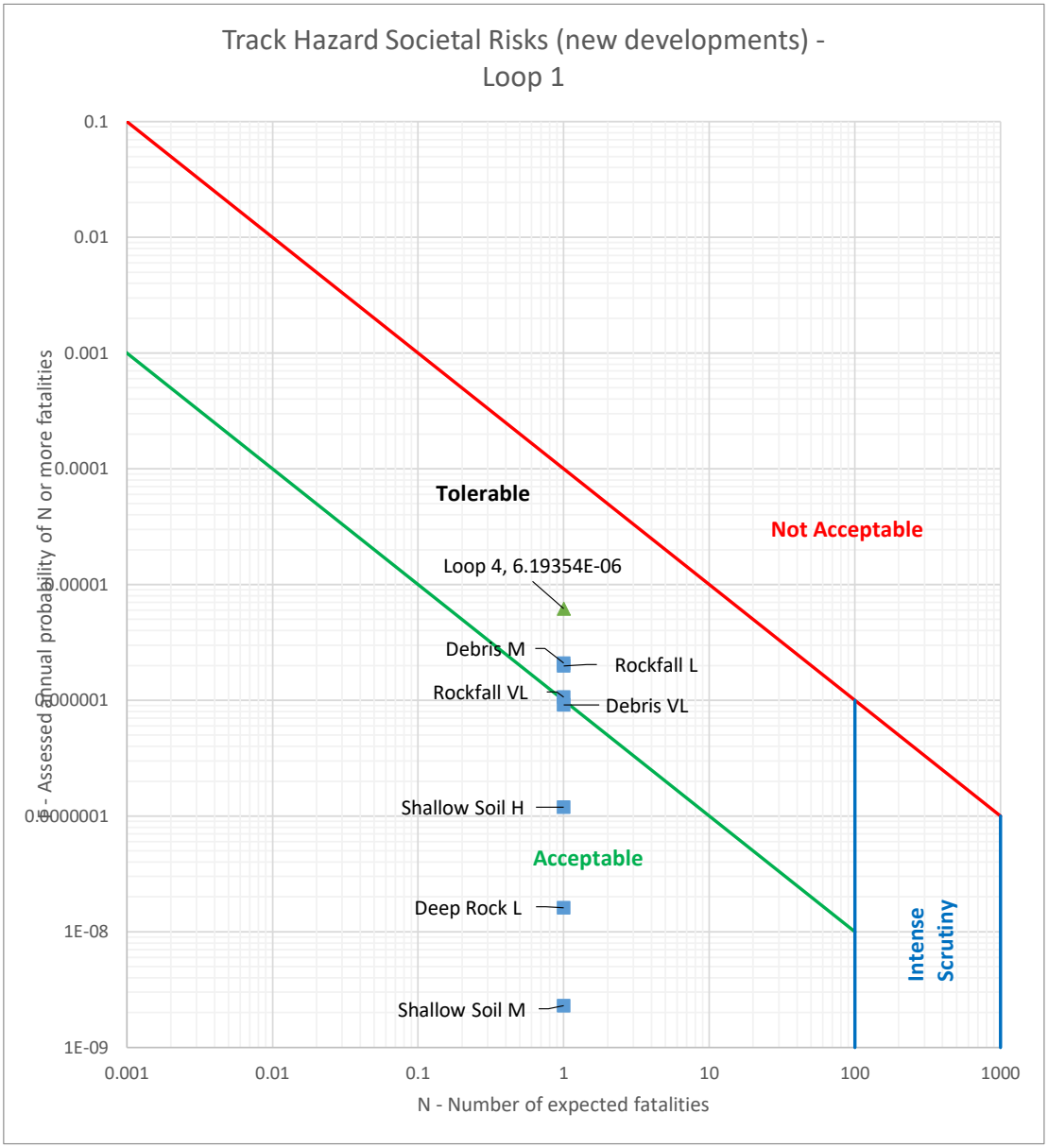
Branch 7 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Branch7	Cut Rock on Trail L	0.000765	0.5	1	0.5	0.5	10	3	3.51E-11	Acceptable	5247.55	1.83992E-07	1	Acceptable
Branch7	Cut Soil on Track L	0.00105	0.05	1	0.5	0.1	10	3	9.63E-13	Acceptable	5247.55	5.05052E-09	1	Acceptable
Branch7	Cut Soil on Track H	0.066	0.05	1	0.5	0.1	10	3	6.05E-11	Acceptable	5247.55	3.17477E-07	1	Acceptable
Branch7	Debris L	0.00003	0.7	1	1	0.1	525.51	3	4.05E-11	Acceptable	5247.55	2.12338E-07	1	Acceptable
Branch7	Debris M	0.0003	0.7	1	1	0.1	157.95	3	1.22E-10	Acceptable	5247.55	6.38219E-07	1	Acceptable
Branch7	Deep Rock L	0.00003	0.01	1	1	0.5	130	3	7.15E-13	Acceptable	5247.55	3.75191E-09	1	Acceptable
Branch7	Fill undermining M	0.00495	0.01	1	0.5	0.1	10	3	9.08E-13	Acceptable	5247.55	4.76213E-09	1	Acceptable
Branch7	Fill undermining H	0.024	0.01	1	0.5	0.1	10	3	4.4E-12	Acceptable	5247.55	2.30894E-08	1	Acceptable
Branch7	Rockfall VL	0.00542323	0.2	1	0.7	0.5	1	3	1.39E-11	Acceptable	5247.55	7.3044E-08	1	Acceptable
Branch7	Rockfall L	0.00336681	0.5	1	0.7	0.5	1	3	2.16E-11	Acceptable	5247.55	1.13367E-07	1	Acceptable
Branch7	Shallow Soil VL	7.2402E-06	0.01	1	1	0.1	31.623	3	8.4E-15	Acceptable	5247.55	4.42772E-11	1	Acceptable
Branch7	Shallow Soil L	9.4578E-06	0.01	1	1	0.1	31.623	3	1.1E-14	Acceptable	5247.55	5.76769E-11	1	Acceptable
Branch7	Shallow Soil M	7.0073E-05	0.01	1	1	0.1	31.623	3	8.12E-14	Acceptable	5247.55	4.2646E-10	1	Acceptable
Branch7	Shallow Soil H	0.00109126	0.01	1	1	0.1	31.623	3	1.27E-12	Acceptable	5247.55	6.63984E-09	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Branch 7 - Risk to Life Summary Table
	REVIEWED	DRP		

Loop 1 - F-N Pairs

Notes: Assumes 25488 visitors per year. Cumulitive risk along this segement is tolerable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 1 - F-N Pairs
	REVIEWED	DRP		

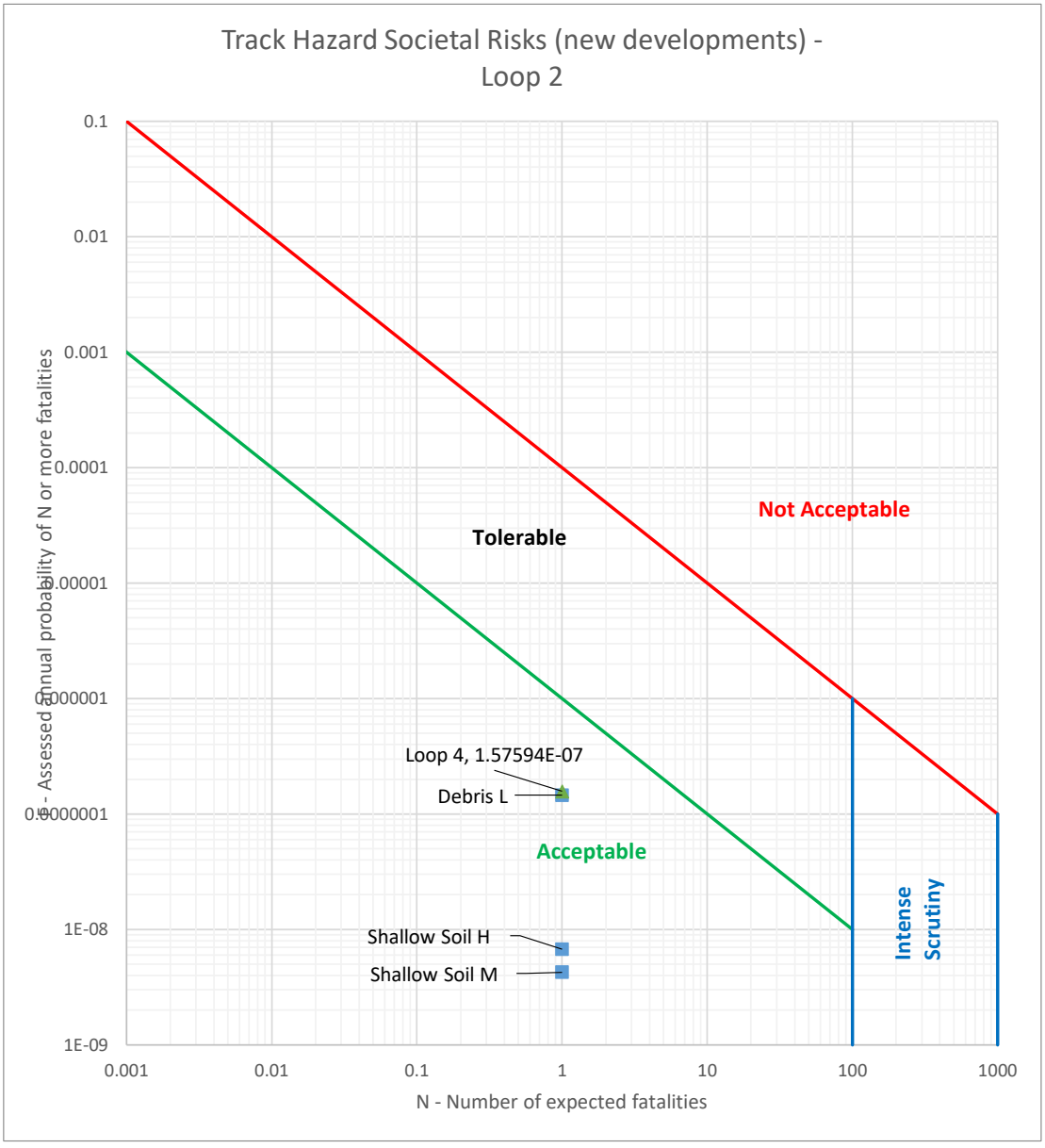
Loop 1 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Loop1	Debris VL	0.00001	0.7	1	1	0.1	1393.7	3	3.58E-11	Acceptable	25488.1	9.11764E-07	1	Acceptable
Loop1	Debris M	0.0003	0.7	1	1	0.1	106.92	3	8.23E-11	Acceptable	25488.1	2.09847E-06	1	Tolerable
Loop1	Deep Rock L	0.00003	0.01	1	1	0.5	115	3	6.33E-13	Acceptable	25488.1	1.61211E-08	1	Acceptable
Loop1	Rockfall VL	0.016279	0.2	1	0.7	0.5	1	3	4.18E-11	Acceptable	25488.1	1.06496E-06	1	Tolerable
Loop 1	Rockfall L	0.0121095	0.5	1	0.7	0.5	1	3	7.77E-11	Acceptable	25488.1	1.98049E-06	1	Tolerable
Loop 1	Shallow Soil VL	2.584E-06	0.01	1	1	0.1	31.623	3	3E-15	Acceptable	25488.1	7.64032E-11	1	Acceptable
Loop 1	Shallow Soil L	5.0697E-06	0.01	1	1	0.1	31.623	3	5.88E-15	Acceptable	25488.1	1.49977E-10	1	Acceptable
Loop 1	Shallow Soil M	7.7811E-05	0.01	1	1	0.1	31.623	3	9.02E-14	Acceptable	25488.1	2.30058E-09	1	Acceptable
Loop 1	Shallow Soil H	0.00403422	0.01	1	1	0.1	31.623	3	4.68E-12	Acceptable	25488.1	1.19226E-07	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 1 - Risk to Life Summary Table
	REVIEWED	DRP		

