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Wildland Consultants Limited

Fiordland Link Concession Application Technical Assessment of Selected Aspects

Draft for Client

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Quality Assurance Statement	
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Wildland Consultants Limited

Fiordland Link Concession Application
Technical Assessment of Selected Aspects

Contents

1 Introduction

1.1 Background

On 4 November 2009 Riverstone Holdings Limited (the applicant) lodged a concession application (the application) under the Conservation Act 1987 to construct and operate the monorail component of the Fiordland Link Experience across land managed by the Department of Conservation (the Department).

MWH audited a 2007 concession application for the monorail component. The current application has a modified scope of work in that it includes a bike track which runs parallel to the monorail for part of the monorail route. Where aligned with the monorail, the bike track will also serve as a construction road initially and then as a monorail service road. Neither the separate construction/service road nor the mountain bike track were part of the 2007 concession application.

The revised application is for a concession, in the form of an easement in terms of Part 3B of the Conservation Act 1987 to allow the construction, operation, monitoring and maintenance of the following activities on Department of Conservation land:

- An approximately 29.5km long monorail track within a six metre wide footprint, along which a monorail will operate and be maintained.
- A three metre wide construction track along the length of the monorail route, to be left in place after construction is complete for use as a mountain bike track.
- Connection spur tracks approximately three metres wide to provide access to the monorail track during construction and in some cases, during operation for emergency access and maintenance activities.
- Terminus buildings and facilities on the eastern side of the Mararoa River near the start of the Kiwi Burn Loop Track.
- Terminus buildings and facilities at Te Anau Downs within Fiordland National Park.
- Where the monorail track enters private land the continuation of the mountain bike track on the DoC estate to Te Anau Downs for approximately 17km.

The concession is sought for an easement over a 200m wide corridor of land within which the monorail track and construction/mountain bike track would be located, except for:

- 2.3km of the route between approximately 24km and 26.5km, on the true right of the Upukerora River where a 300m wider easement is sought to allow for construction around subsiding bluff, and
- An easement continuation of the mountain bike track on the DoC estate once the monorail enters private land.

The term applied for is 49 years.

The Fiordland Link Experience journey would have three sections:

- Queenstown to Mt Nicholas Station – 20km via a catamaran, southwest across Lake Wakatipu to wharf facilities at Mt Nicholas Station
- Mt Nicholas Station to Kiwi Burn Terminus – 45km by an all terrain vehicle from wharf facilities up the Mt Nicolas, Von and Mavora Lakes existing back country roads to a terminus located between the Mavora Lakes Road and the swing bridge over the Mararoa River
- Kiwi Burn Terminus to Lake Te Anau – 43.5 km by an electrically powered monorail through tussock land, Snowdon Forest and farm land to a terminus close to the lake shore at Te Anau Downs.

The mountain bike track between Kiwi Burn and Te Anau Downs could also become a critical leg of the separately proposed Three Lakes Ride, a multi-day journey between Queenstown on Lake Wakatipu, Te Anau Township on Lake Te Anau and Manapouri Township on Lake Manapouri.

Three lengths of the monorail section (i.e. Kiwi Burn Terminus to Te Anau Downs Terminus) would be within land managed by the Department. Firstly the access road from Mavora Lakes Road to the terminus site at Kiwi Burn would be within a marginal strip to the Mararoa River. Secondly, the length of the monorail from 0km to 29.5km (from Kiwi Burn Terminus end) would be mainly within Snowdon Forest, which is part of the Te Wāhipounamu (South West New Zealand) World Heritage Area. Thirdly, the terminus site at Te Anau Downs would be within the Fiordland National Park.

For land managed under the Conservation Act 1987 or the National Parks Act 1980, the Department is the administrative authority. The Department has engaged Wildland Consultants Ltd to assist with an audit of the concession application. MWH has been engaged by Wildland Consultants Ltd to carry out an independent assessment of the application with respect to construction engineering, traffic engineering, wastewater, solid waste, hydrology and hydraulics, and geotechnical components. The site boundaries for the purpose of this audit are shown in Appendix A. The area of land within these boundaries is termed the Site.

1.2 Purpose

The Department is seeking independent technical audit and review of the material submitted by Riverstone Holdings in respect to terrestrial biodiversity, engineering, freshwater/aquatic, landscape and noise as they would relate to activities on land administered by the Department (the Site). The purpose of the Department is to assess the effects on public conservation land from the proposed activities associated with the concession application.

This report addresses the engineering audit and review of the application.

1.3 Scope of Work

The scope of MWH work comprises:

- Review whether Riverstone Holdings and/or its consultants have used accepted processes, methodology, and industry standards in the application, EIA, and additional reports.
- Review whether the contents of the application, EIA, and additional reports are factually correct.
- Review whether there are any information gaps or omissions in respect of the activities proposed on public conservation land.
- Review whether the applicant has identified all potential effect of the activities proposed on public conservation land, and whether measures proposed to avoid/remedy or mitigate effects are appropriate.

The scope of work is to include an assessment of effects in terms of a scale provided by the Department of Conservation i.e.:

- No effect – no effects at all
- Minimal effect – Minute (positive or adverse) effect that is basically unnoticeable
- Temporary effect – Effect that is temporary in nature
- Potential significant adverse effect – Potential adverse effect in the environment which can be avoided, remedied or adequately mitigated
- Unmitigated potential significant adverse effect – Serious adverse effect on the environment and cannot be remedied or adequately mitigated

- Insufficiently assessed effect – Effect where the information available is insufficient or inadequate to enable assessment of effects
- Positive effect – Effect that results in an improvement in the conservation values of the environment

The staging of MWH work is:

- **Stage 1 – Review Concession Application**. Review concession application with respect to construction engineering, traffic engineering and user access, wastewater, solid waste, hydrology and hydraulics, and geotechnical components and assess effects of activities on land administered by the Department
- **Stage 2 – Draft Audit Report**. Summarise the findings of the review in a report
- **Stage 3 – Final Audit Report**. Edit the draft audit report based on the direction received from the Department of Conservation.

Further work may comprise:

- liaising with other auditors and attending meetings for auditors prior to completing audit report
- preparing for and attending meetings with Wildland Consultants Limited, the Department, or the applicant
- responding to requests for clarification on the findings given in the MWH audit report, from Wildland Consultants Limited, the Department, or the applicant.

Work that MWH has carried out to date comprises:

- A site visit in 2006 with DoC staff and a representative of Riverstone Holdings Limited; i.e. route flown by helicopter with landings at the proposed Kiwi Burn Terminus location, at the Kiwi Burn and Mararoa River confluence, at the proposed locations of the Whitestone and Upukerora River crossings and near the wetland along the route at 27km.
- Meeting in Christchurch on 27 August 2009 with Riverstone Holdings representatives and key stake holders.
- Review of the application and supporting information (Stage 1 of MWH work)
- Preparation and submission of a draft audit report (Stage 2 of MWH work).

1.4 Application Information Received

MWH has received a CD entitled Riverstone Holdings Limited Department of Conservation, Application for Concession Monorail and Mountain Bike Track, dated November 2009. This CD includes the application document and appendices (Appendix A to P).

1.5 Limitations

The assessment undertaken by MWH was limited to construction engineering, traffic engineering and immediate visitor access, wastewater, solid waste, hydrology and hydraulics, and geotechnical components associated with the proposed construction and operation of that part of the proposed monorail and mountain bike track located within the Site as defined in Section 1.5 and on the drawings in Appendix A.

The assessment is not a full review of all the matters that the Minister of Conservation is required to have regard to when considering a concession application pursuant to Section 17U of the Conservation Act 1987.

The assessment has been limited to the identified activities proposed to be undertaken within the Site, without consideration of related activities outside the Site. For example, transporting and disposing of sewage and solid waste outside of the Site may have effects beyond the Site, such as effects on wider network road traffic, service infrastructure and treatment and disposal facilities.

As part of this review, MWH has not considered applications submitted previously (e.g. in 2006 and 2004).

It is understood that the Department and Wildland Consultants Limited (on behalf of the Department) have engaged other parties to assess the application with respect to other matters, including cultural impacts, freshwater ecology, noise effects, terrestrial ecology, archaeology impacts, recreational effects and landscape values. Accordingly, MWH has not reviewed the material in Appendices G, H, I, J, K, L, M, O and P of the Application documents.

It is noted that the monorail would be powered by electricity. MWH has not reviewed the supply of electricity, usage of electricity, health and safety effects associated with the use of electricity, and risks such as power failure. The electrical power supply would have implications during both the construction and the operation.

1.6 Definitions

Parameter	Definition
Site	As defined on the drawings in Appendix A. Generally, the Site comprises: • the access road from Mavora Lakes Road to and the terminus site at Kiwi Burn • the length of the monorail route from 0km to 29km (from Kiwi Burn Terminus end), • the terminus site at Te Anau Downs
Sewage	Toilet water (also known as black water) and washing water of domestic character (also known as greywater or sullage)
Wastewater	Contaminated or potentially contaminated water other than sewage, and stormwater. Dirty stormwater (i.e. sediment laden water), contaminated processing water (e.g. washing water from machinery cleaning, runoff from construction storage areas, concrete slurry).
Solid waste	Any material, other than liquid or gas, disposed of off-site as waste or on-site as waste or spoil, e.g. domestic refuse generated by workers (e.g. lunch scraps, packaging), natural spoil from excavating foundations, and other earthworks, vegetation cleared from Site, waste generated from machinery (e.g. used oil filters, used oil, replacement parts), processing and construction (e.g. concrete slurry).
Hydrology	Study of rainfall-runoff characteristics, catchment flows, surface water flow paths, natural water courses (e.g. Mararoa River, Whitestone River, Upukerora River, Dunton Creek, Retford Stream), flood plains.
Hydraulics	Study of hydraulic capacity of water courses, hydraulic capacity of pipelines, containment of flows, river channel behaviour, sediment loads, bed loads, erosion and scour, interception from natural flow paths.
Traffic Engineering and Immediate Visitor Access	Study of the safe and efficient movement of people and goods within and immediately adjacent to the site, with respect to the design, construction and management of the physical infrastructure necessary for this movement (e.g. roads, monorail track, cycleway and monorail maintenance track, traffic signs, access points) as well as traffic planning aspects.
Construction Engineering	Study of the planning and management of the construction of structures such as buildings and transport infrastructure including monorails. It includes design of structures (and any temporary structures), cost estimating, procurement, and construction management.

2 Overview of Proposed Activity

2.1 Introduction

Riverstone Holdings Limited proposes to create and operate a 43.8 km electrically powered monorail from the Kiwi Burn terminus to the Te Anau Downs terminus as part of the Fiordland Link Experience. As part of the monorail construction, a separate construction track parallel to the monorail route with separation varying between 20-80m would be created. This would be modified to a mountain bike track and monorail maintenance track upon completion of the construction works. This track would be located within the 200-300m wide easement corridor where the monorail runs within land administered by the Department. Where the monorail enters private land, the mountain bike track alignment will remain within DOC estate.

The monorail would be a single track with three passing bays at the 10, 20 and 30km marks. The length of the passing bays is not specified in the application. Sections of the monorail, totalling approximately 29.5 km, including both terminal buildings would be within land managed by the Department. The access road from Mavora Lakes Road to and the terminus site at Kiwi Burn would be within a marginal strip to the Mararoa River. The length of the monorail from 0km to 29.5km (from Kiwi Burn Terminus end) would be mainly within Snowdon Forest, which is part of the Te Wāhipounamu (South West New Zealand) World Heritage. The terminus site at Te Anau Downs would be within the Fiordland National Park.

The construction and mountain bike track will be located within land managed by the Department for its entire length. However, the width of the easement Riverstone Holdings is applying for where the mountain bike track differs from the monorail corridor is unknown.

For the construction, three main construction depots outside DoC administered land will be established for storage of material and machinery maintenance etc. The construction track, which will remain in place as mountain bike track upon completion of the works, will be used for transport of equipment and machinery to the construction fronts. Construction crews will be starting at the termini on either end of the monorail route. Spur tracks will be located every 200-300m to connect the construction track to the monorail route. A temporary construction track along most of the monorail route will be created to gain access to the foundation locations of the monorail. It is proposed that the construction track along the monorail route itself will be reinstated as soon as construction is completed. Most of the spur tracks are expected to be substantially rehabilitated after construction of the monorail. A small number of spur tracks will be left in service for monorail maintenance and emergency activities, serving alongside the maintenance function of the cycle track.

The Draft Construction Management Plan (Appendix B of the application) mentions minor construction site depots which are not further discussed in the application, e.g. proposed activities, size, location.

It is stated that the construction of the monorail will require a 4-5m wide corridor cleared of vegetation along the monorail line between foundations and a wider clearance width of 6m at each foundation. The foundations will be located 20m apart from each other. The mountain bike and spur track width is stated to be 3m. However, the required clearance width for the tracks is not stated in the application. Required clearance height for the monorail alignment is stated in the application as a minimum of 12m. The clearance height for the construction/mountain bike track and the spur tracks is not stated.

The required clearance width of the mountain bike track during the operation will be highly dependent on the target user group of the track. The required clearance width could be significant if family groups are targeted.

On slopes, the separation between the construction/mountain bike track is proposed to vary between 20 and 30m. For flat sections of the monorail, the separation between the monorail and the construction/mountain bike track is stated to vary between 70 and 80m.

This section provides an overview of aspects of the proposed activity directly related to construction engineering, traffic engineering and access, wastewater, solid waste, hydrology and hydraulics, and geotechnical components of the application.

2.2 Overview

2.2.1 Route Alignment

Section 2.2 of the concession application describes the proposed route of the monorail through land administered by the Department.

Section 4 provides an overview of the proposed activities associated with the Fiordland Link Experience. This section describes the proposed monorail, terminus buildings, passenger consolidation and car park facility at Te Anau Down and other infrastructure.

The proposed route is shown on drawings 30 to 34 in Appendix A of the Fiordland Link Experience Preliminary Engineering Assessment of Monorail Proposal which forms Appendix E of the application. The drawings show the proposed monorail corridor, the mountain bike track alignment (where it runs separately to the monorail corridor) and terrain information which influence the construction methodologies of the monorail such as side slope on open land, side slope in bush, etc.

2.2.2 Environment

The Hydrology and River Geomorphology Assessment forms Appendix F of the concession application and describes the nature of the rivers along the proposed monorail route and assesses the impact of the proposed activities on these rivers.

Appendix C of the Preliminary Engineering Assessment of Monorail Proposal (application as Appendix E) includes compiled literature on the geology along the proposed monorail route (Geology of the Wakatipu Area).

Appendix G contains the Assessment of Potential Effects on Aquatic Ecology and the Noise Assessment forms Appendix H.

The Terrestrial Ecology Report in Appendix I of the application describes the fauna and flora along the proposed monorail corridor and assesses the impact of the proposed activities on fauna and flora.

Appendices J, K, L and M contain the Landscape Effects Report, the Tourism Assessment, the Assessment of Recreation Effects and the Cultural Impact Assessment respectively.

