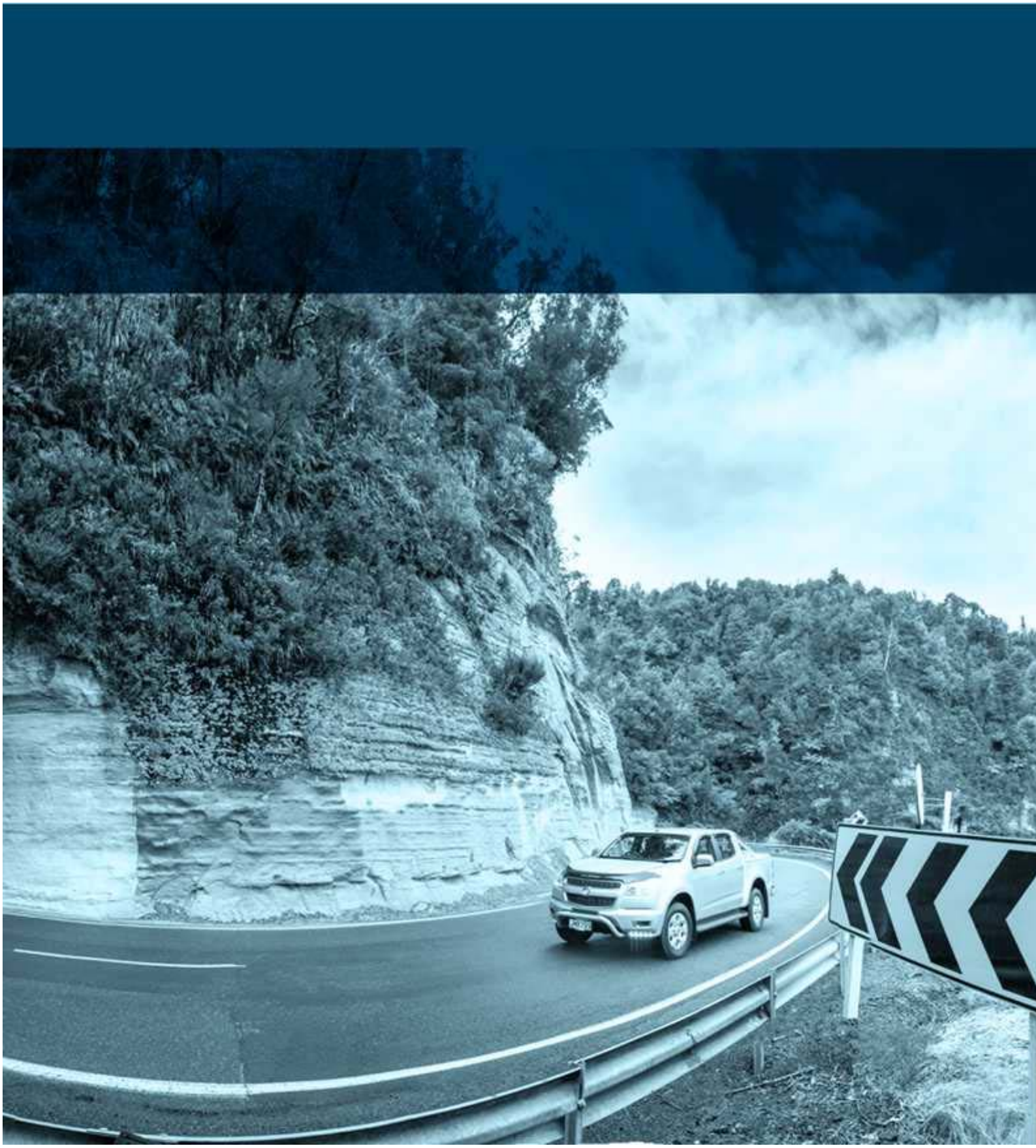
Section 5 – Construction of the Project



5 Construction of the Project

5.1 Overview

This section provides an overview of the proposed construction methodologies for the Project. It should be read in conjunction with Section 4 and with the construction drawings provided in Volume 2 of the AEE.

Construction of the Project will inevitably result in adverse environmental effects that need to be assessed and managed. Effects include those related to construction water management, terrestrial and aquatic ecology, noise, vibration, dust, and traffic. The Construction Environmental Management Plan (CEMP) (refer Volume 5) provides a framework for the management of construction activities and any associated effects.