Loop 2 - F-N Pairs

Notes: Assumes 25488 visitors per year. Cumulitive risk along this segement is acceptable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 2 - F-N Pairs
	REVIEWED	DRP		

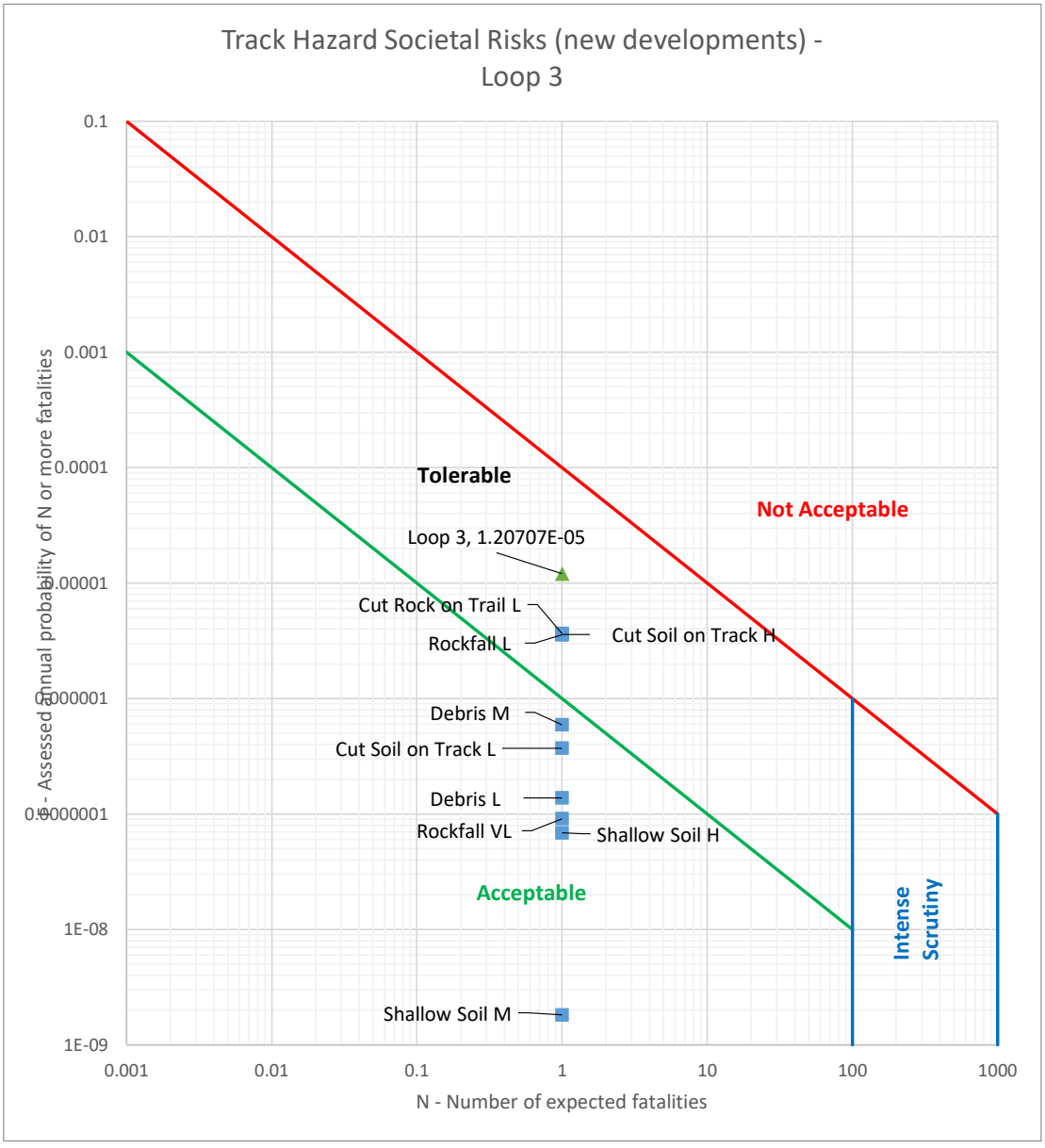
Loop 2 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Loop 2	Debris L	0.00003	0.7	1	1	0.1	74.36	3	5.73E-12	Acceptable	25488.1	1.45939E-07	1	Acceptable
Loop 2	Shallow Soil VL	9.8351E-06	0.01	1	1	0.1	31.623	3	1.14E-14	Acceptable	25488.1	2.91464E-10	1	Acceptable
Loop 2	Shallow Soil L	1.226E-05	0.01	1	1	0.1	31.623	3	1.42E-14	Acceptable	25488.1	3.62208E-10	1	Acceptable
Loop 2	Shallow Soil M	0.00014387	0.01	1	1	0.1	31.623	3	1.67E-13	Acceptable	25488.1	4.25311E-09	1	Acceptable
Loop 2	Shallow Soil H	0.00022833	0.01	1	1	0.1	31.623	3	2.65E-13	Acceptable	25488.1	6.74895E-09	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 2 - Risk to Life Summary Table
	REVIEWED	DRP		

Loop 3 - F-N Pairs

Notes: Assumes 44229 visitors per year. Cumulitive risk along this segement is tolerable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 3 - F-N Pairs
	REVIEWED	DRP		