A summary of the existing environment is provided in the Section 3 of concession application and Section 8 of the application provides an assessment of the environmental effects.

2.2.3 Engineering Design

Section 5 of the concession application presents the proposed construction methodology for the monorail and the construction/mountain bike track.

Appendix E of the application (Preliminary Engineering Assessment of Monorail Proposal) gives a more detailed overview of the construction methodology including the proposed mountain bike track standard (Department of Conservation Track Construction and Maintenance Guideline (VC1672)) and erosion and sediment control measures during construction (in accordance with Auckland Regional Council Technical Publication 90 (ARC TP90)).

Drawings 3 and 5 of the same appendix show typical cross sections of the monorail, proposed monorail foundation type and mountain bike track construction on 25° side slope and along flat and swampy bush.

Drawings 40 and 41 show indicative site plans of the Kiwi Burn and Te Anau Downs Terminus respectively.

Section 4.2 of the concession application describes the proposed monorail and gives indicative specifications of the monorail trains, i.e. monorail seating capacity, length, speed, maximum grade, turning, vehicle height and width, and power. More train specifications, such as lighting and safety systems, are listed in Section 6.4.2.

Section 4.5.2 contains information on the proposed power supply to the termini and the monorail track.

Sections 4.5.3, 4.5.4 and 4.5.5 address water supply, sewage disposal and stormwater disposal respectively at the Kiwi Burn terminus. Water supply, sewage disposal and stormwater disposal at the Te Anau Downs terminus has not been addressed in the application.

Section 4.5.6 considers communication methods between the monorail trains, termini and all-terrain vehicles and outside telephone communication from the Te Anau Downs terminus.

The operation of the monorail, including trip and passenger management, maintenance and safety are included in Section 6 of the application. There is however no matching information concerning trip or user management information for the mountain bike track which may generate a separate user market to the monorail facility itself.

Appendix B contains a DRAFT Construction Management Plan (CMP). The CMP includes or will include in the final version responsibilities of the project manager, construction methodology, H&S management, Hazardous Substances Management Plan, Traffic Management Plan, Noise Management Plan, Risk Management Plan, Waste Management Plan, Erosion and Sediment Control Plan, In River Works Management Plan, and Terrestrial Ecology Management Plan. The CMP will continue to evolve as more detail is developed relating to construction and monitoring activities.

The objectives of the CMP are:

- To provide guidance on environmental management for the construction of the monorail and associated facilities
- To avoid, remedy or mitigate any adverse environmental effects associated with construction activities
- To provide detail of construction methodologies and management of effects during construction

A DRAFT Operational and Environmental Management Plan (OEMP) forms Appendix C. The purpose of the OEMP is to describe the monorail, termini and mountain bike track operation and maintenance, address emergency situations. The plan also addresses the environmental monitoring and management and recreational users. The current DRAFT OEMP submitted with the concession application is an outline only of the matters that will be covered and it is proposed to be developed once a monorail supplier has been appointed.

Ongoing erosion and sediment control during the operation of the monorail is not addressed in the application.

The information provided on engineering design within the application is focused on the monorail construction and the parallel mountain bike track establishment. The construction of the termini buildings has not been addressed within the application. The construction of the mountain bike track where it runs separately to the monorail has not been addressed in the application.

2.2.4 Route Characterisation

Section 4.2 of the application characterises the monorail as follows:

- Low-to-the-ground single track straddle monorail run on a track, supported at approx. 20m centres by precast piers (500mmx400mm)
- Electrically powered, with transformers at suitable pier sites at intervals along track

- Monorail cars run on rubber pneumatic tyres
- Track 95% pre-stressed hollow concrete beams (0.8mx1-1.5m), 5% long span or curved steel rail
- Spacing & beam length varied to suit foundation, topography & alignment
- Top of rail typically 1-2m above ground, range 1-6m above ground to allow for vehicular of pedestrian access and as necessary to establish a consistent grade, pass waterways and ground undulations avoiding excavations along the rail route
- Maximum grade of track 6.5%
- Minimum turning circle of 60m diameter, 15km/h
- Three passing bay sections at approx 10, 20 & 30km from Kiwi Burn end

Section 5.2 of the application characterises the foundation requirements for the monorail track:

- Three foundation types proposed, bored piles, precast pads and precast pads supported by driven piles depending on ground conditions
- At river crossings it is proposed that the monorail beams are supported on 1m diameter, 10m deep piles for the complete width of the active flood channel
- No foundations within active flood plain of rivers

Table 12 in Section 7.2 of Appendix I (Terrestrial Ecology Report) presents the length of monorail track through different terrain types. Eight different terrain types have been identified. Almost half (14.3km) of the monorail route will be constructed on side slopes, where 14.0km are in forest and only 0.3km on open land. 3.3km of the route will be located in swampy bush (2.6km) or open swampy land (0.7km). 1.5km of monorail track will require deep piled river foundations on open flat land and 0.2km of the monorail track has to span over deep gullies. 10.2km of track is located on flat land, with 6.1km in bush and 4.1km in open land.

Section 9.3 of the application states that approximately 27ha of indigenous vegetation and habitat along the route requires permanent removal for the construction of the monorail and construction/mountain bike track.

2.2.5 Engineering Risk and Mitigation

The applicant does not address engineering risks and their mitigation other than in very general terms in the Draft Construction Management Plan.

2.3 Geotechnical Engineering, Hydrology and Geomorphology

2.3.1 Activities Undertaken

A desk-top review of the geology along the proposed monorail route has been carried out and is included in the application as Appendix C (Geology of the Wakatipu Area by the Institute of Geological & Nuclear Science) of the Preliminary Engineering Assessment (Appendix E of the application). The report presents a map which indicated predominant geological features along the monorail route.

The Hydrology and River Geomorphology Assessment (Appendix F) has been carried out by NIWA and is based on a desk-top study, a field inspection (by air) of the bed and banks of the Upukerora, Whitestone, Mararora and Kiwi Burn Rivers where the monorail is proposed to cross the active channel and the analysis of available historic aerial photos.

The Preliminary Engineering Assessment states that during a route walk-over probing from the surface, observing of materials in stream beds and banks, and soils exposed by tree fall were carried out.

2.3.2 Information Provided

The Geology of the Wakatipu Area report does not include a conclusive statement in terms of stability issues at the termini sites or along the route.

The Preliminary Engineering Assessment states that the geology of the area indicates that most of the proposed route crosses outwash gravels and tills (i.e. boulders, cobbles, gravels, sands, silts and clays) with only one rock outcropping in the Mararoa River near the proposed location of the Kiwi Burn terminus.

The hydrology assessment identified a number of slope stability issues along the proposed monorail route. It goes on to state that the majority of the instabilities can be readily avoided by minor monorail track alterations. The report stated that "there is one particular area of instability on the true right bank of the Upukerora River ("Bluff Slip") that has the potential to jeopardise the monorail infrastructure and needs more detailed investigation by the engineers". The report recommends that the monorail route either climb above the unstable hill slope and traverses ground which is unaffected by any existing or predicted future instability or avoid this area all together by crossing the river and travelling along the true left hand side of the Upukerora River.

The Preliminary Engineering Assessment states that "further specialised geotechnical investigation will be required as the project progresses". The report also states that the "geotechnical conditions are suitable for the construction of the monorail".

2.4 Hydrological/Hydraulic Engineering

2.4.1 Activities Undertaken

The Hydrology and River Geomorphology Assessment (Appendix F) has been carried out by NIWA and is based on a desk-top study, a field inspection (by air) of the bed and banks of the Upukerora, Whitestone, Mararora and Kiwi Burn Rivers where the monorail is proposed to cross the active channel and the analysis of available historic aerial photos.

2.4.2 Information Provided

The proposed monorail alignment requires several river crossings. The key river crossings are once over the Mararoa River (approx. 1km from Kiwi Burn terminus), three times over the Kiwi Burn River (between 3.5 - 5km), once over the Whitestone River (approx 13km), and three times over the Upukerora River (between 21-23.5km). Additionally, approximately 22 crossings of minor streams are required.

The report states that, due to their width, support pillars will be required in river beds of the Mararoa, Whitestone and Upukerora rivers, at each crossing point. 20m pier spacing should allow the track to span the entire active channel of Kiwi Burn and other small streams.

The proposed route passes close to the Dunton Swamp and passes near a small wetland at approx 27km.

The analysis of rainfall data from 15 gauging sites from the vicinity of the proposed monorail route showed that rainfall in the region of the proposed monorail route is relatively uniform.

Mean flow in the three major rivers, the Mararoa, Whitestone, and Upukerora Rivers, is 12.4 m^3/s, 1.6 m^3/s and 4.0 m^3/s respectively. Flood frequency statistics for these three rivers for the mean annual flood and 1 in 100 year flood event are provided in the report.

The Mararoa, Kiwi Burn, Whitestone and Upukerora Rivers are gravel bed channels with freedom to adjust within their valley margins. These channels are laterally mobile and subject to fluctuation in bed level.

The report acknowledges that vehicles and machinery operating within the active channel during construction and possibly during future maintenance work will disrupt the armour of the river bed and temporarily increase sediment transport through the channel. The entry and exit of vehicles from the river channel may cause damage to the river banks which could result in increased bank erosion.

Overall, the construction effects of the monorail on the geomorphology of the Mararoa, Kiwi Burn, Whitestone and Upukerora Rivers are expected to be short lived and minor. However, scour around piers installed within active channel should be expected.

The report makes no reference to climate change and the consequential changes for example in rainfall and wind strengths. These changes will have effects on river flows, soil erosion, and windfall.

The report provides flood flow estimates for the three main river crossings but not for the tributary to the Mararoa River adjacent to the terminus.

The report provides flood flows but does not consider river hydraulics which include flow velocities and peak flood levels.

2.5 Construction Engineering

2.5.1 Activities Undertaken

The Preliminary Engineering Assessment of the monorail proposal has been carried out by Opus and forms Appendix E of the application. Opus carried out the following site investigations:

- Walking in from the Kiwi Burn footbridge and following proposed route up to the Kiwi Burn saddle
- Flying over the entire route, landing at key sections such as river crossings etc.
- Walking the complete route from the proposed Kiwi Burn terminus location to the end of the monorail route on DoC administered land
- Fixing additional tape markers to mark to entire route
- Survey of sections of the route using Trimble GPS surveying equipment. Sections that were not surveyed are between 17.5-25.5km (around "Bluff Slip" area), the Kiwi Burn saddle, and around 27km (near wetland)
- The incomplete sections have been in-filled with GPS data obtained from hand held GPS equipment which is sufficiently accurate for establishing the monorail corridor.

The construction methodology and its environmental impact have been refined during a series of workshops with the team assembled by Riverstone for this project.

2.5.2 Information Provided

2.5.2.1 Construction

Kiwi Burn Terminus & Access Road

The applicant proposes to construct a new sealed vehicle access road from Mavora Lakes Road to the proposed Kiwi Burn terminus as well as form and seal the intersection of the access road and Mavora Lakes Road. Car parking provisions at the termini for mountain bike track and potential individual monorail users has not been addressed in the application.

The proposed terminus site comprises a 80m long x 13m wide terminus building with toilet facilities, administration facilities and a platform, with one side of platform for monorail access from ground level and one side for all-terrain vehicle access, turning and queuing facilities for monorail and all-terrain vehicles. The proposed footprint of the terminus is 1040m^2 (building) plus 900m^2 (roading).

The applicant proposes that three temporary construction depots are established on private farm land.

The applicant proposes that erosion and sediment control, hazardous substances, in river works, dust, noise, and site rehabilitation will be specified in the Construction Management Plan.

Design & General Construction of Monorail

The proposed concept for the monorail is a low-to-the-ground single track straddle monorail run on a predominantly pre-cast concrete track, supported at approximately 20 metre centres by pre-cast concrete piers. The spacing and beam length would be varied to suit the foundation, topography and alignment. Three passing bays are proposed at 10 kilometre intervals along the track to enable trains travelling in opposite directions to pass. The applicant does not specify the length of these passing bays or the separation between the bay and the main monorail track. The applicant proposes that the detailed design of the monorail alignment will be undertaken in conjunction with a monorail supplier.

The monorail would be electrically powered, with transformers at approximately 1.6 kilometre spacing along the track, and the monorail cars will run on rubber pneumatic tyres.

The applicant proposes that the top of the monorail track would be typically 1 to 2 metres above the ground, but would range from 1 to 6 metres above ground in places, depending on the topography and alignment. The maximum grade of the track would be 6.5%. The minimum turning circle of the monorail at 15 kilometres per hour would be 60 metres in diameter.

The applicant has proposed that 3 foundation types would be suitable to accommodate varying ground conditions along the route; bored concrete piles, precast .pads, and precast pads supported on driven steel piles. Piers will be precast concrete, grouted into the precast concrete foundations.

Bored concrete piles with 1m diameter are proposed for the full width of the active channel. These piles will be 10m deep into the alluvial gravels to allow for future scour. The applicant does not address the effects of river bank scour (and NIWA's report notes the extensive coverage of valleys with former river braids) and how scour and changing river braids will be addressed. Foundations would be designed for river flood flows and the monorail track would have sufficient clearance above rivers to avoid debris. The applicant has not specified the flood event to which the monorail and construction/mountain bike track are proposed to be designed to, i.e. foundations, river clearance, erosion and sediment control, bridge design, etc.

Te Anau Downs Monorail Over-bridge & Terminus Facility

The applicant proposes to construct an over-bridge over State Highway 94 for the monorail track as well as coach access to the terminus site.

The applicant does not specify how the mountain bike track is proposed to cross State Highway 94.

The proposed terminus size is not specified in the application but will be larger than the Kiwi Burn Terminus. The terminus building will include toilet facilities, café, kiosks, administration facilities and a platform, with one side of platform for monorail access from ground level and one side for coach access, turning and queuing facilities for monorail and coaches, information kiosk, related retail and a restaurant/café.

The applicant proposes that a temporary construction yard and permanent maintenance facility be located on private farmland close to the terminus building.

Construction Methodology for Construction/Mountain Bike Track and Monorail

The report states that the proposed monorail route traverses a combination of rolling hills, areas of steep terrain consisting of gullies and small watercourses and open river flats. The topographical nature of the route requires the monorail to have "considerable horizontal and vertical curvature".

An indicative monorail route has been marked within the 200-300m wide corridor. A 3-D monorail alignment to the ground has not been created yet and further work for this is required. The Preliminary Engineering Assessment states that the monorail alignment will have some scope to be adjusted to avoid large trees, banks, bluffs, creeks, etc. The Preliminary Engineering Assessment does not categorically state that ridge excavation will be prohibited and there is some risk that the final alignments may bring pressure to undertake such ridge excavation to improve the vertical alignment.

The Preliminary Engineering Assessment identifies further work that is required as the monorail proposal develops:

- Monorail alignment to be developed in conjunction with supplier and a ground model
- Access/mountain bike track standards and locations to suit construction and operation
- Geotechnical investigation, especially in the areas of more difficult topography.