Construction of the Project will take approximately four years, and will be progressed at several locations simultaneously, along the 6km length of the route. The construction methodology refers to a number of construction zones along the alignment.[26]

5.2 Introduction

This section provides an overview of the proposed construction methodology, sequencing and staging across the Project, followed by further information relating to the nature, scale and duration of construction activities, within the main construction zones. A general description of the following construction activities is provided in this section:

- Construction establishment, including yards and site and haul road establishment;
- Water and wastewater;
- Vegetation clearance;
- Earthworks and erosion and sediment control;
- Streamworks;
- Drainage;
- Bridge construction;
- Tunnel construction;
- Pavement and surfacing;
- Landscape reinstatement; and
- Network utilities management.

This section contains cross-references to the relevant technical reports (in Volume 3), construction drawings (in Volume 2) and management plans (in Volume 5), where further information about the construction of the Project can be obtained.

[26] It is noted that the Project has been developed to a consent level design stage. As the design and investigation process continues it is possible that some design details and aspects of the construction methods may change.

5.3 Construction Environmental Management

Given the sensitive cultural and natural environment values associated with the Project alignment, careful management of works will be undertaken to avoid, remedy, mitigate or offset environmental effects during construction.

5.3.1 Construction Environmental Management Plan

A draft CEMP has been prepared for the Project (refer to Volume 5) and provides the overarching framework for the management of environmental effects associated with construction of the Project. The CEMP is supported by a suite of management plans, which outline the management of specific construction effects, including:

- Construction-related water discharges (Construction Water Management Plan (CWMP));
- Ecological and landscape effects (Ecology and Landscape Management Plan (ELMP));
- Construction traffic (Construction Traffic Management Plan (CTMP));
- Construction noise (Construction Noise Management Plan (CNMP));
- Dust (Dust Management Plan (DMP)); and
- Disturbance and handling of contaminated material (Contaminated Land Management Plan (CLMP)).

The environmental management framework for the Project is further described in Section 10 of the AEE.

5.3.2 Recognising Cultural values

The Transport Agency has consulted directly with Ngāti Tama in developing the Project. This will continue over the duration of the Project. Protocols will be developed with Ngāti Tama to recognise Ngāti Tama's cultural values and significant sites and provide for appropriate cultural management during construction. These protocols will cover aspects such as:

- Kaitiaki responsibilities, including cultural monitoring requirements for activities occurring at sensitive sites, such as vegetation clearance, earthworks, salvaging and translocation of protected fauna;
- Tikanga and cultural practice in relation to Project activities;
- Vegetation clearance, cultural harvest and use of vegetation to be removed during construction;
- Accidental Discovery Protocol.

5.4 Construction method development

The construction methodology and activities outlined in this section were developed through a collaborative and iterative process involving engineers, constructors and ecologists. The intention has been to balance the engineering and construction requirements, programme implications and likely environmental effects to achieve a methodology that, as far as practicable, avoids or, where avoidance is not possible, remedies or mitigates adverse effects. This included consideration of the following:

- The location and extent of construction yards, laydown areas and construction access tracks/haul roads. The intent was to minimise disturbance and vegetation clearance in sensitive environmental areas, and as far as practicable avoid locating construction activities in or in close proximity to sensitive features;
- Construction of bridge and tunnel works to minimise impacts on sensitive environmental areas and habitats;
- Construction programme and timing of particular activities to take advantage of seasonal weather conditions or minimise disruption to ecological breeding and migration patterns where feasible; and
- Transport Agency construction guidelines and standards that seek to avoid and minimise adverse environment effects.

The construction methodology described here aims to retain flexibility for future refinements that might be required during the detailed design or during construction of the Project, while at the same time, ensuring sufficient certainty of outcomes to enable effects to be robustly assessed in this AEE.

5.5 Construction programme

5.5.1 Construction duration

The Project is anticipated to take four years to construct. Construction works are programmed to commence in Quarter 4 2018 and be complete around the end of 2022. An indicative programme is set out in Figure 5.1.

5.5.2 Working hours

General working hours will be between Monday and Sunday 6.30am-9pm. These general hours take into account the remote Project location and small number of surrounding dwellings.

There will however be some construction activities undertaken outside the general working hours. These activities may include:

- Works on the existing SH3 corridor, including construction of site access points (SAPs) at the start of the Project and tie-ins of the new alignment to the existing State highway at the end of the Project;
- After-hours material and plant delivery, including bridge and tunnelling equipment and materials where the transport of oversize loads outside working hours will be less disruptive;
- Tunnelling works, which will be undertaken 24 hours a day; seven days a week during the relevant phase of the Project;
- Early morning concrete pours; and
- On-site servicing of plant and equipment to minimise impacts on construction programme.