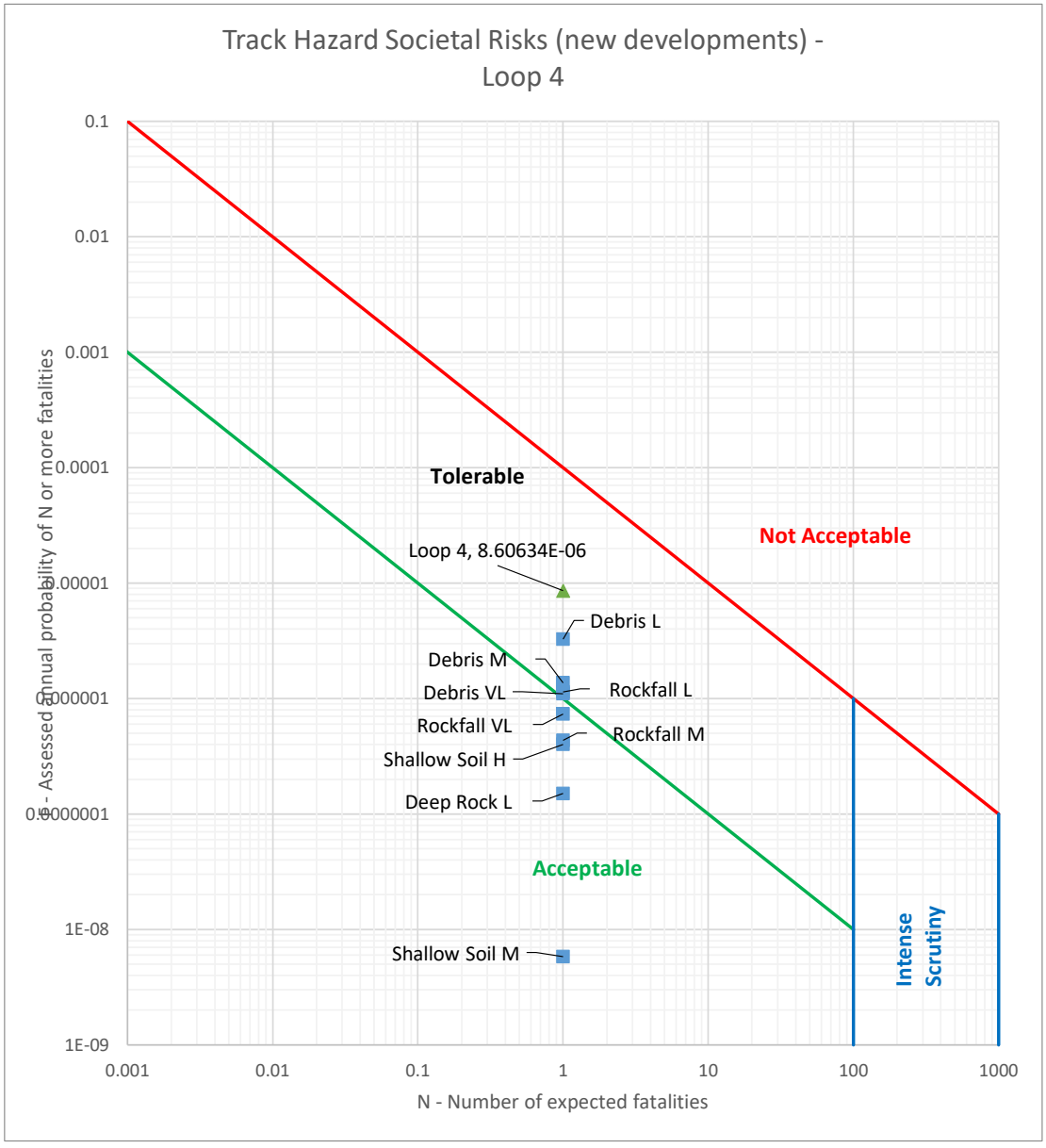
Loop 3 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Loop 3	Cut Rock on Trail L	0.0018	0.5	1	0.5	0.5	10	3	8.25E-11	Acceptable	44229.35	3.64892E-06	1	Tolerable
Loop 3	Cut Soil on Track L	0.00915	0.05	1	0.5	0.1	10	3	8.39E-12	Acceptable	44229.35	3.70974E-07	1	Acceptable
Loop 3	Cut Soil on Track H	0.0885	0.05	1	0.5	0.1	10	3	8.11E-11	Acceptable	44229.35	3.5881E-06	1	Tolerable
Loop 3	Debris L	0.00003	0.7	1	1	0.1	40.474	3	3.12E-12	Acceptable	44229.35	1.37841E-07	1	Acceptable
Loop 3	Debris M	0.0003	0.7	1	1	0.1	17.393	3	1.34E-11	Acceptable	44229.35	5.92352E-07	1	Acceptable
Loop 3	Rockfall VL	0.00080104	0.2	1	0.7	0.5	1	3	2.06E-12	Acceptable	44229.35	9.09365E-08	1	Acceptable
Loop 3	Rockfall L	0.01258203	0.5	1	0.7	0.5	1	3	8.07E-11	Acceptable	44229.35	3.57084E-06	1	Tolerable
Loop 3	Shallow Soil VL	3.5033E-06	0.01	1	1	0.1	31.623	3	4.06E-15	Acceptable	44229.35	1.81686E-10	1	Acceptable
Loop 3	Shallow Soil L	5.3084E-07	0.01	1	1	0.1	31.623	3	6.16E-16	Acceptable	44229.35	2.94627E-11	1	Acceptable
Loop 3	Shallow Soil M	3.5531E-05	0.01	1	1	0.1	31.623	3	4.12E-14	Acceptable	44229.35	1.82177E-09	1	Acceptable
Loop 3	Shallow Soil H	0.00134114	0.01	1	1	0.1	31.623	3	1.56E-12	Acceptable	44229.35	6.87806E-08	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 3 - Risk to Life Summary Table
	REVIEWED	DRP		

Loop 3 - Risk to Life Summary Table

Notes: Assumes 44229 visitors per year. Cumulitive risk along this segement is tolerable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 3 - Risk to Life Summary Table
	REVIEWED	DRP		

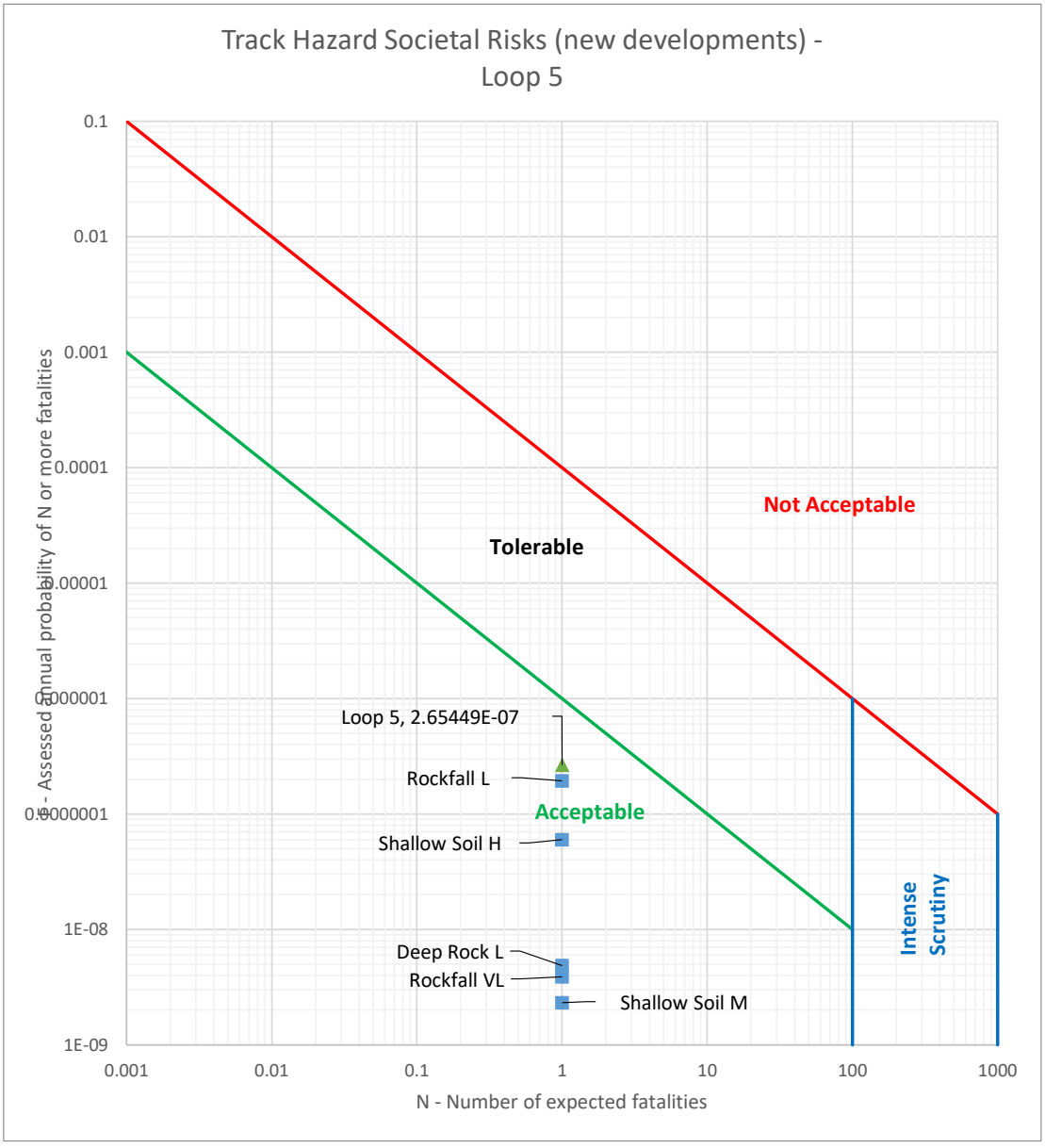
Loop 4 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Loop 4	Debris VL	0.00001	0.7	1	1	0.1	969.03	3	2.49E-11	Acceptable	44229.35	1.10006E-06	1	Tolerable
Loop 4	Debris L	0.00003	0.7	1	1	0.1	960.27	3	7.39E-11	Acceptable	44229.35	3.27033E-06	1	Tolerable
Loop 4	Debris M	0.0003	0.7	1	1	0.1	40.16	3	3.09E-11	Acceptable	44229.35	1.36771E-06	1	Tolerable
Loop 4	Deep Rock L	0.00003	0.01	1	1	0.5	620	3	3.41E-12	Acceptable	44229.35	1.50824E-07	1	Acceptable
Loop 4	Rockfall VL	0.00646726	0.2	1	0.7	0.5	1	3	1.66E-11	Acceptable	44229.35	7.34175E-07	1	Acceptable
Loop 4	Rockfall L	0.00402144	0.5	1	0.7	0.5	1	3	2.58E-11	Acceptable	44229.35	1.1413E-06	1	Tolerable
Loop 4	Rockfall M	0.00153157	0.5	1	0.7	0.5	1	3	9.83E-12	Acceptable	44229.35	4.34668E-07	1	Acceptable
Loop 4	Shallow Soil VL	1.4529E-05	0.01	1	1	0.1	31.623	3	1.68E-14	Acceptable	44229.35	7.46388E-10	1	Acceptable
Loop 4	Shallow Soil L	2.4307E-06	0.01	1	1	0.1	31.623	3	2.82E-15	Acceptable	44229.35	1.22761E-10	1	Acceptable
Loop 4	Shallow Soil M	0.00011345	0.01	1	1	0.1	31.623	3	1.32E-13	Acceptable	44229.35	5.81888E-09	1	Acceptable
Loop 4	Shallow Soil H	0.00781172	0.01	1	1	0.1	31.623	3	9.06E-12	Acceptable	44229.35	4.00614E-07	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 4 - Risk to Life Summary Table
	REVIEWED	DRP		