The mountain bike track is intended to be on the uphill side in sloping terrain.

The proposed construction methodology is outlined in Section 5 and Appendix E of the concession application and is as follows:

- Construction of terminal buildings first and then construct track from both ends
- Temporary construction track to be installed along the monorail route and one permanent construction track parallel to monorail route with spur tracks at regular intervals to connect the monorail route with the construction track. The construction track to be used as mountain bike and monorail maintenance track once construction is complete
- Clearance of vegetation along monorail route to give a corridor of 4-6m width and minimum of 12m height
- Clearance of vegetation along construction/mountain bike track and spur tracks to give corridor of 3m
- Alignment of monorail to be chosen to minimise earthworks and to avoid significant trees

Construction Methodology – Foundation & Pier Construction:

- Set-up three main construction depots and their access roads on private farm land. These construction depots are accessible by public road or using existing farm roads.
- Tree clearance/transplantation along the construction track, the spur tracks, and the monorail route (4 teams of 2 people with 12t excavator each and 4WD support vehicle each). Cut material mulched or removed off site
- Survey to set-up initial pegging of routes for clearance followed by detailed survey for foundations and piers and for design and construction of beams (4 teams of 2 with 4WD truck each)
- Stripping of topsoil, installation of erosion & sediment control and construction of construction track, the spur track and the monorail track (4 teams of 3-4 with 12t excavator and 4WD trucks). Topsoil to be cleared to one side for later re-use
- Erosion and sediment control in accordance with Auckland Regional Council TP90
- Construction track to be in accordance with DoC Track Construction and Maintenance Guideline (VC1672) with light bridging over streams
- Piling of river foundations (2 teams of 4-5 with 35t piling rig per team). Construction of access including environmental management measures to each piled foundation and erection of piled foundations. River crossings accessible via public road and/or farm roads/tracks
- A number of 3m wide spur tracks would be required to gain access to the monorail during construction of foundations and piers. One spur track would provide access to a number of foundations (10-15) that can be constructed linearly (i.e. from the farthest foundation back).
- Excavation and placement of pad foundations, piers and backfilling (18 teams of 3-5 with 12t excavator each). Excavation of foundation placing excavated material nearby, placement of foundation and pier by excavator and, following curing of grout, to secure the precast pier into place. Foundation to be backfilled with excavated material with only small surplus material quantities
- Excavation and placement of foundation with driven piles & pier & backfilling (pile driving attachment for 12t excavator). Same plant, equipment and methodology as for pad footings plus pile driving attachment to excavator

Construction Methodology – Component Transportation:

- Depot to construction front- Travelling to the construction front are;4WD utility towing a fuel browser, 4WD equipment with mechanical & hydraulic breakdown gear & mechanic, 4WD towing compressor, survey team.
- Foundation pads & piers - Equipment to bring in precast concrete foundations in the open/flat terrain - 10t Hiab plus, 4WD or specialised tracked vehicle in difficult terrain

- Placement of piers). A completely self contained vehicle able to carry all materials for mixing and pumping of grout into each foundation with no spillage will be used to grout in the piers. (4WD grouting equipped utility vehicle
- Transportation of river foundations Vehicles to follow route create for the piling rig. (flat bed truck with reinforced cage and concrete trucks).

Construction Methodology – Erection of Monorail Beams

- Beams to be placed with launching gantry operating from the section of monorail beam already completed
- Beams to be brought in on a jinker operating on the completed monorail beam from the construction depot
- Beams to be placed by launching gantry with one gantry operating from each depot (3-4 gantries required)
- Placement of longer spanning beams at river crossings with 2 rough terrain cranes where access permits
- Completion of monorail running surface (4 crews of 2). Implementation of final running surface (exact scope of work to be confirmed with monorail supplier)

Construction Methodology – Rehabilitation:

- Removal of temporary construction track on the monorail alignment and the erosion & sediment control measures (4 teams of 3-4 people with 12 t excavator each and 4WD trucks removing metal & silt fences)
- Rehabilitation & Restoration as per Ecology Report (reviewed by others) and implemented in conjunction with DoC

A construction programme for a construction period of 30 months has been provided in the Preliminary Engineering Assessment. The programme is based on a total number of 115 employees.

Design & General Construction of Termini Buildings

The construction methodology for the termini has not been addressed in the Preliminary Engineering Assessment. Appendix P of the application contains an architectural report on Monorail Terminal Buildings for Kiwi Burn and Te Anau Downs.

2.5.2.2 Operation

The applicant proposes to completely remove the temporary construction facilities and erect a monorail maintenance facility on private farmland close to the Te Anau Downs terminus. It is proposed to house a diesel emergency generator at the Te Anau Downs maintenance facility.

The applicant proposes to remove vegetation to maintain a clear corridor of 4 to 6 metres along the monorail route routinely during operation. This work would be carried out outside of monorail operation hours. The monorail track will be inspected daily. It is proposed that an annual inspection of vegetation along the route will be carried out with DoC to identify trees to be removed that pose imminent risk to monorail, mountain bike track and wildlife.

The applicant states that periodic metalling or contouring of the mountain bike track surface, maintaining culverts and clear fallen trees along mountain bike track will be required.

The applicant also proposes to maintain the monorail track, monorail train units and the electrical supply as required.

2.6 Sewage

2.6.1 Activities Undertaken

The applicant does not provide any details on specific activities carried out to determine the requirements for sewage treatment, such as a site and soil investigation of the proposed land application areas.

2.6.2 Information Provided

2.6.2.1 Construction

The applicant proposes to supply kitchen, toilet and shower facilities and a cafeteria at each of the three construction depots that will be established for the construction period of the monorail. These construction depots will be located on private farmland outside of DoC administered land.

The application does not mention toilet facilities at the Kiwi Burn terminus and Te Anau Downs terminus sites or the construction fronts for day use.

2.6.2.2 Operation

Toilet facilities and other wastewater generating facilities (e.g. café at Te Anau Downs) are proposed at the Kiwi Burn terminus and Te Anau Downs terminus. The facilities would be for use by staff, monorail users and other members of the public.

Kiwi Burn Terminus
Toilet and hand washing facilities are proposed for the Kiwi Burn Terminus. Quantities of sewage generation have not been estimated in the application but the applicant has estimated that 15,000 litres of water per day is required to service the Kiwi Burn terminus.

It is proposed that sewage be collected, treated and disposed of on-site. The treatment system would be likely to comprise a septic tank and packed media bed with discharge via drip irrigation, evapo-transpiration or sand trench system. A consent for the discharge of treated sewage to land would be required from Environment Southland for this system.

The area required for land application of treated effluent has been estimated in the application to 2,000 m^2. This area is considered sufficient for land application of secondary treated effluent. However, depending on the soil type, an allowance for a reserve land application area or an allowance for future growth might not be included. The application states that a suitable treatment and disposal system will be selected during the detailed design phase once a soil investigation has been carried out.

The application shows proposed areas for the sewage disposal system on Drawing 40. Some of the areas are located close to the neighbouring farmland. If regulatory set-back distances are not adhered to, agreement with the landowner is necessary for obtaining a resource consent for the discharge of treated effluent. One triangle shaped area proposed for sewage disposal is located on the lower river terrace of a tributary of the Mararoa River and might be within flood levels. The applicant does not indicate flood levels and flooding frequencies at the proposed location.

The Kiwi Burn site poses constraints to the discharge of treated wastewater, e.g. proximity to stream and Mararoa River, eroding river bank, shallow soils, proximity to proposed drinking water supply (i.e. Mararoa River).

Monorail Trains
The application does not state whether there will be toilet facilities included in the monorail trains.

Mountain Bike Track
The application does not state whether there will be toilet facilities provided along the mountain bike track.

Te Anau Downs Terminal
No statement about sewage treatment at the Te Anau Downs terminus is made in the application.

MWH assumes that there is an existing sewage system at the Fiordland National Park Lodge at Te Anau Downs, but it is unclear if the applicant proposes to utilise and upgrade the existing system or if a new system for the monorail is proposed.

The Te Anau downs site poses constraints to the discharge of treated wastewater, e.g. high groundwater, proximity to Lake Te Anau, moderately sloping bank that slopes towards Lake Te Anau, proximity to proposed drinking water supply (i.e. Lake Te Anau), potentially imperfectly drained soils.

2.7 Wastewater

2.7.1 Activities Undertaken

The applicant does not provide any information in terms of activities undertaken to determine the need for contaminated stormwater treatment and the expected quantities.

2.7.2 Information Provided

2.7.2.1 Construction

Contaminated Stormwater Management

The applicant states that all erosion and sediment control for excavations, construction activities, revegetated areas, storage areas for plant, fuel & materials would be managed in accordance with Auckland Regional Council Technical Publication 90 (ARC TP90). MWH considers this guideline as appropriate design guide however, sizing of diversion channels or bunds, contour drains, sediment retention ponds, grit traps and silt fences has to be based on local rainfall parameters. The applicant envisages developing details on erosion and sediment control measures during the design phase and finalised prior to construction.

The application does not address the potential space requirements for sediment and erosion control and the impact this could have on DoC administered land (e.g. additional vegetation clearing).

Contaminated Processing Water

The application states that beams, piers and foundation pads will be precast off site to minimise the amount of work on site negating concrete mixing on site with the associated need for water and waste disposal.

Contaminated processing water, such as dirty wash water (e.g. from washing down plant) would mainly be generated on the construction depots outside DoC administered land.

Diesel, petrol and oil for use in machinery that is required for construction will be stored in sufficient volume to enable refuelling of fleet on site. Grouting materials and cement for construction of foundations (where required) will also be needed. This could result in spillage and potential contamination of soils and waterways.

The applicant states that as part of the Construction Management, prior to construction, an Emergency Response Plan with procedures in particular for hazardous waste will be developed as part of the Hazardous Substances Management Plan.

2.7.2.2 Operation

The applicant anticipates to construct a maintenance workshop for the monorail trains near the Te Anau Downs terminus located on private from land. MWH assumes that contaminated stormwater from wash-down activities will mainly be generated outside land administered by DoC.

At the Kiwi Burn terminus, contaminated stormwater from hardstand, car parks and road is proposed to be directed into grassed swales to provide some treatment before discharge.

Contaminated stormwater management at the Te Anau Down terminus is not addressed in the application.

2.8 Solid Waste and Hazardous Waste

2.8.1 Activities Undertaken

The applicant does not state specific activities that were undertaken to assess the nature and quantity of solid and hazardous waste. The Preliminary Engineering Assessment lists types of hazardous wastes expected to be generated during construction.

2.8.2 Information Provided

2.8.2.1 Construction

The applicant proposes to prepare a Waste Management Plan prior to construction which will identify the main types of waste likely to be generated at the Site and include strategies for dealing with them.

The applicant states that all rubbish and waste (including septic waste) will be removed from the route regularly, with recycling of whatever possible, as prescribed in the Waste Management Plan. However, how waste collection, storage and removal along the monorail route and in particular at the construction fronts are carried out has not been addressed in the application.

Construction waste storage sites are proposed at each construction depot.

Vegetation cleared from within the monorail corridor, construction/mountain bike track and spur tracks would be removed from the route. The construction engineering report states that cut material would either be mulched on site or removed off site. However, the draft construction management plan states that cut vegetation would either be mulched on site or removed to suitable locations still within the DoC estate. In another section of the draft construction management plan it says that cleared vegetation will be cut into short (1-3m lengths) and removed from the immediate vicinity of the route and deposited nearby within the forest. It is not clear which approach the applicant is proposing. Depositing the cut material in nearby forest (on DoC administered land) could potentially lead to additional construction tracks and associated clearance to transport cut material to its end location.

The applicant has not outlined how cleared vegetation and excavated soil would be managed at the terminus sites. The applicant has not outlined how excavated soil would be managed along the route and the termini.

2.8.2.2 Operation

Whilst the applicant proposes to prepare a Waste Management Plan prior to construction, it is not clear if this Plan would cover the management of waste generated during operation.

The applicant proposes to remove all waste, including domestic refuse, associated with the operation and maintenance of the monorail from the Site.

The applicant has not outlined how vegetation that is proposed to be routinely cleared along the monorail corridor during operation would be disposed of.

The primary maintenance facility for the monorail and the backup diesel generator are proposed to be located near the Te Anau Downs terminus on private farm land.

The applicant does not state where the all-terrain vehicles will be located during non-operating hours, where they will be maintained and where fuel storage tanks are located. Refuelling of the all-terrain vehicles might be required at the Kiwi Burn terminus.

2.9 Traffic Engineering and Visitor Access to Facilities

2.9.1 Activities Undertaken

The applicant engaged Traffic Design Group to carry out a traffic impact assessment relating to the traffic and transportation issues arising for the Fiordland Link Experience.

The report assess the traffic volumes, composition, road safety and expected traffic growth along the road network from Queenstown to Milford Sound and along the roads proposed to be utilised by the Fiordland Link Experience, i.e. Mavora Lakes Road, Von Road, and Mt Nicolas Road.

MWH notes that the proposed Round the Mountain Cycle Trail from Walter Peak to Kingston (part of the government's Great Rides programme) follows Von and Mt Nicolas Roads. Predicted visitor numbers for the Round the Mountain Cycle Trail are significant and would generate additional traffic. The success of the Great Rides relies on providing no/low volume traffic routes. The traffic volume is likely to adversely affect the experience for cyclists particularly if the roads remain unsealed. Government funding for the Round the Mountain Cycle Trail has been granted and MWH understands that this trail will commence in the near future.

The Transportation Assessment Report also describes the proposed upgrades and new road constructions associated with the Fiordland Link Experience.

2.9.2 Information Provided

2.9.2.1 Construction

Access into Kiwi Burn Terminus

The applicant proposes to construct a new sealed vehicle access road from Mavora Lakes Road to the proposed Kiwi Burn terminus as well as form, seal, suitably sign and mark the intersection of the access road and Mavora Lakes Road.

The Mavora Lakes Road is an all weather road that caters for property access and through-traffic movements. There is also regular stock-droving. The estimated average annual daily two-way traffic volume is less than 50 vehicles per day. The speed limit of the road in the vicinity of the proposed terminus is 100 kilometres per hour.

There is an existing vehicle access to an existing vehicle parking area at Kiwi Burn, which provides access to the Mararoa River and the Kiwi Burn track. The applicant has not outlined how the potential conflict between construction traffic and users of the existing vehicle access and vehicle parking area at Kiwi Burn would be safely managed.

Kiwi Burn Terminus Layout

The proposed terminus site comprises a 70m long x 18m wide terminus building with toilet facilities, administration facilities and a platform, with one side of platform for monorail access from ground level and

one side for all-terrain vehicle access, turning and queuing facilities for monorail and all-terrain vehicles. The proposed footprint of the terminus is 1260m^2 (building) plus 900m^2 (roading).