All construction works are predicted to comply with the Monday to Saturday day-time construction noise limits set out in NZS 6803: 1999 - Acoustics - Construction Noise (NZS6803:1999).

There is the potential that construction works outside Monday to Saturday 7:30am to 6:00pm will exceed the night-time and Sunday construction noise limits set out in NZS 6803: 1999. However, much of the alignment has large setbacks to the nearest receivers and natural shielding by the local topography, which will, in most cases, enable compliance with the night-time noise limits.

The intention is that works in close proximity to occupied dwellings will be scheduled to be carried out during the hours of Monday to Saturday 7:30am to 6:00pm, to ensure compliance with the NZS6803:1999 limits. However, works outside these hours, which would in turn potentially exceed the night and Sunday noise limits in NZS6803:1999, may be required.

Construction activities will be undertaken in accordance with a CNMP (refer Volume 5). The CNMP will:

- enable the construction team to determine the necessary setbacks, mitigation measures and procedures to enable compliance with the limits; and
- outline the management and communication procedures for night and Sunday works in excess of the noise limits.

5.5.3 Construction regions and zones

For the purposes of programming and physical works management, the Project area has been split into two main construction regions, north and south of the new Mt Messenger tunnel. The regions follow the natural split of the Project area into the Tongaporutu and Mimi catchments.

The construction regions are further split into ten construction zones as outlined in Table 5.1 and illustrated on the construction zone drawings in Volume 2.

Table 5.1 - Construction Regions and Zones

Construction Regions and Zones	Overview of Main Construction Features / Activities
NORTHERN CONSTRUCTION REGION - Chainage 0 – Chainage 3635 Cuts and fills of structural fill are balanced in the northern region, with buttress fill to be imported from the southern region once the tunnel and bridge are complete.	
Zone 1- Chainage 0 – 350	• Northern tie-in to existing SH3 on alignment Note: Zone includes additional 400m on the existing SH3 for construction works
Zone 2 - Chainage 350 – 2375	• Cuts and fills, drainage works • Establishment and operation of main construction yard • Stream diversions • Access tracks / haul roads • Fill disposal site
Zone 3 - Chainage 2375 - 3400	• Cuts and fills, including a large fill on the tunnel approach • Drainage works

Construction Regions and Zones	Overview of Main Construction Features / Activities
	• Piling under fills • Temporary storage of fill material • Stream diversions • Access tracks / haul roads
Zone 4 – Chainage 3400 – 3635 (The tunnel)	• Tunnel portal construction • Tunnel construction yard establishment and operation • Tunnelling operations • Pavement and surfacing and installation of lighting, ventilation etc. • Construction of tunnel control room and water tanks
SOUTHERN CONSTRUCTION REGION – Chainage 3635 to Chainage 5955 Excess fill from the southern zone will amount to approximately 145,000m³ of structural fill and likely will be moved from the south to the north or taken to nearby spoil disposal sites depending on programme.	
Zone 5 – Chainage 3635 – 4150 (The bridge)	• Large cut and fill works between the tunnel and the bridge • Access tracks • Drainage works
Zone 6 – Chainage 4150 – 4270	• Access tracks to the bridge work site • Bridge construction yard establishment and operation • Bridge construction, which will comprise: o Piling works o In-situ pour concrete o Steel erection o Deck slab construction o Pavement and surfacing
Zone 7 – Chainage 4270 – 4825	• Cuts and fills • Access tracks • Drainage works • Spoil disposal site
Zone 8 – Chainage 4825 – 5250	• Cuts and fills • Drainage works • Access tracks • Southern tie-in to existing SH3
Zone 9 – Chainage 5250 – 5955	• Cuts and fills • Drainage works • Access tracks • Tie-in to existing SH3

Construction Regions and Zones	Overview of Main Construction Features / Activities
	Note: Zone includes additional 450m on the existing SH3 for construction works
Zone 10 (no Chainage)	• Fill disposal site

5.5.4 Construction sequence

Construction of the Project will be undertaken on a number of fronts or work faces, such that different construction operations will, at times, be simultaneously progressed across multiple construction zones (refer construction zone drawings in drawing set – Volume 2).