Loop 5 - F-N Pairs

Notes: Assumes 44229 visitors per year. Cumulitive risk along this segement is acceptable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 5 - F-N Pairs
	REVIEWED	DRP		

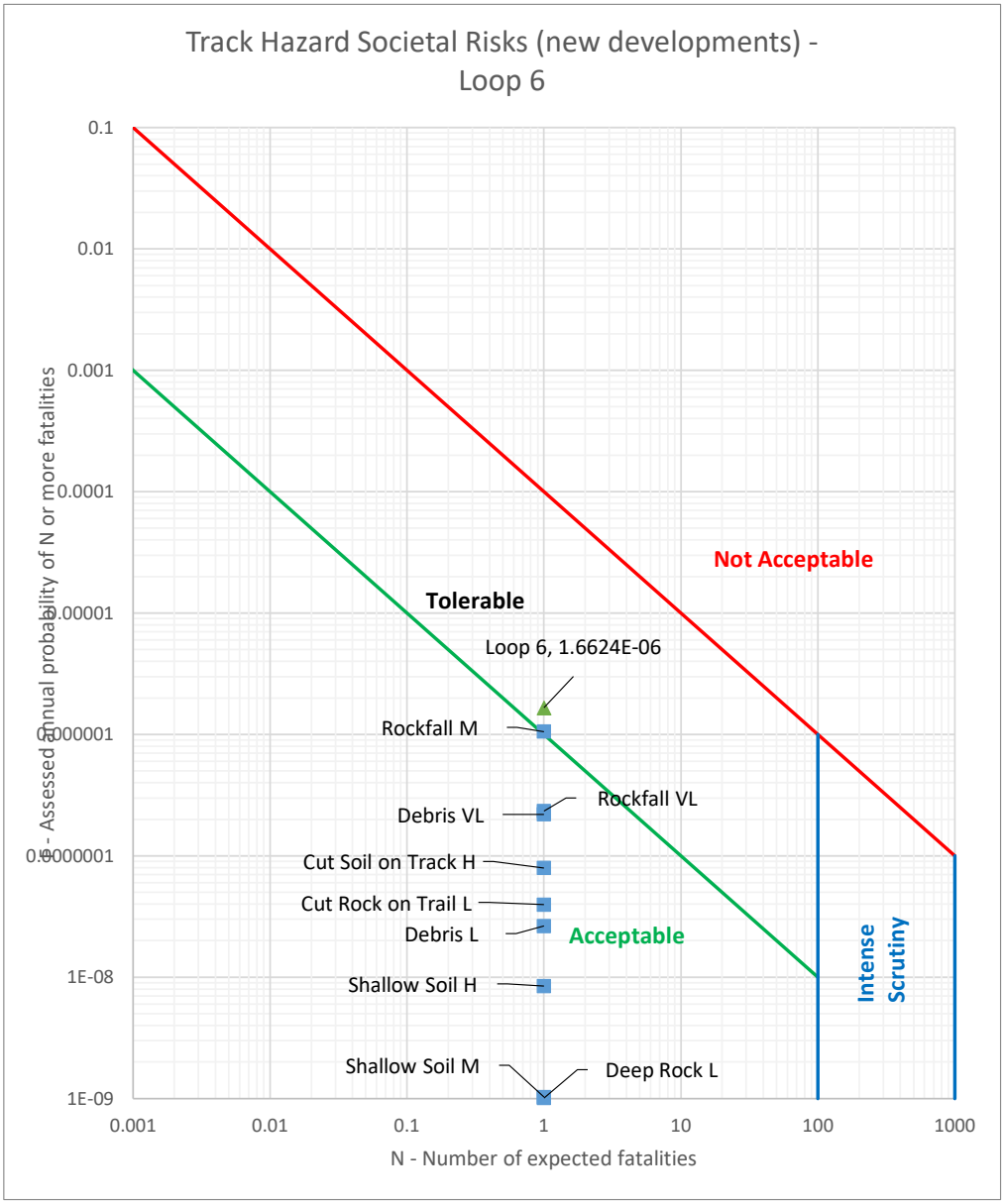
Loop 5 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Loop 5	Deep Rock L	0.00003	0.01	1	1	0.5	20	3	1.1E-13	Acceptable	44229.35	4.86625E-09	1	Acceptable
Loop 5	Rockfall VL	3.4313E-05	0.2	1	0.7	0.5	1	3	8.81E-14	Acceptable	44229.35	3.89398E-09	1	Acceptable
Loop 5	Rockfall L	0.00068282	0.5	1	0.7	0.5	1	3	4.38E-12	Acceptable	44229.35	1.93791E-07	1	Acceptable
Loop 5	Shallow Soil VL	3.0104E-06	0.01	1	1	0.1	31.623	3	3.49E-15	Acceptable	44229.35	1.52224E-10	1	Acceptable
Loop 5	Shallow Soil L	7.4259E-06	0.01	1	1	0.1	31.623	3	8.61E-15	Acceptable	44229.35	3.83015E-10	1	Acceptable
Loop 5	Shallow Soil M	4.5243E-05	0.01	1	1	0.1	31.623	3	5.25E-14	Acceptable	44229.35	2.32264E-09	1	Acceptable
Loop 5	Shallow Soil H	0.00117073	0.01	1	1	0.1	31.623	3	1.36E-12	Acceptable	44229.35	6.004E-08	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 5 - Risk to Life Summary Table
	REVIEWED	DRP		

Loop 6 - F-N Pairs

Notes: Assumes 5247 visitors per year. Cumulitive risk along this segement is tolerable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 6 - F-N Pairs
	REVIEWED	DRP		

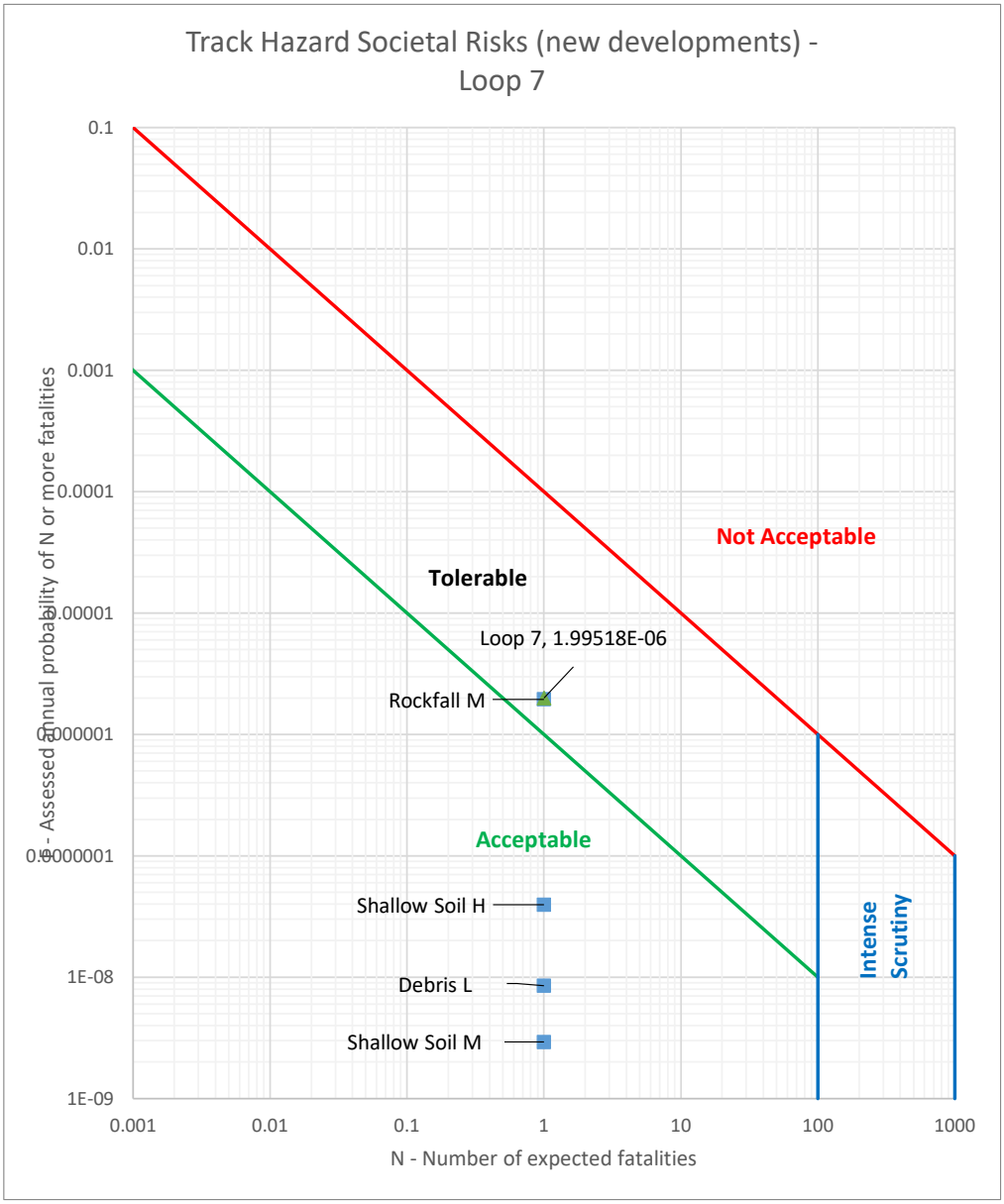
Loop 6 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Loop 6	Cut Rock on Trail L	0.000165	0.5	1	0.5	0.5	10	3	7.56E-12	Acceptable	5247.55	3.96846E-08	1	Acceptable
Loop 6	Cut Soil on Track H	0.0165	0.05	1	0.5	0.1	10	3	1.51E-11	Acceptable	5247.55	7.93693E-08	1	Acceptable
Loop 6	Debris VL	0.00001	0.7	1	1	0.1	1628.9	3	4.18E-11	Acceptable	5247.55	2.19389E-07	1	Acceptable
Loop 6	Debris L	0.00003	0.7	1	1	0.1	65.482	3	5.04E-12	Acceptable	5247.55	2.64586E-08	1	Acceptable
Loop 6	Deep Rock L	0.00003	0.01	1	1	0.5	35	3	1.93E-13	Acceptable	5247.55	1.01022E-09	1	Acceptable
Loop 6	Rockfall VL	0.01735625	0.2	1	0.7	0.5	1	3	4.45E-11	Acceptable	5247.55	2.33766E-07	1	Acceptable
Loop 6	Rockfall M	0.03127514	0.5	1	0.7	0.5	1	3	2.01E-10	Acceptable	5247.55	1.05309E-06	1	Tolerable
Loop 6	Shallow Soil VL	1.0637E-05	0.01	1	1	0.1	31.623	3	1.23E-14	Acceptable	5247.55	6.4668E-11	1	Acceptable
Loop 6	Shallow Soil L	1.3431E-05	0.01	1	1	0.1	31.623	3	1.56E-14	Acceptable	5247.55	8.15633E-11	1	Acceptable
Loop 6	Shallow Soil M	0.00016961	0.01	1	1	0.1	31.623	3	1.97E-13	Acceptable	5247.55	1.03178E-09	1	Acceptable
Loop 6	Shallow Soil H	0.00139001	0.01	1	1	0.1	31.623	3	1.61E-12	Acceptable	5247.55	8.45753E-09	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 6 - Risk to Life Summary Table
	REVIEWED	DRP		