The application does not address provisions for car parking. Sizing of the car parking facilities would be required to take expected visitor numbers and expected duration into account to ensure provision for long stay parking is adequate, i.e. cyclists. Parking for any maintenance/terminus would ideally be separately accounted for.

The cycle track may generate its own separate user base. An estimate of projected usage volumes is required to fully assess the impact from vehicle access. The cycle track could also result in commercial operations ferrying people between the start and end point of the mountain bike track or make return journeys to collect cars etc (similar to Rail Journeys along the Central Otago Rail Trail). This could result in the requirement for the terminus access road to accommodate multiple bike trailer vehicles with adequate turning radii.

The applicant has provided evidence that the terminus platform and proposed monorail train units have suitable capacity to enable egress during an emergency, e.g. a fully occupied monorail train (160 people) arrives at a fully occupied platform (160 people) on fire.

Monorail Track

The proposed monorail track crosses property access roads and pedestrian tracks. The applicant has proposed that these crossing points be designed and constructed to ensure the safety of vehicles and pedestrians using the access roads and tracks.

It is noted that the applicant may also construct a forest canopy walk for monorail passengers at the midway point of the monorail track, however this walkway is not part of current concession application. Traffic safety issues associated with this walkway would need to be considered at the time of any concession application for this activity.

Monorail Over-bridge & Vehicle Access into Te Anau Downs Terminus

The applicant proposes that the monorail pass over State Highway 94 by an over-bridge, which would be designed & constructed in accordance with NZTA standards, and then enter the Te Anau Downs terminus. The proposed coach access at the Te Anau Downs Terminus is south of the existing crossing point for the Fiordland National Park Lodge. The applicant proposes that a suitably signed and marked right turn bay be constructed to separate traffic turning into the terminus and through traffic on the state highway. Whilst the applicant has carried out preliminary consultation with NZTA, the final design and location of the over-bridge and coach access has not been confirmed. A suitable design stage safety audit would be required by NZTA as part of the intersection proposals.

State Highway 94 caters for high levels of through-traffic movement as well as property access. The average annual daily two-way volume of all traffic is approximately 700 to 800 vehicles per day between Te Anau and Milford Sound. The speed limit of the state highway in the vicinity of the proposed terminus is 100 kilometres per hour. NZTA would require a safety audit to confirm that this speed limit is acceptable.

There are several existing crossing points near the location of the proposed over-bridge and coach access, including the access to the Fiordland National Park Lodge, the Lake Mistletoe visitor car park, and the airstrip. In addition, the horizontal and vertical alignment of the state highway in the immediate vicinity of the proposed terminus site constrains the visibility of south-bound traffic. The existing roading environment would need to be considered in the design and construction of the over-bridge and coach access. An appropriate design state(s) safety audit(s) would be required by NZTA to assess these matters in appropriate detail.

Te Anau Downs Terminus Layout

The proposed terminus at Te Anau Downs is similar to that proposed at Kiwi Burn, however it also includes an information kiosk, related retail, and restaurant/café facilities. The proposed footprint of the terminus is 1540m^2 (building) and 700m^2 (roading). It is proposed that the main maintenance facility for the monorail be located on farmland near the airstrip with road access alongside. There is also a proposed vehicle consolidation facility at Te Anau Downs, however the maintenance and vehicle consolidation facility do not form part of the concession application as they are not located on land managed by the Department.

Sizing of the car parking facilities would be required to take expected visitor numbers and expected duration into account to ensure provision for long stay parking is adequate, i.e. cyclists. Parking for any maintenance/terminus would ideally be separately accounted for.

The cycle track may generate its own separate user base. An estimate of projected usage volumes is required to fully assess the impact from vehicle access. The cycle track could also result in commercial operations ferrying people between the start and end point of the mountain bike track or make return journeys to collect cars etc (similar to Rail Journeys along the Central Otago Rail Trail). This could result in the requirement for the terminus access road to accommodate multiple bike trailer vehicles with adequate turning radii.

Construction Traffic

The applicant has estimated that there would be 3 deliveries per day of 20 metre long concrete beams, 20 to 30 light vehicle movements per day (including staff), up to 20 heavy vehicle traffic movements per day (e.g. construction equipment, delivery of construction materials) and road construction activities at each terminus site.

A temporary construction yard is proposed to be located across State Highway 94, probably to south east adjacent to airstrip at the Te Anau Downs end. Whilst this facility is not located on land managed by the Department, the design and construction of the access to the construction yard should be in accordance with NZTA standards.

2.9.2.2 Operation

Terminus Sites

The applicant has indicated that there would be 10 to 20 additional vehicle movements per day at both terminus sites (i.e. on Mavora Lakes Road at Kiwi Burn and on State Highway 94 at Te Anau Downs). These vehicles would be mostly light vehicles and cars, for staffing and maintenance.

The applicant has indicated that there would be up to 10 return trips per day of all-terrain vehicles (effectively 20 trips/day) transporting passengers to and from Mt Nicholas and Kiwi Burn terminus. The vehicles will generate noise and dust on unsealed roads. The increased traffic of all-terrain vehicles could result in increase corrugation of the roads creating uncomfortable riding conditions for cyclist of the Round the Mountain Cycle Trail and/or requiring increase maintenance activities.

MWH has assumed that there would be a similar number of coach trips transporting passengers to and from Te Anau Downs terminus and the passengers' final destination (e.g. Te Anau, Milford).

Monorail Trip Management & Communications

The applicant proposes that up to 4 trains would be operating on the single lane monorail track at one time. Three passing bays are proposed at 10 kilometre intervals along the track to enable trains travelling in opposite directions to pass.

To safely manage the two-way traffic on the single lane track, the applicant has proposed centralised tracking and management of the monorail units via radio, a tracking system and computer control, scheduling use of the passing bays. Monorail operation would be predominantly during daylight hours, but some trips would be after dusk.

The applicant proposes to develop a Safe Operating Plan, including emergency event &, breakdown management, for the monorail. This Plan would be required by NZTA for passenger services licensing purposes.

The applicant also proposes to obtain a designation for the monorail corridor and operation.

Monorail Operation Safety & Emergency Provisions

The applicant has proposed several safety and emergency provisions for the monorail operation, including:

- Manual, visual inspection of the monorail track prior to the first trip each day
- Monorail track equipped with sensors to determine the relevant atmospheric and climatic conditions
- Preparation of emergency management plans
- Use of "shunt" unit to assist with the emergency removal of monorail unit(s)
- Monorail train "driver" to provide manual control as necessary
- Monorail train lighting, e.g. interior lights, headlights, rear lights, stop lights & flashing lights
- Automatic stopping at terminus and manual control by monorail train driver
- Heated concrete rails, especially in frosty or shady sections
- Machinery able to be attached to front of monorail trains to clear snow and minor debris from the track
- Emergency equipment (generators, shunts) located at each terminus.

2.10 Mountain Bike Track (where Separate from Monorail Alignment)

2.10.1 Activities Undertaken

The applicant does not state what specific activities have been undertaken to define the mountain bike track route where it is different to the monorail alignment.

2.10.2 Information Provided

The application states that the construction/mountain bike track will be constructed in accordance with the DoC Track Construction and Maintenance Guideline (VC1672) with light bridging over streams. However, the Preliminary Engineering Assessment states that the specific track specification needs to be developed as part of the further work. Ideally, the design standard for the mountain bike track would be in accordance with the Ministry of Tourism's new Cycle Trail Design Guide produced to support the New Zealand Cycle Trail.

The proposed alignment of the mountain bike track is shown on Drawing 30 but no further description of the route is provided in the application.

3 Assessment of Proposed Activity and Application

3.1 Introduction

This section provides an assessment of the aspects of the proposed activity directly related to construction engineering, traffic engineering, wastewater, solid waste, hydrology and hydraulics, and geotechnical matters. The assessment includes:

- Identification of key questions or matters that should be considered with respect to each activity
- Identification of potential effects or risks that should be considered with respect to each activity and the severity of the effects
- Possible measures to avoid, eliminate or mitigate potential adverse effects or risks identified for each activity

3.2 Geotechnical

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
CONSTRUCTION					
Kiwi Burn Access Road and Terminus	**Earthworks & Construction**	Terrace stability? Foundation requirements? Geotechnical assessment is desk-top study only. Compiled literature without specific geotechnical assessment of terminus.	Foundations not suitable for terminus building, altered monorail route or other manmade structures	Potential significant adverse effect	Geotechnical assessment of terminus site
0-29km of monorail, from Kiwi Burn End	**Earthworks & Construction**	Geotechnical assessment is desk-top study, flyover and walkover only. Compiled literature without specific geotechnical assessment of monorail route. Slope instability at "Bluff Slip" (24-26.5km) At "Bluff Slip" proposed monorail route is climbing above the main scarp area but potential for further slope instabilities above the main scarp area. Engineering report states that monorail route along "Bluff Slip" requires monorail to climb/descend at maximum grade for 1.3km at each end of the slip. Necessary and technically possible to shift monorail	Deeper and larger foundation/piles required. Monorail rail elevated higher than 1-3m above ground for sections of the route and associated visual impact. Increase bank erosion due to increase bank load from foundations close to river banks.	Potential significant adverse effect Potential significant adverse effect Potential significant adverse effect	Identify all hill slope instability and gullying issues along the route. LiDAR survey of the "Bluff Slip" area with the tree layer removed. 3-D on ground monorail alignment including foundation positions. Appropriate mitigation measures for slope instability (surface water controls and drainage) required Factors of safety against ground movement appropriate to the change of use within the easement corridor should apply. Avoid areas of instabilities where possible.

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		route further upslope to avoid all unstable ground? Zones of potential hill slope instability and gullying along the proposed monorail route were investigated by helicopter only. Number of slope stability issues along the proposed monorail route. Areas of instability are generally localised, in the order of 2-4m in height, where creeks, streams or rivers have eroded the toe of a side slope. Appropriate slope stability assessment required to confirm the stability of the pre- and post-construction landforms. Location of foundations in respect to river banks?			
Construction, Spur & Mountain Bike Tracks	**Earthworks & Construction**	Route of track through deep gullies, rivers, etc? Specification of bridges proposed for track over rivers? Bridges to be left in place for mountain bike track after construction complete or only temporary bridges for construction traffic?	Increased earthworks required More engineered structures required Additional vegetation clearance required	Potential significant adverse effect Potential significant adverse effect Potential significant adverse effect	Proposed design standards, proposed alignment and alignment characterisation with respect to cut, fill, structures etc to be submitted for review by DoC
Te Anau Downs Terminus	**Earthworks & Construction**	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
OPERATION					
Kiwi Burn Access Road and Terminus	**Rehabilitation & Maintenance**	Management of erosion/sediment control	Terrace erosion at terminus location Road wash-out during flood events	Potential significant adverse effect Potential significant adverse effect	Monitor stormwater management and, where necessary, make changes (e.g. increase size of drains & swales, and silt fences)
0-29km of monorail, from Kiwi Burn End	**Rehabilitation & Maintenance**	Management of erosion/sediment control Scour protection of foundations in rivers River bank erosion in vicinity of foundations Erosion of slope instabilities Excavation on steep slopes for tracks and monorail foundations is significant and the reinstatement should be engineered to optimise the placement of fill, and avoid unnecessary destabilisation.	Water and sediment runoff damages Damage and frequent maintenance of foundation required Change of active river channel; river training works and associated roading	Potential significant adverse effect Potential significant adverse effect Potential significant adverse effect	Monitor stormwater management and, where necessary, make changes (e.g. increase size of drains & swales, and silt fences) Facilitate river braiding by extending piled foundation across full potential width for river braiding. Engineered fill placement for rehabilitation of monorail track and spur tracks
Construction, Spur & Mountain Bike Tracks	**Rehabilitation & Maintenance**	Management of erosion/sediment control Wash-out of bridges during flood events	Frequent maintenance access required Contamination of surface water and rivers with increase debris Change of river flow due to increased erosion or material input to river channel, i.e. washed-out bridges, concrete structures, etc.	Potential significant adverse effect Potential significant adverse effect Potential significant adverse effect	Monitor stormwater management and, where necessary, make changes (e.g. increase size of drains & swales, and silt fences)

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
Te Anau Downs Terminus	**Rehabilitation & Maintenance**	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*

3.3 Hydrology and Hydraulics

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
CONSTRUCTION					
Kiwi Burn Access Road and Terminus	**Earthworks, Construction & Stormwater Management**	What are peak flood levels in the Kiwi Burn and Mararoa rivers relative to the proposed access road and terminus What is the proposed design flood during construction? River bed loads of Mararoa River and its tributary near proposed terminus Any drainage problems with Site at present? Location of access road, terminus, loop track and other proposed infrastructure with respect to flood levels of river and tributary streams and inundation areas? What effect (if any) proposed infrastructure has on the conveyance of the streams/rivers? Adequate sound ground for terminus building, monorail track and ATV track? Terrace stability? Risk of altered flow path of stream Location of construction access road / storage area	Concentration / altered surface water flow paths, bank scour and erosion, flood levels, altered ecology Runoff of water and sediment causes harm to flora and fauna Foundations and/or floor levels not suitable for terminus building, altered monorail route or other manmade structures Infrastructure blocks channels to extent that flood levels are increased. Infrastructure and lives are at risk from floods. Increased soil erosion and higher flood levels change bed profiles with increased bed and suspected river loads, more active river erosion / braiding	Potential significant adverse effect Potential significant adverse effect Potential significant adverse effect Potential significant adverse effect Potential significant adverse effect	Hydrological, geomorphologic and hydraulic assessment to include effects of access road and terminus on river levels, sediment and bedload transport effects, river bank erosion, and effects of climate change on flood flows Clarify design criteria for terminus and access road. For example building floor levels will be designed to be above 200 yr Average Recurrence Interval flood level including allowance for climate change

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		Effects of climate change			
0-29km of monorail, from Kiwi Burn End	**Earthworks, Construction & Stormwater Management**	What are peak flood levels in the Kiwi Burn and Mararoa rivers relative to the proposed monorail? What is the proposed design flood during construction? Any drainage problems with Site at present? Will overland water flow paths be altered so as to affect ecology? Stormwater drain design & capacity appropriate for catchment flows and sediment loads? Discharge locations? Exact monorail alignment? Issues associated with construction outside active river channel but within the flood plain River bank erosion from vehicle access	Concentration / altered surface water runoff paths, scour; altered ecology Runoff of water and sediment causes harm to flora and fauna Monorail is at risk from flooding	Potential significant adverse effect Potential significant adverse effect Potential significant adverse effect	Monitor stormwater management and, where necessary, make changes (e.g. Increase size of drains & swales, and silt fences) Use of standard construction techniques to minimise sediment runoff (e.g. catch drains, silt fences) Keep monorail out of areas at risk from flooding. Where rivers/streams need to be crossed ensure piers are designed with consideration given to scour and channel hydraulics. Clarify design criteria for flood protection during construction
	River Crossings	Flood event that applicant is proposing to base detailed design of foundation and monorail height on? River profile during appropriate flood events Appropriate level of track clearance above river level during flood event? Height of piers at river	Discharge of sediments/concrete slurry/contaminants into river; altered ecology Scour/erosion of river banks results in more engineered structures Build-up of debris upstream of piers	Potential significant adverse effect Potential significant adverse effect Potential significant	Clarify design criteria associated with flood protection during construction Detailed design of river crossings, taking account of river levels, sediment and bedload transport effects, river bank erosion, and