As each zone, or subzone, is accessed the approach will involve:

- **Preparatory works**[27] – Initial works to enable Establishment Works and Construction Works, such as:
  - site surveys;
  - investigations (including geotechnical investigations);
  - monitoring;
  - land disturbance activities to establish site access, access tracks, construction yards, laydown areas and spoil disposal sites and associated erosion and sediment control. Aspects of these works may be undertaken as Permitted Activities (refer Section 2.5).
- **Establishment works** – Progressively opening up the site including, for example, narrow access tracks to reach and construct sediment ponds; followed by wider vegetation clearance, stream diversions, and construction of full width access tracks and construction yards.
- **Main construction works** – Ground improvement, bulk earthworks (including cut and fill activities), drainage installation, bridge construction, tunnelling, pavements and surfacing, reinstatement of site following the completion of construction, landscaping, installation of permanent road furniture and ancillary works.

An indicative construction programme is set out in Figure 5.1.

[27] Preparatory Works do not include vegetation clearance.

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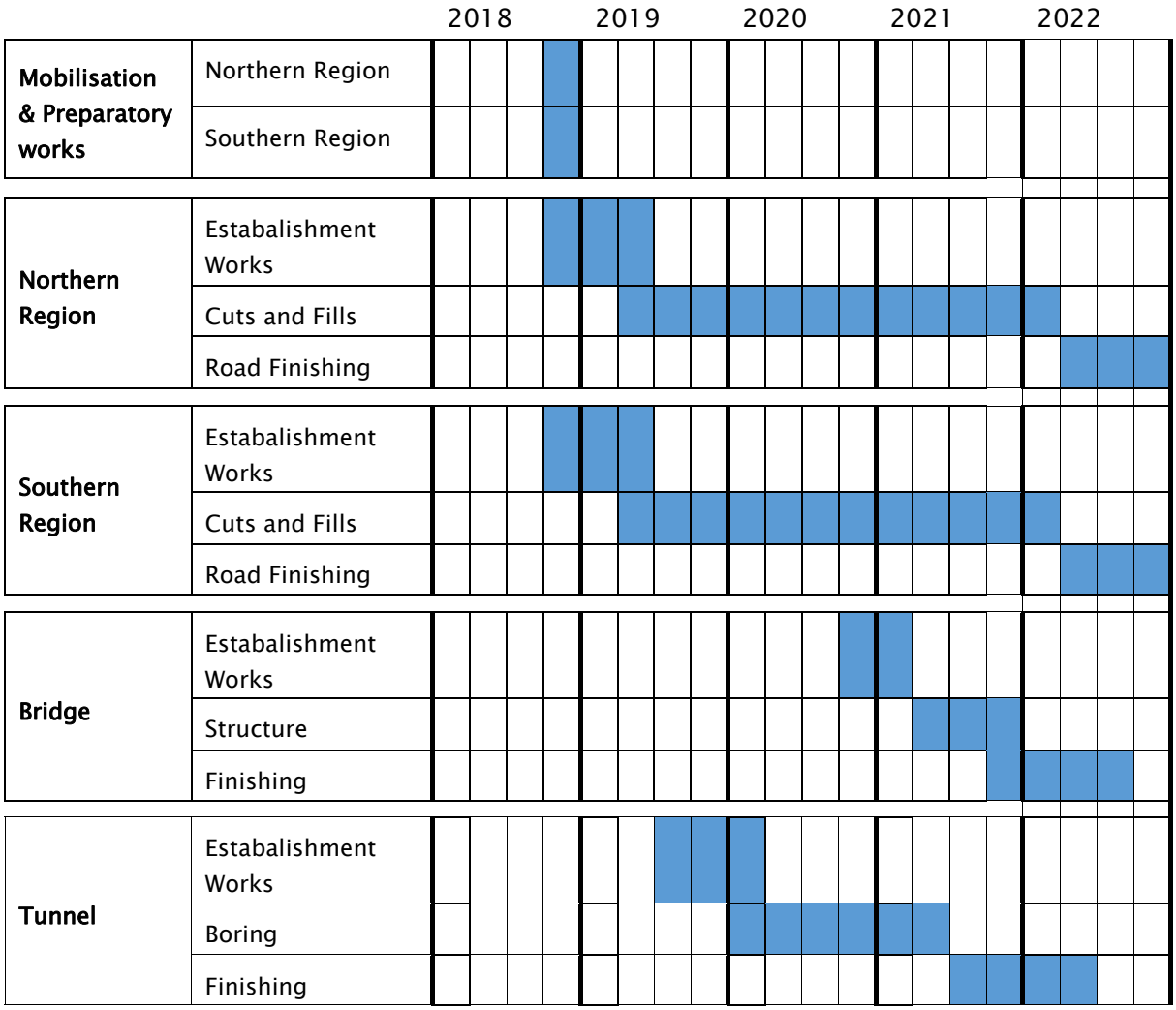