Loop 7 - F-N Pairs

Notes: Assumes 44229 visitors per year. Cumulitive risk along this segement is tolerable.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 7 - F-N Pairs
	REVIEWED	DRP		

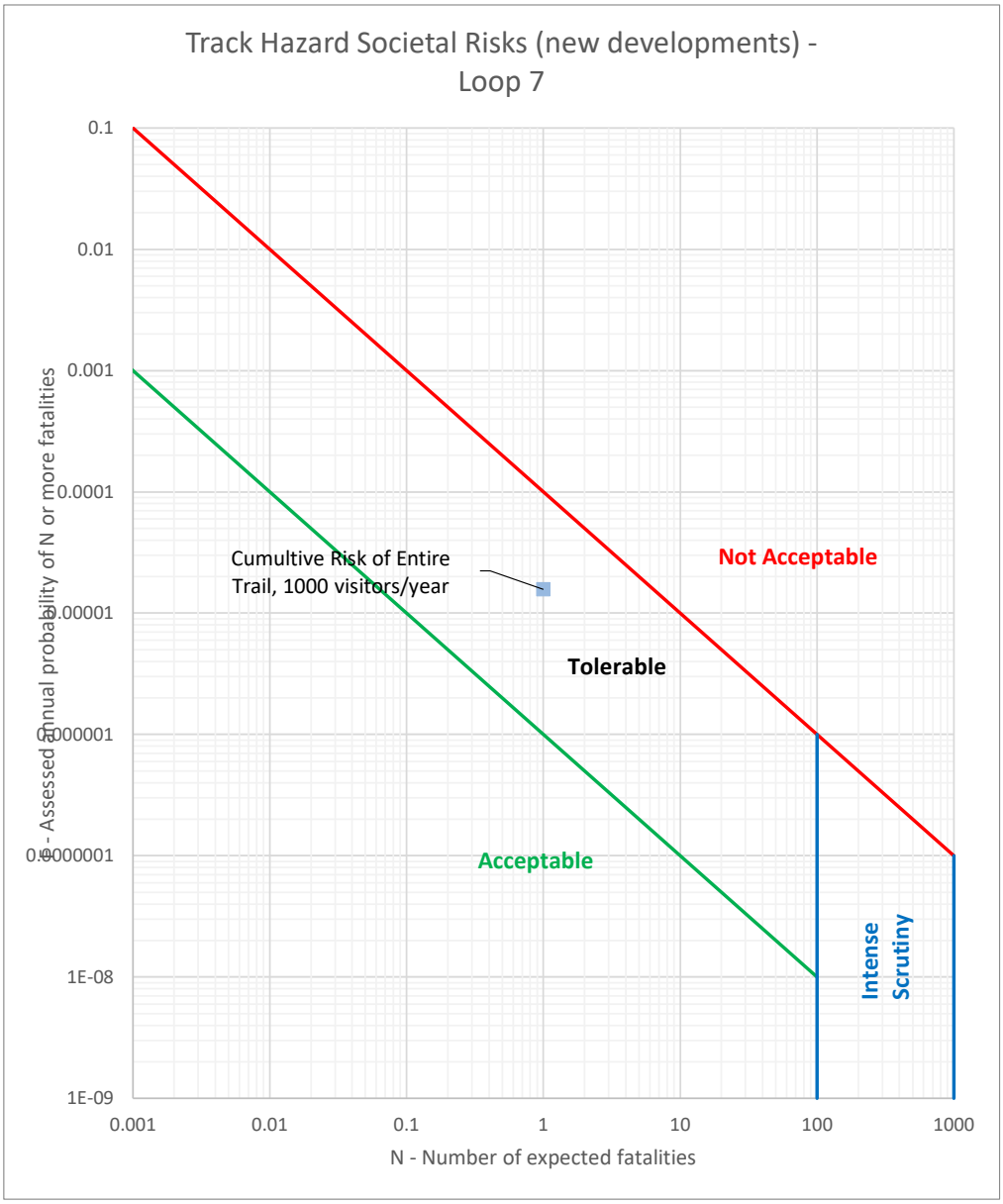
Loop 7 - Risk to Life Summary Table

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
Loop 7	Rockfall M	0.00684845	0.5	1	0.7	0.5	1	3	4.39E-11	Acceptable	44229.35	1.94362E-06	1	Tolerable
Loop 7	Shallow Soil H	0.00077177	0.01	1	1	0.1	31.623	3	8.95E-13	Acceptable	44229.35	3.95782E-08	1	Acceptable
Loop 7	Shallow Soil L	3.1298E-06	0.01	1	1	0.1	31.623	3	3.63E-15	Acceptable	44229.35	1.62045E-10	1	Acceptable
Loop 7	Shallow Soil M	5.7207E-05	0.01	1	1	0.1	31.623	3	6.63E-14	Acceptable	44229.35	2.93154E-09	1	Acceptable
Loop 7	Shallow Soil VL	7.2788E-06	0.01	1	1	0.1	31.623	3	8.44E-15	Acceptable	44229.35	3.73194E-10	1	Acceptable
Loop 7	Debris L	0.00003	0.01	1	1	0.5	35	3	1.93E-13	Acceptable	44229.35	8.51471E-09	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Loop 7 - Risk to Life Summary Table
	REVIEWED	DRP		

Overall Trail - F-N Pairs

Assumes 1000 walkers are completing the entire trail, from Fairhaven to Skenes Creek (including all loops and Branch) each year.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Overall Trail - F-N Pairs
	REVIEWED	DRP		

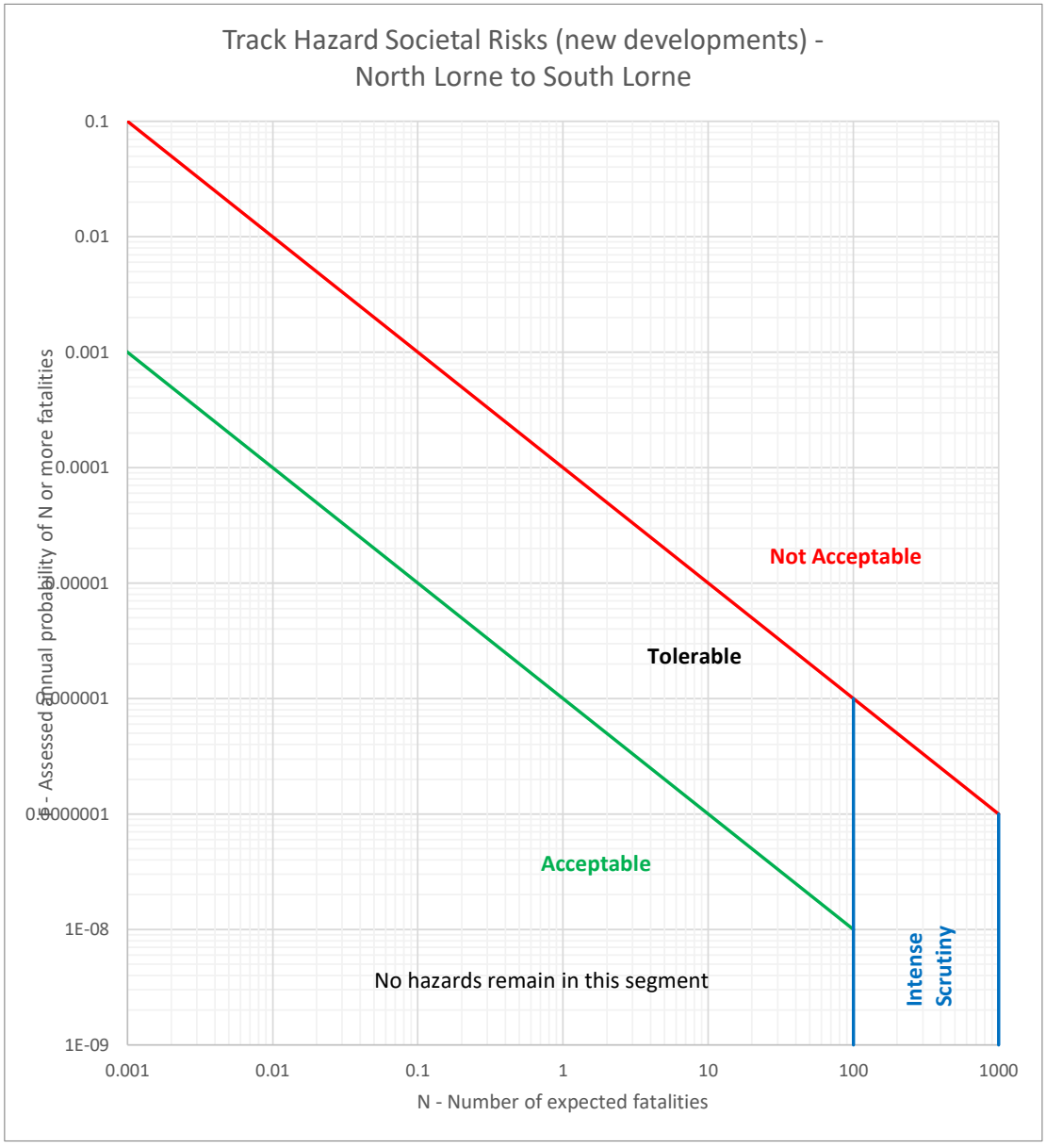
Overall Trail - Risk to Life Summary Table, Assumes 1000 visitors/year