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		crossings? Stability of river banks and river beds Effects of changes in river bed levels, river bank profiles and flood plain coverage, including those from natural causes and monorail construction e.g. piers in floodway Effect of piers on flood levels, sediment transport, (deposition and scour) and river bed levels. Monorail sections in flood prone locations Monorail route along "Bluff Slip" area within potential unstable ground. Detailed geotechnical investigation required. Vehicles and machinery operating within the active channel during the construction phase will disrupt the armour of the river bed.	increases flood levels, altering river flow paths and ecology; potential for backwater and altering hydrology of wetland Flood event results in river impacting monorail bridging structure (excluding piers), with structure/debris blocking flow Need for clearance above river level during flood event raises monorail alignment significantly either side of river Bed load build-up and upstream shoaling Construction in river leads to discolouration, sediment and contaminants during construction period	adverse effect Potential significant adverse effect Potential significant adverse effect Potential significant adverse effect Temporary effect	effects of climate change on flood flows Geotechnical assessment of stability of river banks Scour and erosion protection measures near piers
Construction, Spur & Mountain Bike Tracks	**Earthworks, Construction & Stormwater Management**	Exact track alignment Any drainage problems with Site at present? Will overland water flow paths be altered so as to affect ecology? Culverts underneath track required?	Concentration / altered surface water runoff paths, scour; altered ecology Runoff of water and sediment causes harm to flora and fauna Track is at risk from	Potential significant adverse effect Potential significant adverse effect Potential significant adverse effect	Clarify design criteria associated with stormwater protection during construction Monitor stormwater management and, where necessary, make changes (e.g. increase

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		Stormwater drain design & capacity appropriate for catchment flows and sediment loads? Discharge locations?	flooding		size of drains & swales, and silt fences)
	River Crossings	Type of bridges proposed? Foundation design of bridges? Location of foundations in respect to active river channel and flood prone areas?	Need for clearance above river level during flood event Increased earthworks required	Potential significant adverse effect	Clarify design criteria associated with stormwater protection during construction
Te Anau Downs Terminus	**Earthworks, Construction & Stormwater Management**	Lake levels during flood periods *As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*
OPERATION					
Kiwi Burn Access Road and Terminus	**Rehabilitation**	Management of erosion/sediment runoff until vegetation established	Water and sediment runoff damages areas outside working site	Temporary effect	Monitor stormwater management and, where necessary, make changes (e.g. Increase size of drains & swales, and silt fences)
	Stormwater Management	*As for construction*	*As for construction*	*As for construction*	*As for construction*
0-29km of monorail, from Kiwi Burn End	**Rehabilitation**	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*
	Stormwater Management	Anticipated runoff flows and levels crossing the monorail alignment? Effect of flows on monorail support structure? Design criteria for flood protection during operational	Local failure of monorail	Potential significant adverse effect	Ensure all monorail supports are well clear of runoff channels Clarify design criteria associated with flood protection during

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		life of structure			operational life of structure
	River Crossings	Altered stream flow with piers in river during dry weather and flood events? Scour /erosion controls Stability of river banks Vehicle access to river channels for pier maintenance purposes Design criteria for flood protection during operational life of structure	More extreme weather events than predicted Scour/erosion of river banks results in new section of monorail needing to be built Build-up of debris upstream of piers dams river, altering river flow paths & and ecology; potential for backwater or altering hydrology of downstream wetland Flood event results in river impacting bridge spans / overtopping monorail, with track blocking debris flow	Insufficiently assessed effect Potential significant adverse effect Potential significant adverse effect Potential significant adverse effect	Continued maintenance of scour and erosion protection measures near piers Assessment of flora and fauna Monitoring of river morphology adjacent to river crossings Clarify design criteria associated with flood protection during operational life of structure
Construction, Spur & Mountain Bike Tracks	**Rehabilitation**	*As for 0-29km of monorail*	*As for 0-29km of monorail*	*As for 0-29km of monorail*	*As for 0-29km of monorail*
	Stormwater Management	Anticipated runoff flows crossing the track alignment? Maintenance of stormwater control features? Wash-out of track during high rain event	Local track failure Increased track maintenance required Frequent remetalling required	Potential significant adverse effect Potential significant adverse effect Potential significant adverse effect	Monitor stormwater management and, where necessary, make changes (e.g. increase size of drains & swales, and silt fences)
	River Crossings	Wash-out of track/bridges during flood events Scouring of bridge foundations?			Clarify design criteria associated with flood protection during operational life of

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		Design criteria for flood protection during operational life of structure			structure
Te Anau Downs Terminus	**Rehabilitation** **Stormwater Management** *As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*

3.4 Construction Engineering

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
CONSTRUCTION					
Kiwi Burn Terminus & Access Road	**Access Road & Terminus Facility**	Section 5 (Construction) of the application does not address the construction of the Kiwi Burn Terminus & Access Road Draft Construction Management Plan does not address the construction of the Kiwi Burn Terminus & Access Road e.g. delineation of construction zones Exact location of construction yard Location of construction access Traffic to and from construction yard?	Noise Unplanned tracks through DoC land Runoff to nearby stream & Mararoa River H&S risk for existing users during construction	Temporary Effect Insufficiently Assessed Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	Construction Management Plan Operations and Environmental Management Plan H&S Plan for Construction
0-29.5km of monorail, from Kiwi Burn End	**Design & General Construction**	Geotechnical survey required Detailed topographical survey (LiDAR) 3-D monorail alignment required to confirm earthwork quantities, vegetation clearance height and visual and noise impacts 3-D monorail alignment to confirm feasibility of route, i.e. around "Bluff Slip" Slope stability i.e. along the proposed route at "Bluff Slip" Seismic assessments of monorail structure Exact number and location of passing bays	Monorail track height over rivers alters alignment either side of river; greater visual & noise impact Increased earthworks Insufficient clearance between monorail track and rivers to allow for free river flow during flood events or passing of debris Significant engineering structures required to	Insufficiently Assessed Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	LiDAR survey Risk management plan prepared with involvement of all relevant parties Design & construction to be in accordance with relevant NZ standards Contractor experience

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		Design river flow for design of river crossings? Confirmation of foundation design and design height of monorail for river crossings Design height of monorail, i.e. what height is the top of the monorail car above ground level? Scouring and accretion of gravels around piles in river channels Flood debris removal from around river piers. Control and disposal of concrete truck wash down not addressed	stabilise slopes Piers located within active river channel or bed of river Additional tracks and vegetation/canopy removal within DoC land Possible alkaline concrete discharges to streams and pollution of waterways	Potential Significant Adverse Effect Minor Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	with technology & site conditions –wind, ice and snow loads Geotechnical survey, slope stability & seismic assessment conducted prior to any concession Construction Management Plan
Construction, Spur & Mountain Bike Tracks	**Design & General Construction**	Track formation requires engineered design. DoC Track Construction and Maintenance Guideline (VC1672) to be used as general guide only. DoC should note that tracks will need to be engineered for heavy construction machinery and will thus be more substantial than those generally designed to this guideline. Where is metal for construction tracks coming from? Substantial amount required. Additional truck movement from where to where? Sedimentation control measures to be designed to a particular rainfall event – possibility of rainfall exceeding design rainfall	Poor or short term water management measures along construction/mountain bike track can result in high maintenance costs Additional tracks and vegetation/canopy removal within DoC land Possible alkaline concrete discharges to streams and pollution of waterways	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		event and over-topping of ponds, washout of sediment fences etc. Additional impact of installation of erosion control measures, i.e. sediment ponds or vegetated swales not addressed in application Maintenance requirements of erosion and sedimentation control? Control and disposal of concrete truck wash down not addressed Track width including cut-off drain and clearance width and height Ownership of mountain bike track upon completion of construction? Construction standard (i.e. water management) of construction/mountain bike track and resulting maintenance of mountain bike track?			
0-29.5km of monorail, from Kiwi Burn End & Construction, Spur & Mountain Bike Tracks	**Construction Methodology**	Location of access track for piling rig, rough terrain cranes and concrete trucks. 100% outside DoC land without impact on rivers/streams? Alternative construction methodology for long span beams over rivers where rough terrain cranes can not achieve access to site? Metal track along monorail route not addressed in construction methodology. Construction standard? Sediment and erosion	Damage to vegetation as transport 20m long piers and beams along track through "tight" sections Additional construction traffic from metal trucks and stress on existing roads Noise Unplanned tracks along entire monorail	Potential Significant Adverse Effect Temporary & Minor Effect Temporary & Minor Effect Potential	Construction Management Plan Operational and Environmental Management Plan

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		control along this track? Drainage features installed? Protection of sensitive tree routes? Removal of metalcourse on completion from among tree roots etc difficult Locations of minor construction depots along the monorail route? 3m width for construction track is bare minimum, widening on bends might be required to allow trucks to turn around corners Passing bays along construction track require reasonable size to allow construction vehicles to pull over, park and pass each other. Where is metal for construction tracks coming from? Substantial amount required. Additional truck movement from where to where? Can monorail achieve performance (grade) required to avoid "Bluff Slip" instability? What is involved in the process of installing the running surface of the monorail?	route Runoff/ disposal of excess concrete slurry Additional tracks and vegetation removal within DoC land	Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	
	Construction Programme	Is time allowance for curing of grout to carry dead load of piers/beams and jinker allowed in construction programme adequate or is additional temporary support required? Is time allowance in construction programme for adverse weather (snow, rain), extreme events (e.g. slips), and working in sensitive	Extended construction period	Temporary & Minor Effect	

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		environments adequate? Has sufficient monetary allowance been made by applicant for erosion and sediment control? (this is major factor in effective erosion and sediment control) Allowance for flooding of rivers during spring and winter in construction programme? Hydrological report recommended to avoid construction in river beds during periods of flooding Allowance for tailor-made foundations (e.g. near wetland, poor soils, river crossings) and impact on programme Construction programme assumes that design is completed prior to construction contract, i.e. detailed design survey done, alignment agreed with monorail manufacturer, geotechnical investigation done, the monorail supplier tender complete, the pier heights, and beam spans and curvatures are all known. Commercial pressures may be such that early commencement is required without full design of alignment – potential for delay if unexpected circumstances arise outside scope of standard details to accommodate.			
	Construction Machinery	Launching gantry used for straight beam erection. We assume this	Curved sections of monorail required to	Potential Significant	Marking a construction

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		machinery will not launch curved sections? If not, what is proposed construction methodology in these areas? Extra clearance required for cranes and handling? Can curved sections be transported along monorail through 4-6m wide cleared corridor? Risk that 12t excavators might not be large enough for driving piles in some areas.	be constructed by conventional techniques (e.g. cranes, excavators) Unplanned tracks along entire monorail route and wider vegetation clearance required Noise Leaking petrol, hydraulic fluids	Adverse Effect Potential Significant Adverse Effect Temporary & Minor Effect Potential Significant Adverse Effect	access track along monorail route to minimise disturbance to within this track Construction Management Plan Emergency Management Plan
	Vegetation Clearance	Selection of trees outside 4-6m corridor? Potential collateral damage during tree felling. Felling might result in need to protect the vegetation margins with shade cloth to give time for the vegetation to adapt? 3m wide construction track bare minimum for type of machinery proposed Clearing corridor for construction track and spur tracks not addressed in application and will be wider than 3m to allow for erosion and sedimentation control and manoeuvring of construction machinery. Total width depends on cut and fill batters, side slopes and the location of drainage features.	Damage to neighbouring trees and vegetation, especially where 20m+ tree Greater canopy opening than stated in concession Unplanned tracks along entire monorail route for disposal of felled vegetation	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	Skilled staff Selection of trees in consultation with DoC

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		Management of construction traffic along one-lane 3m wide road? Increase number of passing bays? Track creeping wider than 3m with re-gravelling as track is maintained? Potential for metal to harm roots of surrounding trees Monorail performance limitations might be driver for final alignment rather than significant habitat Impact on vegetation from dispersal of felled material in nearby area? Impact of installation of erosion control measures, i.e. sediment ponds or vegetated swales? More clearance required			
	Earthworks	Management of sediment/erosion runoff Extent of earthworks required for cuts across side ridges and gullies to achieve grade on track Disposal location of excavated material that is not used for backfilling? Impact of installation of erosion control measures, i.e. sediment ponds or vegetated swales? More clearance required?	Sediment runoff	Potential Significant Adverse Effect	Silt bunding, covering of exposed earth
Te Anau Downs Terminus	**Monorail Over-Bridge & Terminus Facility**	Delineation of construction site? Exact location of terminus? Location of construction storage yard?	Noise Unplanned tracks through DoC land Runoff to Lake Te	Temporary & Minor Effect Potential Significant Adverse Effect	Construction Management Plan Concept design

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		Location of construction access? Location of bike track where it differs from monorail alignment? Management of erosion/sediment runoff? Final elevation of monorail track from SH94 to terminus, turning loop & of terminus building Terminus dimensions not stated, application states that it will be larger than Kiwi Burn	Anau Design height of bridge crossing alters design level of terminal building; fill material required & greater visual impact	Potential Significant Adverse Effect	showing elevation of monorail track from overbridge to terminus and existing ground profile
OPERATION					
Kiwi Burn Terminus	**Rehabilitation & Maintenance**	Time for full rehabilitation of site	Land contaminated by washing water, machinery lubricants, oils	Potential Significant Adverse Effect	Uplift and disposal
0-29km of monorail, from Kiwi Burn End	**Rehabilitation & Maintenance**	Disposal location for vegetation? How is stripped topsoil re-spread over monorail track and effect of this? Activities following events that cause slips or other changes that need attention? Replacement of beams or piers considered major event that would require track along monorail alignment to be reinstated to an extent but highly unlikely to happen Is stripped topsoil sufficient and fertile enough to allow re-growth of native bush? Contamination of topsoil?	Potential for significant maintenance activities Disturbance of rehabilitated vegetation No full rehabilitation of vegetation	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
Construction, Spur & Mountain Bike Tracks	**Rehabilitation & Maintenance**	Disposal location for vegetation? Activities following events that cause slips or other changes that need attention? Removal of passing bays along mountain bike track? How many remain to cope with maintenance vehicles? Is stripped topsoil sufficient and fertile enough to allow re-growth of native bush? Contamination of topsoil?	Potentially high number of vehicle access along mountain bike track for maintenances	Potential Significant Adverse Effect	
Te Anau Downs Terminus	**Rehabilitation & Maintenance**	*As for Kiwi Burn Terminus* Mechanism of transferring trains to workshop	*As for Kiwi Burn Terminus* Additional monorail track on DoC land	*As for Kiwi Burn Terminus* Potential Significant Adverse Effect	*As for Kiwi Burn Terminus*