Figure 5.1 – Indicative Construction Programme and Sequencing

The overall construction sequence will generally be as follows:

- Establish construction yards, SAPs, access tracks and erosion and sediment controls in the northern construction region. Undertake site survey prior to vegetation clearance (refer to Section 5.12.2). Install drainage works, including temporary and permanent works as appropriate (drainage will continue to be installed throughout the construction phase).
- While works in the northern construction region are underway, commence construction of SAPs, laydown areas, and installation of environmental controls in the southern construction region. The initial focus will be on establishing a number of SAPs to allow multiple work fronts to be opened.
- Works in the northern construction region will focus on establishing access to the northern tunnel portal, construction of the tunnel yard, and commencing bulk earthworks and cut and fill activities within the northern construction region.

- Once working areas are established at the northern tunnel portal, work will begin on construction of the northern tunnel portal.
- Works in the northern and southern construction regions will continue, including constructing access to the southern tunnel portal before the tunnelling operations reach that point.
- Tunnelling will begin from the northern or southern end, depending on actual programme.
- Construction of the bridge abutments and foundations, following by construction of the bridge structure itself.
- Once the tunnel has broken through, material can be transported from the southern construction regions to the on-alignment disposal sites in the north (Zone 3).
- Once areas subject to bulk earthworks and cut and fill activities are at final levels, any overburden or preload will be removed and final pavement and surfacing works for the road will begin. This will be followed by the installation of road furniture (lighting, barriers, signage etc.), line marking and landscaping.
- Reinstatement and rehabilitation works will be completed across the wider Project area, including reinstatement of construction yards and haul roads, and completion of ecological and landscape planting in accordance with the ELMP.

Refer to the construction staging drawings in Volume 2 for further detail on construction staging and sequencing.

Throughout this work a programme of ecological monitoring and management will be put in place to avoid, remedy, mitigate or offset potential ecological effects. This programme will include the salvage, recovery and translocation of high value flora and fauna from within the construction footprint, where practicable.

In addition, replacement and restoration planting will be carried out to mitigate and offset the effects of the construction of the Project. This will include restoration planting of 6ha of swamp forest and wetland, restoration of 8.9km of riparian margin, replacement mitigation planting of 9ha, and revegetation of as much of the construction footprint that will not be road as is practicable.

The details of the mitigation and offset measures are discussed in Technical Report 7h, and will be set out in the ELMP. Wider environmental management measures will be in place through the construction period as detailed in the CEMP.

5.6 Construction establishment

One main construction yard will be established for the Project, along with smaller yards to support bridge and tunnel construction activities and works where crews are based in remote locations.

The construction yard locations (outlined below and shown on the construction staging and the erosion and sediment control conceptual plans in Volume 2) are based on consideration of a number of factors, including:

- Sites which minimise environmental, social and cultural effects;
- Access to and safe operation of yard access in relation to SH3;

- Proximity to the alignment and key work areas, such as bridge or tunnel works; and
- Topography of the area, favouring reasonably level sites to minimise site establishment works.

All yards will be fenced as required to make them secure during the construction phase. Yard establishment will include site clearance, ground preparation, and the installation of erosion and sediment control measures and temporary drainage (refer to the CWMP for detail on the latter).

Upon the completion of works, the construction yards will be disestablished and the areas reinstated. Reinstatement requirements will be detailed in the ELMP.

5.6.1 Main construction yard

The main construction yard will be located at the northern end of the alignment (around Chainage 400 – 550). A new SAP will be established to provide a safe entry and egress to the yard from SH3 (refer to Section 5.7.2 for further detail on the SAPs for the Project).

The northern construction yard will be the central hub for construction work providing for:

- Main Project office, administrative centre (with training room, first aid room and toilets), and meeting place for construction staff and visitors;
- Main carpark for the site;
- Main plant/equipment storage and workshop and servicing;
- Limited fuel storage and refuelling facilities;
- Main access to northern end of alignment;
- Main delivery point and laydown area for materials (including stockpiles); and
- Transfer and segregation point for site and Project office waste (for off-site disposal).