	Combined Risks Per Hazard										
Trail Segment	Shallow Soil Landslide	Rockfall	Debris Flow	Deep Seated Rock Landslide	Fill Hazard onto Track	Fill Hazard Undermining Track	Cut Rock onto Track	Cut Rock Undermining Track	Cut Soil onto Track	Cut Soil Undermining Track	Combined Risk Total
FL	4.07E-08	1.29E-06	1.69E-07	9.17E-10		1.38E-08	1.24E-07		1.84E-07		1.83E-06
L					8.05E-07						8.05E-07
LC	2.06E-08	1.20E-06	9.05E-08	4.31E-10		2.64E-08	4.19E-07	4.13E-11	4.19E-07	8.22E-12	2.18E-06
CW	2.26E-08	2.10E-06	1.66E-07	6.46E-10	1.13E-07	3.96E-08	3.24E-07	1.37E-10	5.30E-07	2.75E-09	3.30E-06
WK	8.66E-09	6.29E-07	6.57E-08	4.12E-10	9.68E-08	4.04E-08	6.51E-07		7.09E-07		2.20E-06
KSm	3.12E-08	5.20E-07	6.38E-08	8.61E-10	4.40E-08	3.31E-09		9.17E-09		1.83E-09	6.74E-07
KSk	4.11E-09	4.54E-07	7.77E-08	9.76E-10	6.65E-07	1.33E-07	1.10E-06		9.82E-07		3.42E-06
Branch1	1.15E-09	1.17E-08	5.12E-09								1.80E-08
Branch2	1.93E-10	8.01E-09	5.34E-08	2.75E-11							6.16E-08
Branch3	1.19E-10	1.50E-08	3.28E-09								1.84E-08
Branch4	3.33E-11	5.83E-10									6.16E-10
Branch5	5.55E-13	1.11E-13									6.66E-13
Branch6	1.30E-10	3.21E-10		2.04E-10							6.55E-10
Branch7	1.37E-09	3.55E-08	1.62E-07	7.15E-10		5.31E-09	3.51E-08		6.15E-08		3.02E-07
Loop1	4.78E-09	4.78E-09	6.32E-10	6.32E-10							1.08E-08
Loop2	4.57E-10	0.00E+00	5.73E-09								6.18E-09
Loop3	1.60E-09	8.28E-08	1.65E-08				8.25E-08		8.95E-08		2.73E-07
Loop4	9.21E-09	5.22E-08	1.30E-07	3.41E-09							1.95E-07
Loop5	1.42E-09	4.47E-09		1.10E-10							6.00E-09
Loop6	1.84E-09	2.45E-07	4.68E-08	1.10E-10			7.56E-09		1.51E-08		3.17E-07
Loop7	9.73E-10	4.39E-08		1.93E-10							4.51E-08

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	Overall Trail - Risk to Life Summary Table, Assumes 1000 visitors/year
	REVIEWED	DRP		

L, North Lorne to South Lorne - F-N Pairs, Mitigation

Notes: Estimated risk outcmes after mitigations measures are implemented. Assumes 44229 visitors per year. Identified hazards no longer pose any credible risk.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	L, North Lorne to South Lorne - F-N Pairs, Mitigation
	REVIEWED	DRP		

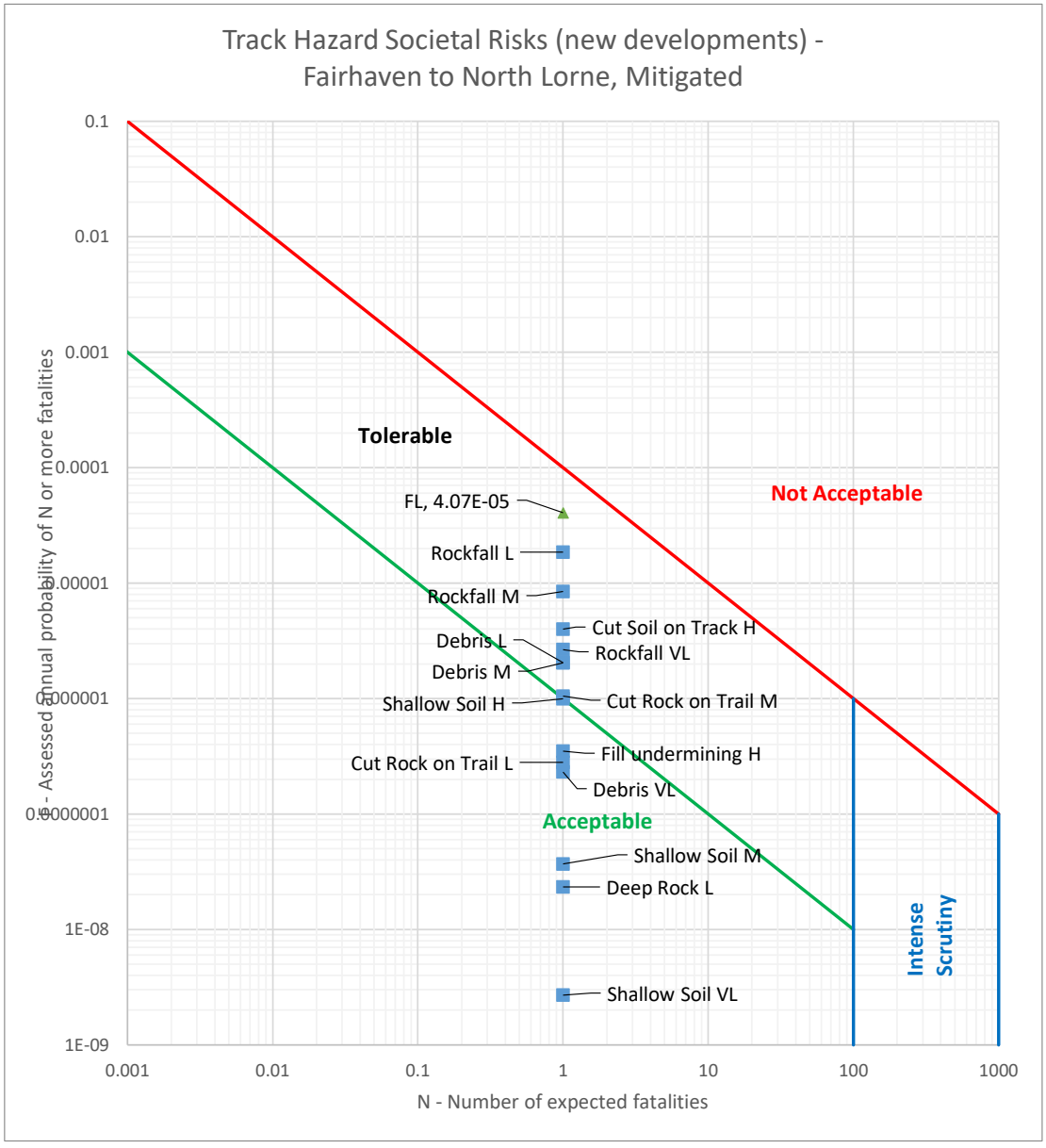
L, North Lorne to South Lorne - Risk to Life Summary Table, Mitigated

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
L	Fill onto track M	0	0.3	1	0.2	0.1	10	3	0	Acceptable	44229.35	0	1	No Hazard
L	Fill onto track H	0	0.3	1	0.2	0.1	10	3	0	Acceptable	44229.35	0	1	No Hazard

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	L, North Lorne to South Lorne - Risk to Life Summary Table, Mitigated
	REVIEWED	DRP		

FL, Fairhaven to North Lorne - F-N Pairs

Notes: Estimated risk outcmes after mitigations measures are implemented. Assumes 25488 visitors per year. Cumulative risk is now within a tolerable range.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	FL, Fairhaven to North Lorne - F-N Pairs
	REVIEWED	DRP		