3.5 Sewage

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
CONSTRUCTION					
Kiwi Burn Terminus	**Sewage disposal**	Toilet facilities provided at terminus during terminus construction? If yes: Type of toilet facility and treatment method? Staff numbers and sewage quantities? Water supply? Location of facilities? Discharge location?	Potential for people to go to the toilet in the bush/streams if toilets are only located at construction depots. Odours Breeding ground for flies/vermin Health risk to staff Potential contamination of land, streams & rivers	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	Portable containment toilets at terminus during construction
	Water Supply	Supply of process water?	Water taken from streams	Temporary effect	Water cart available during construction
0-29km of monorail, from Kiwi Burn End	**Sewage disposal**	Toilet facilities provided at construction fronts? If yes: Type of toilet facility and treatment method? Staff numbers and sewage quantities? Water supply? Location of facilities? Discharge location?	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	Portable containment toilets at each construction front
	Water Supply	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
Construction, Spur & Mountain Bike Tracks	**Sewage disposal**	*As for 0-29km of monorail*	*As for 0-29km of monorail*	*As for 0-29km of monorail*	*As for 0-29km of monorail*
	Water Supply	*As for 0-29km of monorail*	*As for 0-29km of monorail*	*As for 0-29km of monorail*	*As for 0-29km of monorail*
Te Anau Downs Terminus	**Sewage disposal**	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*
	Water Supply	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*
OPERATION					
Kiwi Burn Terminus	**Sewage disposal**	***Sewage generation*** User numbers, monorail users, day visitors and staff? Flushing toilets and urinals? Other facilities e.g. basins, sinks, etc? Sewage quantities? Allowance for growth in visitor numbers (4 trains, 160pax) ***Receiving Environment*** Underlying soil type(s) & limiting horizons? Groundwater (e.g. depth, use)? Topography? Surface water management? Climate (e.g. evapo-transpiration, rainfall), climate suitable for evapo-transpiration system? Proximity to sensitive receivers (e.g. lake, groundwater takes, wetland)	Odours from toilets. Untreated or poorly treated sewage discharges into groundwater and Mararoa River. Surface runoff or ponding of effluent from land application system. Groundwater contamination. Water supply contamination. Public health risk. Heavy machinery damages land application area during construction or	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	NZBC AS/GS1 provides indicative numbers for toilet pans, urinals & hand basins Regular cleaning & maintenance programme AS/NZS 1547:2000 provides guidance on sizing on-site sewage treatment and disposal systems Secondary treatment units sized in accordance with best practice Provision of reserve area for land application area Low level and high level alarms on pump stations Fence off and signpost

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
		Treatment & Disposal System Resource consent required Capacity, land area and level of treatment of treatment system Location of parts of the land application system on lower river terrace (flooding, groundwater levels?) Location of reserve area? Adequate setback distances? Operation/maintenance requirements? Existing systems in vicinity? Performance of existing systems in vicinity?	operation. Vandalism of system Potential contamination of tributary of Mararoa River. Additional land required as visitor numbers increase.	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	land application area All manholes and pump stations to have lockable lids Concept design for terminus to include location of on-site sewage system + location of reserve area to allow for growth from 1 train to 4 trains of 160pax
	Water Supply	Water treatment method Capacity & location of tanks Resource consents required	Additional land area required for tanks	Minor effect	Concept layout for terminus to include water intake location and tanks
0-29km of monorail, from Kiwi Burn End	**Sewage Disposal**	MWH assumed that no toilet facilities will be provided in the monorail trains	-	-	-
	Water Supply	MWH assumed that no water will be provided in the monorail trains	-	-	-
Construction, Spur & Mountain Bike Tracks	**Sewage Disposal**	Toilet facilities provided along track? If yes: Type of toilet facility and treatment method? User numbers and sewage quantities? Location of facilities? Discharge location?	Potential for people to go to the toilet in the bush/streams if toilets no toilets provided Odours Breeding ground for flies/vermin Health risk	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant	Containment toilets along track

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
			Potential contamination of land, streams & rivers	Adverse Effect Potential Significant Adverse Effect	
	Water Supply	MWH assumed that no water will be provided along track	-	-	-
Te Anau Downs Terminus	**Sewage disposal**	User numbers? Flushing toilets and urinals? Other facilities e.g. basins, sinks, café, etc? Water supply? (Tank?) Sewage quantities? Existing facilities? Disposal field area required and proposed location? Clarification on utilisation of existing facilities, upgrade existing facilities or new facilities Sewage generation from existing facilities (e.g. Fiordland National Park Lodge) Location, capacity, condition & performance of existing sewage system (if to be upgraded to accommodate terminus)	Odours from toilets Untreated or poorly treated sewage discharges into Lake Te Anau Surface runoff or ponding of effluent from land application system Groundwater contamination Public health risk Heavy machinery damages land application area Vandalism of system Additional land required as visitor numbers increase Existing system not appropriate for upgrading Overloading of new sewage system by hotel & restaurant and	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	*As for Kiwi Burn Terminus* Requirement for new system, separate for terminus facilities

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
			bar		
	Water Supply	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*

3.6 Wastewater

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
CONSTRUCTION					
Kiwi Burn Terminus	**Contaminated Stormwater Management**	Stormwater flows and level of contaminants (loads)? Discharge locations? Downstream effects? Emergency provisions for other contaminants (e.g. alkalinity from concrete slurry, oil spills)? Sensitive areas*?* Required land area for stormwater treatment? Location of treatment areas? *see Hydrology and Hydraulics*	Runoff to nearby stream and Mararoa River, harm to flora and fauna Accidental spillages Land area required for stormwater treatment Additional vegetation clearance required for treatment	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	Size stormwater management feature to appropriate rainfall. Monitor stormwater management and, where necessary, make changes (e.g. increase size of drains, install new silt fences). Have plan in event of emergency spill. *see Hydrology and Hydraulics*
	Contaminated processing water	Types of construction activities that produce contaminated processing water? Nature of contaminated stormwater, e.g. concrete slurry, grout, etc? Treatment or containment? Discharge quantities, sediment loads and contaminant levels Hydraulic receiving capacity of environment (land, water body, sensitive receivers) compared to discharge	Contaminated processing water (e.g. high sediment levels, high pH/alkaline, contaminants from spill) discharged/runoff to nearby stream & Mararoa River; harm to flora and fauna	Potential Significant Adverse Effect	Have plan in event of emergency spill Containment and transport of contaminated processing water off site OR special treatment prior to discharge
0-29km of monorail, from Kiwi Burn End & Construction, Spur &	**Contaminated Stormwater Management**	Disposal locations of cut vegetation within DoC estate?	Water and sediment runoff damages areas outside working site. Accidental spillages.	Potential Significant Adverse Effect Potential Significant Adverse Effect	Agree locations for construction storage sites along route prior to construction

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
Mountain Bike Tracks			Location of construction storage site along route in sensitive area Additional tracks and vegetation clearance required	Potential Significant Adverse Effect Potential Significant Adverse Effect	
	Contaminated processing water	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*
Te Anau Downs Terminus	**Contaminated Stormwater Management** **Contaminated processing water**	*As for Kiwi Burn Terminus*	Runoff to Lake Te Anau, harm to flora and fauna *As for Kiwi Burn Terminus*	Potential Significant Adverse Effect *As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*
OPERATION					
Kiwi Burn Terminus	**Rehabilitation & Operation**	Maintenance/emergency provisions? (e.g. fire, plant washing water, diesel spill)? Maintenance of stormwater management facilities? Land requirement and location of grassed swales for stormwater treatment	Sufficient land area available for stormwater treatment? Hydraulic overloading of sewage disposal field with additional stormwater run-off?	Insufficiently assessed effect Potential Significant Adverse Effect	Develop more specific Operations and Environmental Management Plan with emergency procedures
0-29km of monorail, from Kiwi Burn End & Construction, Spur & Mountain Bike Tracks	**Rehabilitation & Operation**	Disposal locations of cut vegetation within DoC estate? Clearing width and height for construction/mountain bike track and spur tracks? Land requirement for stormwater treatment/discharge	Water and sediment runoff Clearing width for construction track wider than 3m Installation of cut-off drain on slopes requires wider vegetation clearance	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	Define design standard of tracks and clearance width

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
Te Anau Downs Terminus	**Rehabilitation & Operation**	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*

3.7 Solid Waste

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
CONSTRUCTION					
Kiwi Burn Terminus	**Site Establishment & Earthworks**	Quantity? Any intermediate stockpile / final disposal location if not disposed of locally? Source of any additional fill? Required land area for stormwater treatment? Location of treatment areas? *See also Wastewater*	Sediment runoff from exposed earth areas to nearby stream and Mararoa River, harm to flora and fauna Concentration and alteration of surface water flow paths Dust Odour, breeding ground for vermin, leachate from cleared vegetation if not managed Visual nuisance Blocking of existing access road/tracks to Kiwi Burn/Mavora Lakes	Potential Significant Adverse Effect Potential Significant Adverse Effect Minor effect Potential Significant Adverse Effect Potential Significant Adverse Effect Insufficiently assessed effect	Develop more specific Waste Management Plan Designated areas for vegetation & spoil temporary stockpiles Erosion/sediment controls
	Construction Waste Disposal	Emergency provisions for spills of hazardous material (e.g. oil, petrol) Sensitive areas? Waste storage area locations?	Contaminants from waste may leach into environment if not contained appropriately; harm to flora and fauna Accidental spillage; harm to flora and fauna Nil if all solid waste	Potential Significant Adverse Effect Potential Significant Adverse Effect	Develop more specific Waste Management Plan Designated areas for construction waste Safe containment for hazardous waste & hazardous substances Emergency plan for spills

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
			contained, removed and disposed of outside of National Park		
	Domestic Refuse Disposal	Quantity? Type of storage receptacles & storage location Management of medical/first aid waste and domestic quantities of other hazardous waste?	Litter Odour, breeding ground for vermin, leachate from refuse if not contained or removed regularly Animals and scavenging	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	Develop more specific Waste Management Plan
	Hazardous Waste Management	Quantity and nature? Storage/management? Emergency provisions for spills of hazardous material (e.g. oil, petrol)	Discharges into environment	Potential Significant Adverse Effect	Have plan for dealing with leakages and other minor losses / discharges to the environment
0-29km of monorail, from Kiwi Burn End & Construction, Spur & Mountain Bike Tracks	**Site Establishment & Vegetation Disposal**	Quantity? Clearance corridor width and height for monorail realistic? Clearance corridor width and height for construction/mountain bike track and spur tracks not specified? Final deposition location within DoC estate? Sensitive areas? Erosion and sediment control May require large quantity of fill to cross over gullies and to achieve maximum grade of monorail	Sediment runoff from exposed earth areas, harm to flora and fauna Leachate from mulched vegetation will have a high level of nutrients (e.g. BOD); runoff could lead to eutrophication of streams Odour, breeding ground for vermin if unmanaged pile Falling trees damage other vegetation	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	Develop more specific Waste Management Plan Identification of sensitive areas Erosion and sediment control

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
	Earthworks	Quantity? Erosion & sediment control Source of any additional fill/ disposal location for extra fill	Sediment runoff from exposed earth areas Concentration and alteration of surface water flow paths Dust Additional land area/vegetation clearance required for temporary stockpiles	Potential Significant Adverse Effect Potential Significant Adverse Effect Minor effect Temporary effect	Develop more specific More specific Waste Management Plan Designated areas for temporary spoil stockpiles Erosion/sediment controls
	Construction Waste Disposal	Emergency provisions for spills of hazardous material (e.g. oil, petrol)	Discharges into environment	Potential Significant Adverse Effect	Have plan for dealing with leakages and other minor losses / discharges to the environment
	Domestic Refuse Disposal	Collection and storage management for refuse produced at construction fronts (lunch wrappers, cigarette buts, drink bottles, etc)?	Littering in DoC estate Odour Breeding ground for vermin	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	Develop more specific Waste Management Plan Refuse and recycling collection points at construction fronts
	Hazardous Waste Management	*As for construction waste disposal*	*As for construction waste disposal*	*As for construction waste disposal*	*As for construction waste disposal*
Te Anau Downs Terminus	**Site Establishment & Earthworks**	May require large quantity of fill to achieve maximum grades on monorail track from over-bridge to terminus & loop track *As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	Concept design levels and elevations provided for monorail track from over-bridge to terminus & loop track *As for Kiwi Burn Terminus*
	Construction Waste Disposal	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
	Domestic Refuse Disposal Hazardous Waste Management				
OPERATION					
Kiwi Burn Terminus	**Disposal of Operation/ Maintenance & Emergency Waste**	Quantity and nature? Storage/management? Emergency provisions for spills of hazardous material (e.g. oil, petrol)	Contaminants from waste may leach into environment if not contained appropriately; harm to flora and fauna Accidental spillage; harm to flora and fauna Nil if all solid waste contained, removed and disposed of outside of National Park	Potential Significant Adverse Effect Potential Significant Adverse Effect	Develop more specific Waste Management Plan Develop more specific Operations and Environmental Management Plan Designated areas for waste storage Safe containment for hazardous waste & hazardous substances Emergency plan for spills
	Domestic Refuse Disposal	Quantity? Type of storage receptacles & storage location Management of medical/first aid waste and domestic quantities of other hazardous waste?	Litter Odour, breeding ground for vermin, leachate from refuse if not contained or removed regularly Animals and scavenging	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	Develop more specific Waste Management Plan Develop more specific Operations and Environmental Management Plan Provision of appropriate refuse receptacles & removal on weekly basis
	Hazardous Waste Management	Emergency provisions for spills of hazardous material (e.g. oil, petrol)	Contaminants from waste may leach into environment if not contained appropriately; harm to	Potential Significant Adverse Effect	Develop more specific Operations and Environmental Management Plan

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
			flora and fauna Accidental spillage; harm to flora and fauna	 Potential Significant Adverse Effect	
0-29km of monorail, from Kiwi Burn End	**Rehabilitation**	Nil if all solid waste removed and disposed off site and full rehabilitation effected	Nil if all solid waste removed and disposed off site and full rehabilitation effected	No effect	Develop more specific Operations and Environmental Management Plan
	Vegetation Disposal	Disposal location for regularly removed vegetation	Leachate from mulched vegetation will have a high level of nutrients (e.g. BOD); runoff could lead to eutrophication of streams	Potential Significant Adverse Effect	Develop more specific Operations and Environmental Management Plan
	Disposal of Operation/ Maintenance & Emergency Waste	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*
	Domestic Refuse Disposal	Quantity? Type of receptacles?	Litter in DoC land if monorail stopping points are added Odour, breeding ground for vermin, leachate from refuse stored drums if not removed regularly from monorail	Potential Significant Adverse Effect Potential Significant Adverse Effect	Provision of refuse and recycling station along mountain bike track and regular collection of material
	Hazardous Waste Management	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*
Construction, Spur & Mountain Bike Tracks	**Rehabilitation** **Vegetation Disposal** **Disposal of**	*As for 0-29km of monorail*	*As for 0-29km of monorail*	*As for 0-29km of monorail*	*As for 0-29km of monorail*