The yard will be approximately 5,000m^2 in size with an indicative layout shown in Figure 5.2.

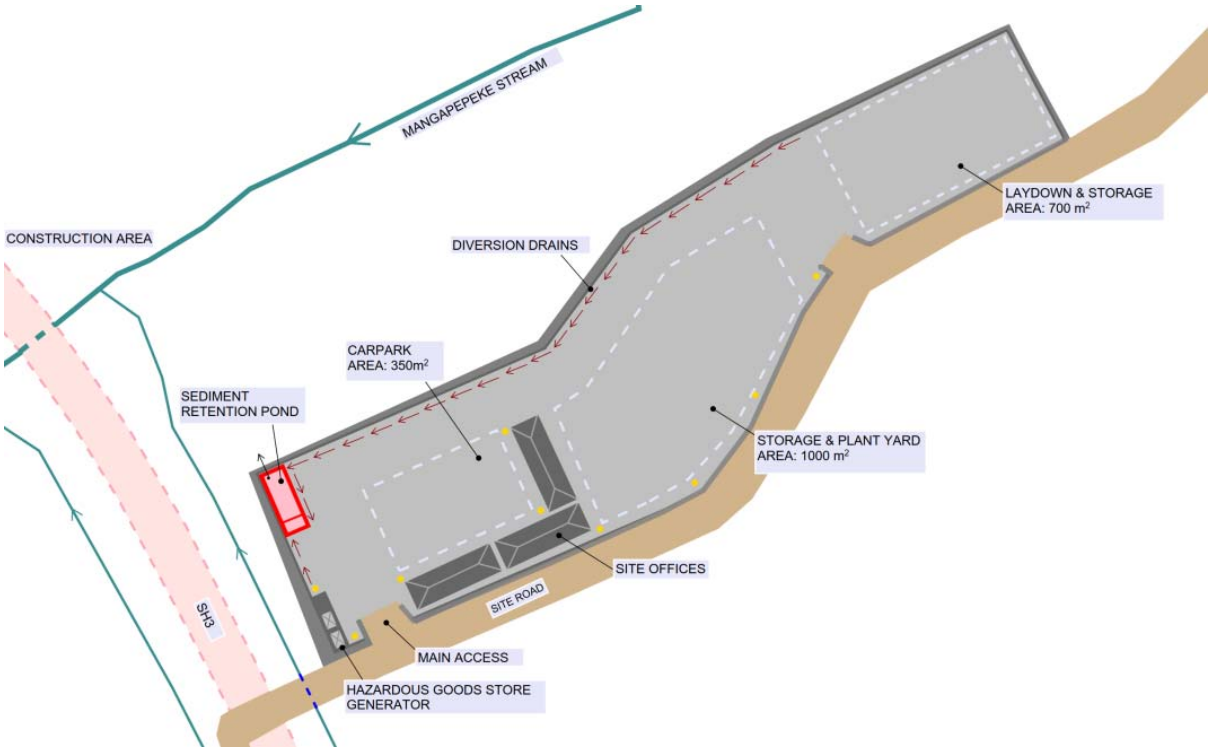


Figure 5.2 – Main construction yard – indicative layout (refer to Volume 2 for full size drawing)

5.6.2 Secondary construction yards

Small construction yards (approximately 2500m^2) will be established at the bridge and tunnel construction work areas, along with remote locations where crews are based. The yards will comprise a small office and welfare facility for the duration of the respective works. The yard will also provide for:

- Local plant/equipment storage;
- Local access to alignment;
- Delivery point for construction materials; and
- Collection of site waste.

5.7 Site access and haul roads

5.7.1 Access philosophy

Site access arrangements for the construction phase have been designed to provide direct access to key work areas, including the bridge abutments and the tunnel, and enable work to be undertaken concurrently in several construction zones. Compared with the alternative of having to work progressively from each end of the Project, this will provide the following benefits:

- Accelerated construction of the bridge and tunnel to facilitate the transport of material from the southern to northern construction regions, minimising the transportation of fill on public roads;

- Minimises unnecessary traffic on the temporary access tracks, enabling their widths to be kept to a minimum; and
- Enables the most efficient sequence for the tie-ins of the new road to SH3 by keeping them free of construction traffic and minimising the duration of potential disruption and traffic impacts.