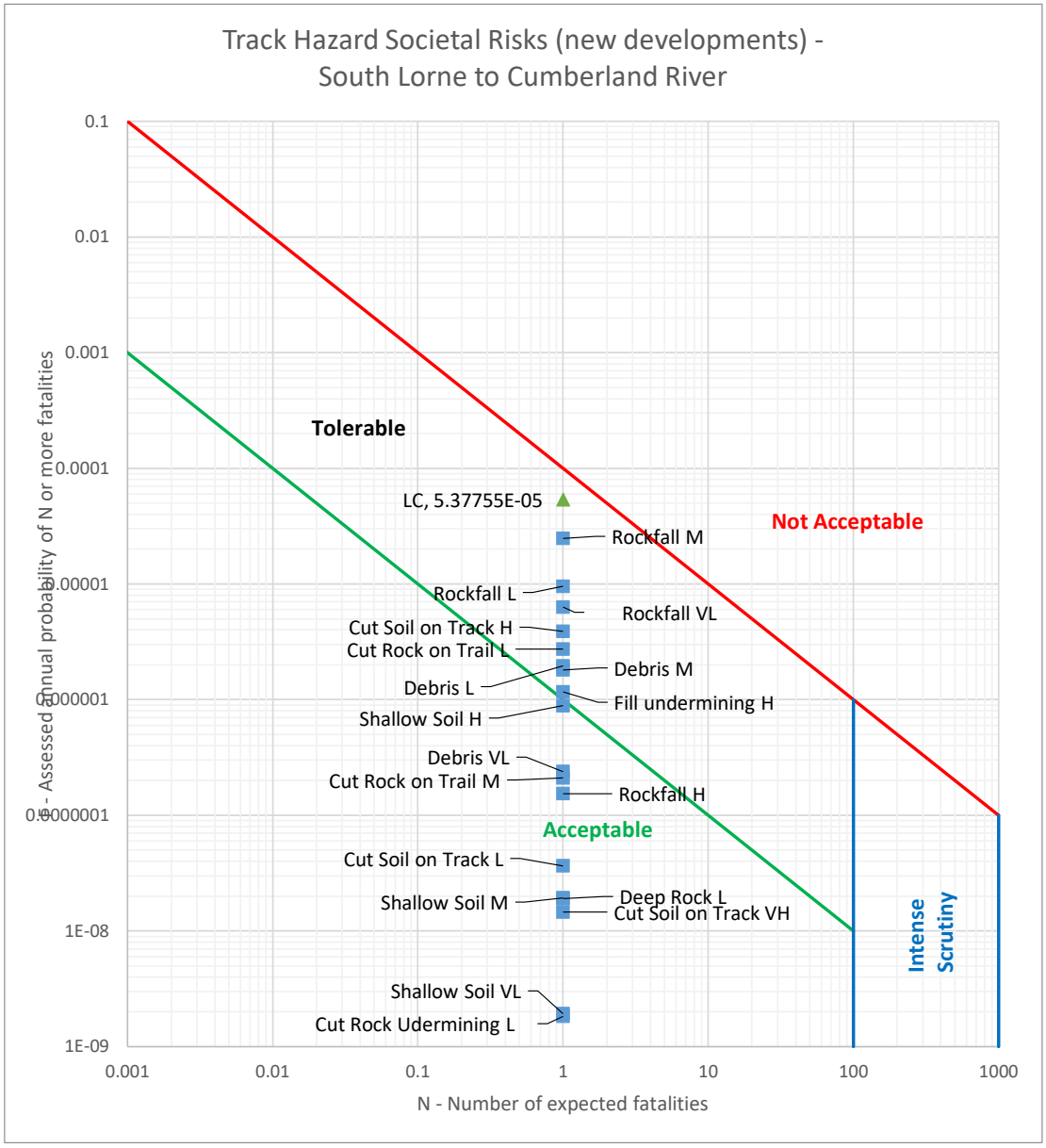
FL, Fairhaven to North Lorne - Risk to Life Summary Table, Mitigated

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
FL	Cut Rock on Trail L	0.0006	0.2	1	0.5	0.5	10	3	1.1E-11	Acceptable	25488.1	2.80369E-07	1	Acceptable
FL	Cut Rock on Trail M	0.0009	0.5	1	0.5	0.5	10	3	4.13E-11	Acceptable	25488.1	1.05138E-06	1	Tolerable
FL	Cut Soil on Track VL	0.00003	0.05	1	0.5	0.1	10	3	2.75E-14	Acceptable	25488.1	7.01777E-10	1	Acceptable
FL	Cut Soil on Track H	0.171	0.05	1	0.5	0.1	10	3	1.57E-10	Acceptable	25488.1	3.99525E-06	1	Tolerable
FL	Cut Soil on Track VH	0.00003	0.05	1	0.5	0.1	10	3	2.75E-14	Acceptable	25488.1	7.01777E-10	1	Acceptable
FL	Debris VL	0.00001	0.7	1	1	0.1	353.16	3	9.06E-12	Acceptable	25488.1	2.31035E-07	1	Acceptable
FL	Debris L	0.00003	0.7	1	1	0.1	1042.6	3	8.03E-11	Acceptable	25488.1	2.04617E-06	1	Tolerable
FL	Debris M	0.0003	0.7	1	1	0.1	103.87	3	8E-11	Acceptable	25488.1	2.03858E-06	1	Tolerable
FL	Deep Rock L	0.00003	0.01	1	1	0.5	166.71	3	9.17E-13	Acceptable	25488.1	2.33709E-08	1	Acceptable
FL	Fill undermining VL	0.00007	0.01	1	0.5	0.1	10	3	1.28E-14	Acceptable	25488.1	3.28251E-10	1	Acceptable
FL	Fill undermining H	0.075	0.01	1	0.5	0.1	10	3	1.38E-11	Acceptable	25488.1	3.50461E-07	1	Acceptable
FL	Rockfall VL	0.04052673	0.2	1	0.7	0.5	1	3	1.04E-10	Acceptable	25488.1	2.65123E-06	1	Tolerable
FL	Rockfall L	0.11345236	0.5	1	0.7	0.5	1	3	7.28E-10	Acceptable	25488.1	1.85548E-05	1	Tolerable
FL	Rockfall M	0.05177264	0.5	1	0.7	0.5	1	3	3.32E-10	Acceptable	25488.1	8.46731E-06	1	Tolerable
FL	Rockfall H	0	0.5	1	0.7	0.5	1	3	0	Acceptable	25488.1	0	1	No Hazard
FL	Shallow Soil VL	9.1304E-05	0.01	1	1	0.1	31.623	3	1.06E-13	Acceptable	25488.1	2.69958E-09	1	Acceptable
FL	Shallow Soil L	3.3107E-05	0.01	1	1	0.1	31.623	3	3.84E-14	Acceptable	25488.1	9.79093E-10	1	Acceptable
FL	Shallow Soil M	0.00125095	0.01	1	1	0.1	31.623	3	1.45E-12	Acceptable	25488.1	3.69707E-08	1	Acceptable
FL	Shallow Soil H	0.03371458	0.01	1	1	0.1	31.623	3	3.91E-11	Acceptable	25488.1	9.96382E-07	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	FL, Fairhaven to North Lorne - Risk to Life Summary Table, Mitigated
	REVIEWED	DRP		

LC, South Lorne to Cumberland River - F-N Pairs, Mitigated

ated risk outcmes after mitigations measures are implemented. Assumes 44229 visitors per year. Cumulative risk is now within a tol



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	LC, South Lorne to Cumberland River - F-N Pairs, Mitigated
	REVIEWED	DRP		

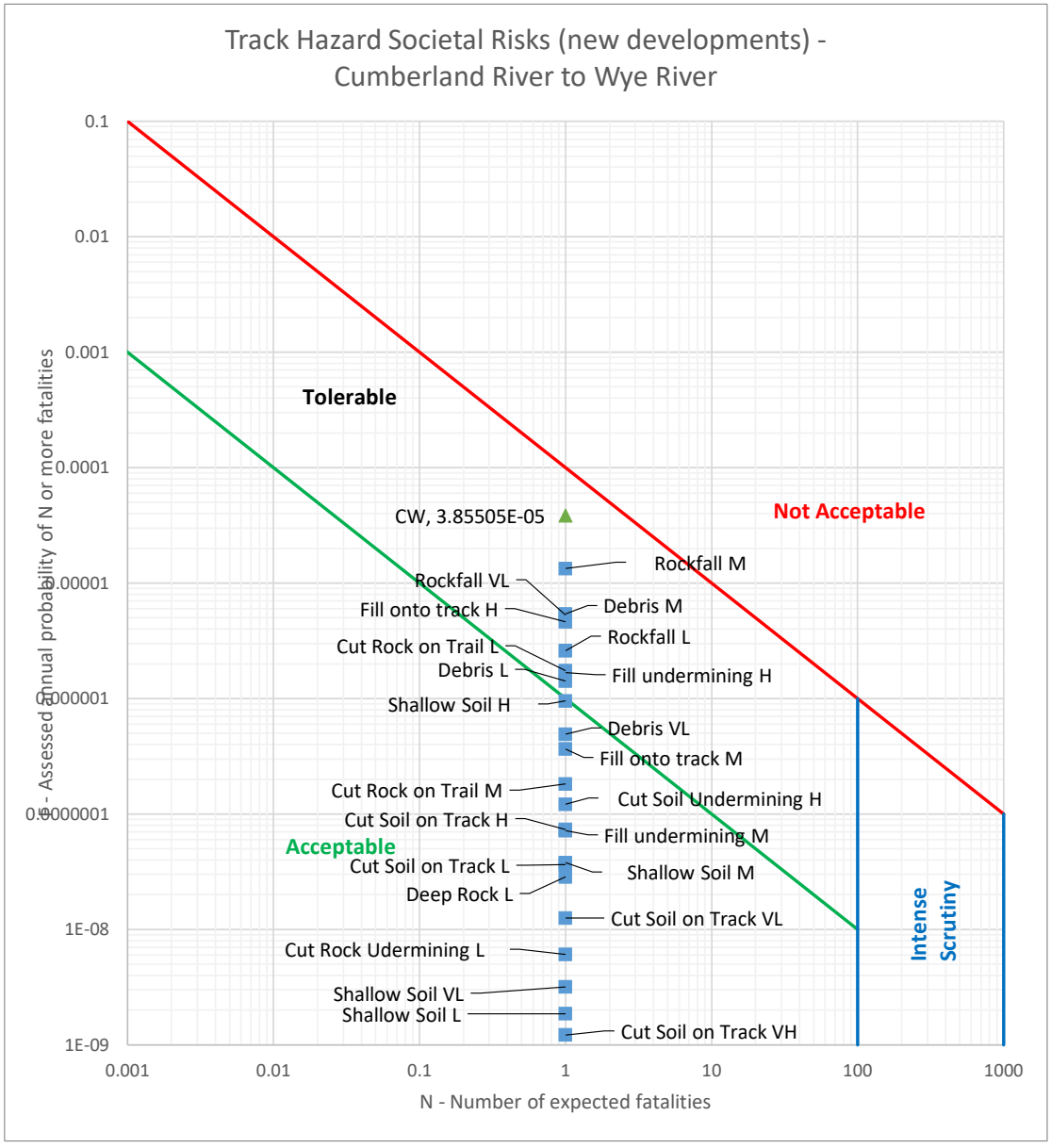
LC, South Lorne to Cumberland River - Risk to Life Summary Table, Mitigated