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effects	Mitigation Measures
	Operation/ Maintenance & Emergency Waste Hazardous Waste Management				
	Domestic Refuse Disposal	Waste management along mountain bike track?	Litter in DoC land from mountain bike track users	Potential Significant Adverse Effect	Provide refuse collection bins and regularly emptying of bins
Te Anau Downs Terminus	**Rehabilitation Disposal of Operation/ Maintenance & Emergency Waste Hazardous Waste Management Domestic Refuse Disposal**	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*

3.8 Traffic Engineering and User Access

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effect	Mitigation Measures
CONSTRUCTION					
Kiwi Burn Access and Terminus	**Access Road into Terminus and Intersection Upgrade**	Management of construction traffic and existing users of Mavora Lakes Road & access road? Appropriateness of Mavora Lakes Road for construction vehicles? Night-time construction traffic?	Greatest traffic safety risk at dawn & dusk Conflict between existing users of parking area and construction traffic	Potential Significant Adverse Effect Minor effect	Limit construction to daylight hours Street lighting of terminus & car parking area Develop Traffic Management Plan Independent safety audit(s) of proposed intersection upgrade and effects on other users at appropriate design stages,
	Kiwi Burn Terminus Layout	Separation between different modes at terminus Separation between terminus and existing access to Mararoa River Sufficient land area allowed for by applicant for future expansion? Adequate provision of car parking – for users of both monorail and mountain bike trail facility. Adequate arrangement for any cycle hire/trailer services. Do the design principles adopted for terminus design ensure for personal security, i.e. lighting operation of monorail after dark?	Additional land required by applicant for future expansion Future conflict between ATVs and cars if facilities are expanded Security risks/ vandalism	Potential Significant Adverse Effect Potential Significant Adverse Effect Minor effect	Layout showing potential future expansion areas Assessment of car parking needs Safety audit/non motorised user audit of terminus facility arrangements – especially where interfaces with roadway.
	Construction	Management of construction traffic	Discourages use of	Potential Significant	Develop more specific

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effect	Mitigation Measures
	Traffic	and existing users of Mavora Lakes Road Sufficient room for manoeuvring/parking/storage	area by recreational users during construction Unplanned tracks over DoC land; consequential damage and repair Construction hazards on site Safety implications of construction traffic	Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	Construction Management Plan, including access, public consultation & security
0-29km of monorail, from Kiwi Burn End & Construction, Spur & Mountain Bike Tracks	**Construction Traffic**	Safe management of construction on single lane track so conflict is low Provision of safe access for recreational users during construction Alignment of mountain bike track where it differs from monorail corridor?	Collision of construction traffic Additional passing bays required due to actual timing of trips or want to increase number of trips Hazardous crossing points for recreational users during construction Applicant doesn't reach agreement with private landowners, altering route	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	Develop more specific Health and Safety Plan Landowner agreements to be provided to DoC
Te Anau Downs Access & Terminus	**Over-bridge over SH94 & Access into Terminus**	Final elevation of monorail track from SH94 to terminus and of turning loop Final elevation of terminus building Safe management of construction traffic, existing users of SH94, users of existing crossing points in vicinity of terminus site	Design height of bridge crossing alters design level of terminal building; fill material required/ visual impact Bridge piers may present hazard to vehicles that loose	Potential Significant Adverse Effect Potential Significant Adverse Effect	Side protection of bridge piers Design & construction of intersection in accordance with NZTA's Planning Policy Manual NZTA's approval for position & design of

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effect	Mitigation Measures
		Crossing point of mountain bike track over SH94, separate overbridge, joint monorail/mountain bike overbridge, crossing on road? End point of mountain bike track at the Te Anau Downs terminus?	control Poorly positioned intersection with SH94 NZTA requires over-bridge and/or coach access onto SH94 at different location, altering monorail track alignment NZTA does not permit over-bridge on SH94, alternative location for terminus required Unsafe crossing of SH94 by mountain bikers. Unsafe end point of mountain bike track close to monorail track or turnaround loop	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect	monorail crossing point Develop more specific Construction Management Plan Design of mountain bike track – SH94 crossing Safety audit to NZTA's satisfaction at appropriate design stages for SH94 interface arrangement.
	Te Anau Downs Terminus Layout	Separation between different modes at terminus Sufficient land area allowed for by applicant for future expansion? Provision for adequate car parking arrangement – for users of both monorail and mountain bike track. Do the design principles adopted for terminus design ensure for personal security, i.e. lighting operation of monorail after dark?	Additional land required by applicant for future development Future conflict between coaches and cars if expand facilities Limits access to lakeside/ future lakeside facilities (e.g. jetty) due to amount of land taken up by terminus building and turning circles of monorail and coaches Greatest traffic safety	Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant Adverse Effect Potential Significant	Confirm DoC boundaries Provision of safe pedestrian crossing facilities through Non Motorised Road User Audit and safety audit of terminus layout. Car parking assessments – to take account of projected parking numbers associated with both monorail and mountain bike track.

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effect	Mitigation Measures
			risk at dawn & dusk Conflict between those using existing accesses, terminus access & pedestrians crossing SH94 to Lake Mistletoe	Adverse Effect Potential Significant Adverse Effect	
	Construction Traffic	*As for Kiwi Burn Terminus* Location of construction access points	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*	*As for Kiwi Burn Terminus*
OPERATION					
Kiwi Burn Access and Terminus	**Access road & Intersection**	Safe management of monorail ATVs and recreational users accessing Mararoa River and Kiwi Burn Track Emergency provisions? Increased traffic volume along Mavora Lakes Road and to terminus in case monorail becomes stand-alone attraction Increase traffic volumes due to popularity of mountain bike track	Vehicle breakdown & passenger safety in emergency events, breakdown or extreme weather conditions (e.g. snow, washout) Dust from vehicles using gravel roads – effect on roads also used by Round the Mountain Cycle Trail Road upgrade needed due to increased traffic volume Higher maintenance requirements of Mavora Lakes Road due to higher traffic volume.	Temporary & minor effect Temporary effect Potential Significant Adverse Effect Potential Significant Adverse Effect	Develop more specific Health & Safety Plan Road safety audit at appropriate design stages of access proposal
0-29km of monorail, from Kiwi Burn End	**Trip management/communications**	Operating hours? Isolated operation with limited accessibility options Safe management of 2-way	Vehicle breakdown & passenger safety in emergency events, breakdown or extreme	Potential Significant Adverse Effect	Restrict operating hours to daylight Develop approved Safe Operating Plan based

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effect	Mitigation Measures
		monorail traffic Fail-safe operation? No existing monorail operation in NZ	weather conditions (e.g. snow, washout) Noise from monorail Failure of tracking system/computer control leads to accident Location of passing bays not appropriate (e.g. due to actual timing of trips or increased no. of trips); applicant applies for concession for new passing bay(s)	Minor effect Potential Significant Adverse Effect Potential Significant Adverse Effect	on international best practice Seek specialist international advice on safe operating systems
	Safety / Emergency Provisions	Track and coach maintenance? How delineate route? How ensure safety of other users of DoC land How ensure safety of those on monorail from other users of DoC land (e.g. hunters firing at monorail accidentally) Provisions in event of power failure Do the design principles adopted for terminus design ensure for personal security, i.e. lighting operation of monorail after dark?	Vehicle breakdown & passenger safety in emergency or extreme weather conditions (e.g. snow, washout) Poorly maintained monorail track and/or units	Potential Significant Adverse Effect Potential Significant Adverse Effect	Develop approved Safe Operating Plan, including emergency provisions & maintenance Designated monorail corridor
Construction & Mountain Bike Track	**Maintenance Traffic**	Mountain biker safety with ongoing maintenance traffic	Risk of accidents	Potential Significant Adverse Effect	Speed limits for maintenance vehicles Warning signs for mountain bikers Temporary diversion routes and signing

Location	Proposed Activity	Key Questions/Matters to Consider	Potential Effects/Risks	Assessment of Effect	Mitigation Measures
					where warranted
Te Anau Downs Terminus	**Access onto State Highway 94 Te Anau Down intersection/overbridge**	Safe management of coaches & users of other accessed Emergency provisions?	Vehicle breakdown & passenger safety in emergency events, breakdown or extreme weather conditions (e.g. snow, washout)	Temporary & minor effect	Develop Health & Safety Plan Road safety audit of access/intersection arrangements at appropriate design stages – to satisfaction of NZTA.

4 Summary

	Opus	NIWA	Traffic Design Group
Accepted methodology, processes, standards			
• Geotechnical	Limited information about standards and guidelines. Only generic geotechnical information provided. Appropriate slope stability assessment must confirm the stability of the pre- and post-construction landforms, and appropriate mitigation measures (surface water control and drainage) be installed to eliminate adverse effects. Factors of safety against ground movement appropriate to the change of use within the easement corridor should apply. Where proposed excavations will intersection land instabilities, modelling required to confirm acceptable effects upon global stability. Actual "test design" on a short length of monorail and associated construction tracks from available LIDAR data over one of the more challenging sections (i.e. steep slopes, crossing over ridges) to confirm assumptions in construction methodology. Specific engineering may be required at localised sites for pile/footings of monorail.	Slope stability information from aerial photogrametry and topographical morphology provided for area along rivers only. Not entire route covered.	NA
• Hydrological	NA	Accepted methodology	NA
• Hydraulic	NA	Not addressed	NA
• Sewage	Feasibility of land application compliant with regulations is not specifically supported with evidence	NA	NA
• Wastewater	ARC TP 90 stated as a guideline for erosion control. No information about use of excess cut material. No information about erosion and sediment control during monorail operation provided.	NA	NA
• Solid and	Limited information about standards and guidelines	NA	NA

hazardous waste			
• Traffic engineering	NA	NA	Generally accepted methodology.
• Construction engineering	Proposed monorail construction parameters provided. Generally accepted methodology and processes used. The reports are a significant improvement over the previous submission and are thus more credible and realistic. In particular the incorporation of an experienced contractor to contribute to the process has greatly enhanced the understanding of the plant that will be used. It has also ensured that the construction programme is more credible and resulted in a believable construction methodology i.e. the use of the construction track as a dual mountain bike / service track.	NA	NA
• Mountain bike track (where separate)	DOC Track Construction and Maintenance Guidelines (VC 1672) proposed; how specifically this document will be used is not stated although this is an appropriate document to use.	NA	NA
Contents factually correct	Generally yes. It is claimed that the road and monorail alignments would avoid large beech trees. The realities around such a claim will not be known until specific alignments have been established. 200-300m wide corridor appears appropriate but no background provided as to why this width is applicable. Has an actual section been modelled to sufficient accuracy to ensure this fits a “worst case” requirement?	Assessed as correct	Assessed as correct
Information gaps with respect to activities			
• Geotechnical	Comments about seismic effects are ambiguous. No information relating to mountain bike track away from monorail	NA	NA
• Hydrological	No information relating to mountain bike track away from monorail. No information about climate change effects No design standards provided.	No information relating to mountain bike track. away from monorail No design standards	NA

		provided.	
• Hydraulic	No design flood levels or other design standards such as termini floor levels.	No hydraulic assessment including river flood levels provided	NA
• Sewage	No information relating to MBT away from Monorail No consideration of potential growth at Kiwi Burn Terminus for MBT users and potential for monorail to be standalone feature. No information relating to sewage generation and treatment at Te Anau Downs Terminus.	NA	NA
• Wastewater	No information relating to MBT away from Monorail	NA	NA
• Solid and hazardous waste	No information relating to MBT away from Monorail	NA	NA
• Traffic engineering	No information about future road end and MBT traffic numbers	NA	No information on provisions for car parking facilities at termini buildings for stand alone monorail attraction users and mountain bike track users No information on target user group of mountain bike track and required track standard and clearance width during track operation.
• Construction engineering	No construction road, mountain bike track and monorail service road design parameters are provided. Cross sections provided are indicative and do not provide guidance around dimensions for stormwater drains, slopes in various materials, fill slope batters, etc. No information about how MBT will cross main rivers No pedestrian monorail crossing points included in design (how will recreationalists cross, will there be electrical hazards?) At river crossings no information about managing river bank scour or designing to accommodate bank scour While the erosion and sediment control measures listed	NA	NA

	are appropriate, there is a lack of detail around these measures – number of, location in relation to the tracks, access to, rehabilitation of the sites. No details are provided for source and quantities of basecourse materials required to be imported to site to form the construction track, spur track or monorail route. There is a lack of precision on the required canopy clearance, both for construction and long term monorail operational safety. Height of monorail over river crossings not yet determined. Clearing of flood debris around bridge piers not addressed. The construction treatment of the track along the monorail route is unclear and the removal and reinstatement of this track is also unclear. The particular risks of alkaline discharge to streams from concrete or concrete truck wash down are not addressed. We are not fully convinced that cuts at ridges are not required to accommodate the monorail alignment constraints. Means of providing running surface on monorail beams unknown. Means of erecting curved beams not yet well developed. Design and rainfall events for erosion and sediment control not stated. Unclear as to whether sufficient monetary allowance has been made for erosion and sediment control. Number of permanent passing bays not defined The extent of tree felling beyond the 4 to 6m wide corridor is unknown and dependant to some extent on advice from the monorail supplier.		
Potential effects			
• Geotechnical	Land instabilities result in significant change monorail alignment outside the corridor. More engineered structures required	NA	NA
• Hydrological	Climate change may have significant effects on the Site	Climate change may	NA

	and significant implications for design and ongoing operation and maintenance.	have significant effects on the river flows and flood levels resulting in high monorail piers at river crossings.	
• Hydraulic	River patterns will change and may result in requirement for additional river bank stabilisation works	River patterns and flow will change. Design height of monorail may be significantly higher than proposed 6m above ground.	NA
• Sewage	Increased sewage flows and loads at termini; need for campsites / amenity sites along mountain bike track with associated sewage facilities and their operation	NA	NA
• Wastewater	Design is based on an approach of low capital investment and higher operation and maintenance requirements rather than design based on minimising future effects and minimising operation and maintenance.	NA	NA
• Solid and hazardous waste	On-going waste management (e.g. litter, culvert cleaning, tree trimming and clearing etc) along mountain bike trail and any associated camp sites, and termini	NA	NA
• Traffic engineering	NA	NA	Potentially the monorail could be come a stand alone attraction. The MBT may grow in popularity. Such growth would have traffic implications on traffic volumes and termini footprint, i.e. car parking facilities.
• Construction engineering	Given the limited information around design standards and vertical and horizontal alignments, the effects of the monorails and road/MBT and MBT in terms of land clearance, foliage clearance, and visual effects can only be indicative at best. Some of the issues that arise from this are addressed in the information gap information following. Ongoing disturbance to streams from MBT track if river	NA	NA

	crossings not permanently bridged. The lack of detail around construction of the monorail track leaves doubt around the visual impact of basecourse remaining in place, the damage to tree roots from the construction and removal of basecourse to form this track. There is a possibility of ridge cuts with resultant visual impact and spoil disposal issues. The visual impact of the monorail at river crossings with the height of crossing unknown. Potential for river bank scouring and/or impact of scour protection at river crossings. Impact of flood debris removal from river piers – impact of excavators in river to clear debris. Affects on aquatic life of alkaline discharge to streams form concrete. Unknown impact from beam surfacing methods. Extra clearance required to erect curved beams. Erosion and sediment control measures overtopped and less effective than assumed (note that these measures are not fully effective and some sediment will be discharged, particularly in large storm events) If insufficient allowance made in contract documents for erosion and sediment control then these measure will be less effective with greater sediment discharges. If a large number of passing bays are constructed and remain then there is an associated visual impact. Clearing beyond the 4 to 6m path may be required for monorail safety and operational reasons.		

5 Conclusions

5.1 Overview

From an engineering perspective only, the applicant has presented a credible proposal and it is considered there are no issues that cannot be addressed by appropriate actions by the applicant. However, the application needs further information in order that the effects of the proposed activity on the Conservation Estate to be assessed adequately. These needs are more specifically described in this section.

5.2 Monorail Alignment

The monorail alignment within the corridor is unknown and a 3-D on ground model to demonstrate vertical and horizontal alignment of the monorail track has not been provided with the application. A more detailed monorail alignment in relation to the following specific points is considered essential to allow a full assessment of effects on the land administered by the Department:

A Monorail alignment in relation to waterways

- The proposed monorail route crosses rivers and runs alongside rivers close to the river banks.
- The application does not state where foundations would be positioned in relation to river banks and where river embankments would be located. A stability assessment of the river banks in this respect has not been carried out.
- The application does not state the flood event which will be used for the design of the monorail river crossing or river crossing foundations within the river channel and other minor river crossings.
- The application does not state the flood event and level that will be used for the design of the minimum floor levels for the termini.
- The application does not address the effects of climate change on hydrology and river hydraulics.
- The clearance heights between the monorail track and the flood river levels have not been specified in the application.
- The detailed design process may result in significant changes to the proposed monorail vertical and horizontal alignments, including in-river piers and embankment erosion control works.

B Monorail alignment in relation to topography

- The proposed monorail route traverses mountainous terrain and other types of ground (e.g. river beds, swamps).
- A number of hill slope instabilities have been identified in the application.
- Geotechnical preliminary design parameters (e.g. cut slopes, fill slopes etc in difference soils / terrain) are not provided.
- One particular slope instability has been identified at “Bluff Slip” (at 24 to 26.5km) and requires further geological investigation to confirm the extent of the area of instability.
- The current monorail route traverses the area which has been identified as potentially unstable
- A LIDAR survey of this area with the tree layer removed is recommended to develop the specific monorail alignment around this area.
- The NIWA report recommends an alignment on the other side of the river to avoid this instability, yet the proposed concession corridor does not allow for this
- A total of 200m of monorail track (between 14-15km) span over deep gullies. The requirements for engineered structures in these areas can not be assessed until a specific monorail alignment for these areas is developed
- A total of 14.3km of monorail track on land administered by the Department is on side slopes with the majority of it (14.0km) is travelling through bush. The steepness of these slopes is not

specified in the application. The construction track and monorail alignments may require cut and fill. The volume of cut and fill can not be determined until the monorail alignment is finalised.

The exact vertical monorail alignment and the required amount of earthworks are essential to assess the impact of the monorail construction on the land administered by the Department.

- The height of the monorail above ground could be significant in places and therefore affect the height of vegetation clearance required.
- The final height of the monorail above ground will impact on the visibility of the monorail. The information provided with the concession application does not include sufficient information to fully assess the visual impacts of the monorail, i.e. no height profile of the monorail track along the route is provided.
- A higher elevated monorail track i.e. above the height of the bush, could significantly impact the noise generated by the monorail train. The noise assessment has been carried out on the basis that the monorail train will travel at a maximum of 8.4m (height of rail at a maximum of 6m plus height of train) above the ground.
- A greater height of the monorail track is likely to result in increased vegetation clearance to ensure clear passage of the monorail track.
- The monorail track alignment is limited by operational constraints of the monorail, such as minimum curvature and maximum grade.
- The need to elevate one specific section of the monorail track, i.e. at a river crossing, may result in alteration of the track height for a longer section to overcome operational constraints.
- The applicant proposes to modify the monorail alignment to avoid significant features such as gullies, swamps or large trees. The feasibility of this is unknown. Moreover, avoiding one feature may result in unavoidable collision with another due to the operational constraints of the monorail.
- The alignment of the monorail will most likely be driven by topographical constraints (grade, side slope steepness, gullies, rivers, etc). These constraints may result in an alignment where it is impossible to avoid significant trees.
- Earthwork volumes are likely to increase if monorail alignment is elevated higher above ground due to the requirement for stronger foundations.
- The topography will influence the location, size, type of sediment control measures utilised.

C Overall

The actual effects of the alignments of the monorail, combined construction road/mountain bike track/ service road, spur roads and separate mountain bike track will only be substantially known once minimum design standards have been adopted and final alignments have been determined based on these minimum design standards.

Provisional design standards could be adopted now. On the basis of these provisional alignments, upper and low bound forest clearances and upper and lower bound earthworks footprints could be determined, and the monorail vertical alignment determined. This would enable ecological, visual and other effects to be assessed with a clear basis of reference.

5.3 Construction, Spur and Mountain Bike Track Alignment

It is acknowledged that the construction track alignment is more flexible than the monorail alignment. However, the impact of the construction track on the land administered by the Department can not be sufficiently assessed with the information provided within the application.

- The application does not provide sufficient detail on the track design, i.e. depth of road metal, foundation of track, stormwater management, erosion and sediment control measures, etc. to assess the actual required vegetation clearance width, maintenance requirements, etc.
- The track design does not provide any details on the proposed type of bridging over rivers, streams or gullies or state whether these are permanent.
- The application does not state the flood event which will be used for the design of minor stream crossings

- A particular area of concern is the location of the construction track in respect to the monorail alignment on steep side slopes. The cut and fill volumes and the need for stormwater control could be significant on steep slopes.
- The length of the spur tracks could increase significantly if the construction/mountain bike track has a greater separation from the monorail alignment than specified in the application.
- The mountain bike track alignment through DoC land where it differs from the monorail corridor has not been described in the application. The assessment of environmental effects provided with the application does not consider the impact of the additional track through DoC land.

5.4 Construction Engineering

A. Vegetation Clearance

- MWH considers the proposed clearance width and height along the monorail track during construction as a bare minimum. Heavy machinery movement and placement of 20m long concrete beam may result in the need for further higher and wider vegetation clearance.
- The proposed clearance width and height for the construction/mountain bike track and the spur tracks are not stated in the application. The required clearance width is expected be wider than the specified track width of 3m. The actual clearance width will depend on the topographical alignment of the track, geotechnical conditions, and the resulting need for stormwater management.
- Vegetation clearance through well established bush may result in collateral damage during felling activities or to later damage due to increased light intensity.
- The additional clearance requirements to establish passing bays along the construction/mountain bike track and the intersections with the spur tracks has not been considered in the application.

B Construction Risks

- An assessment of construction and operational risks relative to the proposed methods of construction access, construction, and operational maintenance and servicing has not been carried out. A risk assessment should identify risks and mitigation measures, and should provide an improved understanding about the needs for construction and their implications of the methods proposed.
- An over bridge is proposed at Te Anau Downs. The area is limited and there are significant design constraints.
- “Bluff Slip” has the potential to jeopardise the monorail alignment as proposed in the application. NIWA recommends that the monorail track avoids this area of instability by crossing the river and travelling along the true left side of the Upukerora River. The proposed 300m wide corridor at this section of the track does not provide for the possibility of crossing the river.

C River Crossings

- The transition between piled river foundations and pad foundations along the river banks has not been addresses in the application. Pad foundations close to river banks may result in river bank instabilities which could lead to a significant change of the proposed alignment and/or foundation design.

5.5 Sewage

A Sewage - Construction

- Toilet facilities during the construction period are proposed at the three construction depots outside of DoC administered land
- The requirement for toilet facilities at the construction fronts has not been addressed.

B Sewage - Operation

- Sewage treatment and disposal facilities are proposed both at the Kiwi Burn Terminus and the Te Anau Downs terminus.

— The land area requirement for sewage treatment and disposal could be significant given the constraints at both locations.
— The areal locations for the land application of treated effluent have not been clearly provided.
— The needs for toilet (and other) facilities along the mountain bike track have not been addressed.

5.6 Solid Waste

A Storage and disposal of potentially hazardous material

— The application contains a DRAFT Construction Management Plan including a Hazardous Substances Management Plan.
— The applicant proposes to contain and remove all hazardous waste and wastewater, with the exception of natural spoil, from the Conservation Estate.
— Failure to plan for, to prepare for, to maintain and operate, to demolish and to rehabilitate storage sites and facilitates increases the risk of adverse effects
— Failure to plan for, to prepare for, to maintain and operate construction and operational plant and equipment increases the risk of adverse effects
— The application does not contain a plan on how to deal with emergency situations, such as accidental spillage of hazardous substances. It is recommended that such a plan is developed and included in the DRAFT Construction Management Plan.
— It is essential the Construction Management Plan is communicated to all involved parties before construction commences.
— There is no guidance on the management of excess cleanfill (i.e. excavated soil from cuts and foundations)
— The guidance around disposal of vegetation waste is conflicting.

5.7 Traffic

A Car Parking Facilities

— There is a potential for high vehicle traffic movement between Te Anau Downs and Kiwi Burn if the monorail become stand alone attraction and as the mountain bike track gains in popularity.
— Car parking facilities and their sizes have not been confirmed in the application.
— The true footprint of the roading works at termini buildings can not be assessed.

B Mountain Bike Track Operation

— The target user group for the mountain bike track has not been identified in the application.
— Maintenance requirements and vegetation clearance width along the track are driven by this user group, i.e. family track required wider clearance width and track standard than more adventurous user groups.

5.8 Risks

Risks have been identified as follows.

- The corridor will be wider than indicated in the application for reasons that include:
    - The health and safety requirements for the operational monorail are not yet established; it may be trees that can fall on the tracks pose an unacceptable hazard to the operation and tree clearances are significantly great than indicated
    - Geotechnical conditions along the corridor have not been specifically identified; cut slopes, fill slopes, carriage way widths (which will vary depending on road alignments) will all influence the “earthworks” footprints.

  - One major geotechnical hazard has been identified (the slip); other significant hazards could be identified with more detailed geotechnical investigations prior to or during construction; these may require realignments or more extensive works to engineer conditions that are stable eg revetments, retaining walls etc
  - Bridging gullies, cutting slopes, digging drainage channels and other engineering works requirement more rather than less engineering of the environment – only nominal engineering is indicated in the application.

- A perception of a design basis has been created in the current application and, because specific design parameters for the different corridors (monorail, mountain bike track, construction road/ mountain bike track/ service road) are not provided, development of a design parameters during further work may result in significantly different effects that are presented in the current application
- Commercial realities influence designs. The application does not include any cost or finance information. Lower impact design and construction practices may well be significantly more expensive than design and construction practices that have higher short term impact or allow for high cost ongoing remedial measures (e.g. control river bank scour, clearing slips, reinstating washouts.
- The monorail examples provided with the application are located in urban environments. Such environments are likely to be well engineered environments where there is good knowledge of geotechnical and other design conditions. The proposed monorail is in a wilderness environment with a detailed understanding of the geotechnical conditions being largely unknown. Clearly this creates risk both for the applicant and the Department in that design parameters in terms of construction and operation. Such risk may include hills side creep in excess of monorail design tolerance, increased tree clearance requirements, grade modifications because of frost and ice, etc.
- The mountain bike track (MBT) design user numbers are not provided. The provision for amenities is not addressed. The MBT is to be a family experience. Shelters, camping facilities, water supplies, toilets and first aid facilities may required along the track. Given the growth of the Central Otago Rail Trail user numbers and the growth in widening or adding to the rail trail experience (horse riding, walking, accommodation, sign posts etc), the proposed MBT may experience similar growths. As a result there would be higher end of road numbers and increased pressure on the Kiwi Burn facilities. Such effects have not been considered.
- Responsibilities for the operation and maintenance of the MBT are not provided. The costs of maintaining a family standard track will be significant and the standard of design and construction will significantly affect operation and maintenance costs
- The monorail may become a stand alone feature with the consequences of higher user numbers at the termini, more frequent monorail trips, increased demands on assets (e.g. access roads, termini, utilities) and associated increase of adverse environmental effects e.g. litter, noise, visual intrusion etc).

In our opinion, the level of engineering information both in written and visual forms and the extent of the unknowns mean that a reasonable understanding of the reality of the proposed monorail and the mountain bike trails in not able to be made (i.e. have a bench mark image of the engineered environment). Thus, it is our opinion there is not a sound basis upon which to carryout a full assessment of effects.

It is considered that, because knowledge about the environment and potential future risks will develop with further investigations and the design and construction will evolve in response to this knowledge, the better understanding of effects, and the input of monorail expertise, any concession process should be staged so as to adequately manage the responsibilities conferred upon the Department through legislation and policies.

5.9 Recommendation

Because of the significant unknowns, it is recommended that the Department consider the following actions:

- Seek preliminary design standards (geometry, structural, flood recurrence interval (including climate change), design life, etc) for the monorail (generally provided), the construction road, the mountain bike track and the monorail service road, termini and spur roads
- Seek independent advice from someone experienced in the design and operation of a monorail, and particularly around the risks of an operation in a wilderness environment
- Seek a lower and upper bound earthworks footprint and tree clearance corridor based on current information to use a benchmark during any subsequent concession process
- Should the Department resolve to grant a concession, then stage the concession process so as to monitor and control the development of project (if a process of provisional concession licences and any ultimate concession licence is not enabled by the legislation) in phase with the development of knowledge about the Site and design and construction needs, and so as to retain and maintain the ability of the Department to optimise the Department's role in fulfilling its responsibilities under the Conservation Act, National Parks Act and relevant Department policies. The concession could be structured with sets of conditions that enable the staged evolution of the project against key performance indicators (KPIs) and "gateways" associated with each set of conditions. These KPIs and "gateways" would be developed by the applicant in consultation with the Department. Sensibly, such concession gateways would be in phase with the project development and the design and construction requirements as they evolve with increased environmental knowledge, filling in the knowledge gaps that currently exist, having monorail expertise involved at the Site, and improvements in understanding of environment effects. Such staging would enable the Department to manage the risks it faces.

Appendix A – Site Boundaries