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
LC	Cut Rock on Trail L	0.00135	0.5	1	0.5	0.5	10	3	6.19E-11	Acceptable	44229.35	2.73669E-06	1	Tolerable
LC	Cut Rock on Trail M	0.00026	0.2	1	0.5	0.5	10	3	4.77E-12	Acceptable	44229.35	2.10825E-07	1	Acceptable
LC	Cut Rock Udermining L	0.000045	0.01	1	0.5	0.5	10	3	4.13E-14	Acceptable	44229.35	1.82669E-09	1	Acceptable
LC	Cut Soil on Track H	0.096	0.05	1	0.5	0.1	10	3	8.8E-11	Acceptable	44229.35	3.89218E-06	1	Tolerable
LC	Cut Soil on Track L	0.0009	0.05	1	0.5	0.1	10	3	8.25E-13	Acceptable	44229.35	3.64895E-08	1	Acceptable
LC	Cut Soil on Track VH	0.00036	0.05	1	0.5	0.1	10	3	3.3E-13	Acceptable	44229.35	1.45938E-08	1	Acceptable
LC	Cut Soil Undermining L	0.000045	0.01	1	0.5	0.1	10	3	8.25E-15	Acceptable	44229.35	3.63373E-10	1	Acceptable
LC	Debris L	0.00003	0.7	1	1	0.1	575.46	3	4.43E-11	Acceptable	44229.35	1.95982E-06	1	Tolerable
LC	Debris M	0.0003	0.7	1	1	0.1	52.984	3	4.08E-11	Acceptable	44229.35	1.80446E-06	1	Tolerable
LC	Debris VL	0.00001	0.7	1	1	0.1	210.01	3	5.39E-12	Acceptable	44229.35	2.38402E-07	1	Acceptable
LC	Deep Rock L	0.00003	0.01	1	1	0.5	78.333	3	4.31E-13	Acceptable	44229.35	1.90574E-08	1	Acceptable
LC	Fill undermining H	0.144	0.01	1	0.5	0.1	10	3	2.64E-11	Acceptable	44229.35	1.16765E-06	1	Tolerable
LC	Rockfall H	0.00054156	0.5	1	0.7	0.5	1	3	3.47E-12	Acceptable	44229.35	1.53697E-07	1	Acceptable
LC	Rockfall L	0.03369889	0.5	1	0.7	0.5	1	3	2.16E-10	Acceptable	44229.35	9.56387E-06	1	Tolerable
LC	Rockfall M	0.08721282	0.5	1	0.7	0.5	1	3	5.6E-10	Acceptable	44229.35	2.47511E-05	1	Tolerable
LC	Rockfall VL	0.0556245	0.2	1	0.7	0.5	1	3	1.43E-10	Acceptable	44229.35	6.31459E-06	1	Tolerable
LC	Shallow Soil H	0.01733223	0.01	1	1	0.1	31.623	3	2.01E-11	Acceptable	44229.35	8.88864E-07	1	Acceptable
LC	Shallow Soil L	1.5376E-05	0.01	1	1	0.1	31.623	3	1.78E-14	Acceptable	44229.35	7.90581E-10	1	Acceptable
LC	Shallow Soil M	0.00037681	0.01	1	1	0.1	31.623	3	4.37E-13	Acceptable	44229.35	1.93226E-08	1	Acceptable
LC	Shallow Soil VL	3.7487E-05	0.01	1	1	0.1	31.623	3	4.35E-14	Acceptable	44229.35	1.92489E-09	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	LC, South Lorne to Cumberland River - Risk to Life Summary Table, Mitigated
	REVIEWED	DRP		

CW, Cumberland River to Wye River - F-N Pairs, Mitigated

Notes: Estimated risk outcmes after mitigations measures are implemented. Assumes 44229 visitors per year. Cumulative risk is now within a tolerable range.



WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	CW, Cumberland River to Wye River - F-N Pairs, Mitigated
	REVIEWED	DRP		

CW, Cumberland River to Wye River- Risk to Life Summary Table, Mitigated

Trail	Trail	Risk to Life (Individual Most at Risk)									Risk to Life (Societal Risk)			
Trial ID	Hazard Type	P(H)	V(D:T)	N_i	w	f	d	s_i	Risk	Evaluation	n	F	N	Evaluation
CW	Cut Rock on Trail L	0.00215	0.2	1	0.5	0.5	10	3	3.94E-11	Acceptable	44229.35	1.74337E-06	1	Tolerable
CW	Cut Rock on Trail M	0.00009	0.5	1	0.5	0.5	10	3	4.13E-12	Acceptable	44229.35	1.82448E-07	1	Acceptable
CW	Cut Rock Udermining L	0.00015	0.01	1	0.5	0.5	10	3	1.38E-13	Acceptable	44229.35	6.07913E-09	1	Acceptable
CW	Cut Soil on Track VL	0.00031	0.05	1	0.5	0.1	10	3	2.84E-13	Acceptable	44229.35	1.25707E-08	1	Acceptable
CW	Cut Soil on Track L	0.0009	0.05	1	0.5	0.1	10	3	8.25E-13	Acceptable	44229.35	3.64895E-08	1	Acceptable
CW	Cut Soil on Track H	0.00181	0.05	1	0.5	0.1	10	3	1.66E-12	Acceptable	44229.35	7.33817E-08	1	Acceptable
CW	Cut Soil on Track VH	0.00003	0.05	1	0.5	0.1	10	3	2.75E-14	Acceptable	44229.35	1.21779E-09	1	Acceptable
CW	Cut Soil Undermining H	0.015	0.01	1	0.5	0.1	10	3	2.75E-12	Acceptable	44229.35	1.21632E-07	1	Acceptable
CW	Debris VL	0.00001	0.7	1	1	0.1	433.28	3	1.11E-11	Acceptable	44229.35	4.91874E-07	1	Acceptable
CW	Debris L	0.00003	0.7	1	1	0.1	416.42	3	3.21E-11	Acceptable	44229.35	1.41819E-06	1	Tolerable
CW	Debris M	0.0003	0.7	1	1	0.1	159.02	3	1.22E-10	Acceptable	44229.35	5.41565E-06	1	Tolerable
CW	Deep Rock L	0.00003	0.01	1	1	0.5	117.5	3	6.46E-13	Acceptable	44229.35	2.85837E-08	1	Acceptable
CW	Fill onto track M	0.00225	0.1	1	1	0.1	10	3	8.25E-12	Acceptable	44229.35	3.6489E-07	1	Acceptable
CW	Fill onto track H	0.0285	0.1	1	1	0.1	10	3	1.05E-10	Acceptable	44229.35	4.62195E-06	1	Tolerable
CW	Fill undermining VL	0.00011	0.01	1	0.5	0.1	10	3	2.02E-14	Acceptable	44229.35	8.93701E-10	1	Acceptable
CW	Fill undermining M	0.00885	0.01	1	0.5	0.1	10	3	1.62E-12	Acceptable	44229.35	7.17612E-08	1	Acceptable
CW	Fill undermining H	0.207	0.01	1	0.5	0.1	10	3	3.8E-11	Acceptable	44229.35	1.6785E-06	1	Tolerable
CW	Rockfall VL	0.04657175	0.2	1	0.7	0.5	1	3	1.2E-10	Acceptable	44229.35	5.2869E-06	1	Tolerable
CW	Rockfall L	0.00915176	0.5	1	0.7	0.5	1	3	5.87E-11	Acceptable	44229.35	2.59731E-06	1	Tolerable
CW	Rockfall M	0.04720996	0.5	1	0.7	0.5	1	3	3.03E-10	Acceptable	44229.35	1.33983E-05	1	Tolerable
CW	Rockfall H	0	0.5	1	0.7	0.5	1	3	0	Acceptable	44229.35	0	1	Acceptable
CW	Shallow Soil VL	6.1999E-05	0.01	1	1	0.1	31.623	3	7.19E-14	Acceptable	44229.35	3.18197E-09	1	Acceptable
CW	Shallow Soil L	3.6271E-05	0.01	1	1	0.1	31.623	3	4.21E-14	Acceptable	44229.35	1.86106E-09	1	Acceptable
CW	Shallow Soil M	0.00073982	0.01	1	1	0.1	31.623	3	8.58E-13	Acceptable	44229.35	3.7943E-08	1	Acceptable
CW	Shallow Soil H	0.01864345	0.01	1	1	0.1	31.623	3	2.16E-11	Acceptable	44229.35	9.56112E-07	1	Acceptable

WSP GOLDER	CLIENT	World Trail	PROJECT	Great Ocean Road Trail Geotechnical Risk Assesment
	DATE	29/09/2022		
	DESIGNED	AJD	TITLE	CW, Cumberland River to Wye River- Risk to Life Summary Table, Mitigated
	REVIEWED	DRP		

APPENDIX C

Important Information

GOLDER

IMPORTANT INFORMATION RELATING OF THIS REPORT

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

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