5.7.2 Site access points

Access to the site during construction will be via specified SAPs as shown Figure 5.3 below and outlined in Table 5.2.

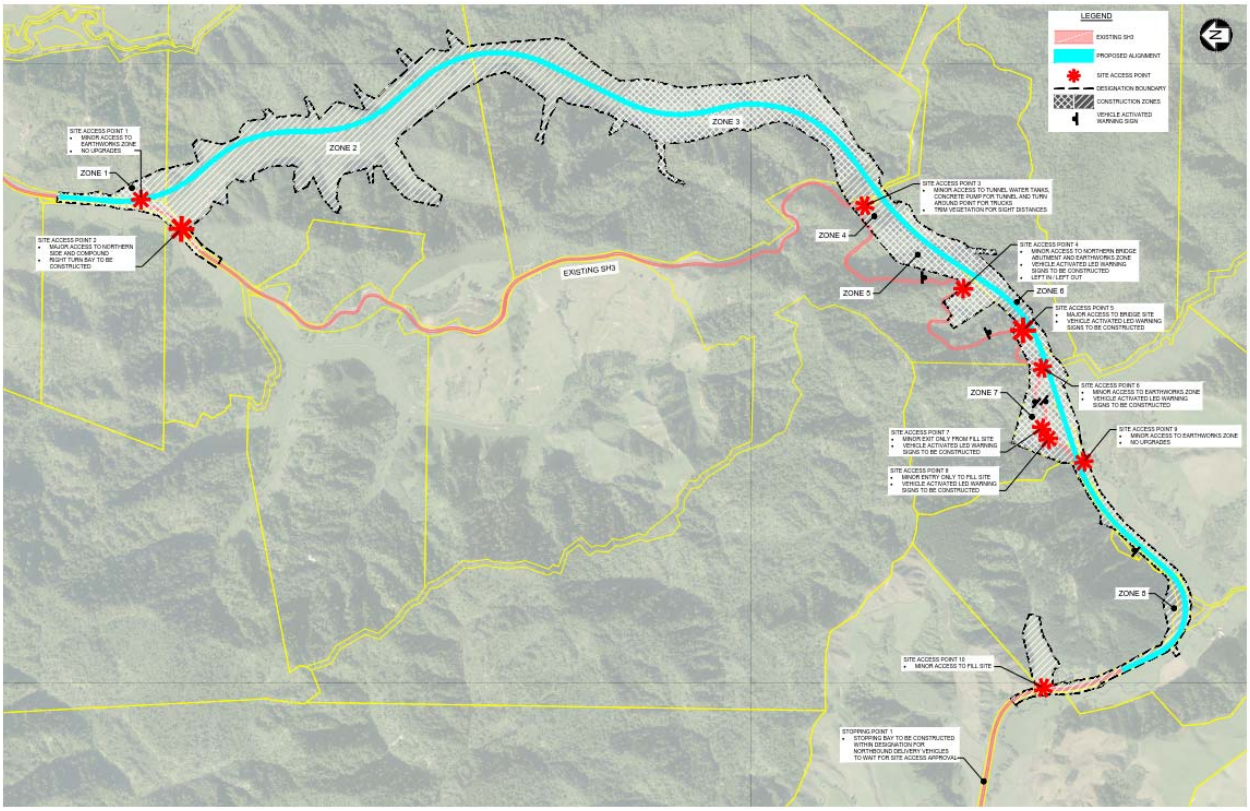


Figure 5.3 – Location of SAPs along the alignment (refer to drawing MMA-DES-TRS-C0-DRG-1001, Volume 2 for full size drawing)

Upgrading of discrete sections of the existing SH3 network will be required to accommodate the safe operation of the SAPs as summarised in Table 5.2.

Table 5.2 – Site Access Points

SAP and work Zone	Purpose	SAP Operation
SAP 1 **Zone2**	SAP 1 will provide access to zone 2 during the early phase earthworks.	The first 10m of the access point will be sealed.
SAP 2	SAP 2 will be the primary access point for the northern construction region, including access to the main construction yard. .	A right turn bay will be constructed (in accordance with Austroads Guide to Road

SAP and work Zone	Purpose	SAP Operation
Northern Construction Region		Construction) to facilitate the safe movement of traffic in and out of the site.
SAP 3 **Zone 4**	SAP 3 is located at the top of the hill adjacent to the tunnel control building and will provide access for: • Light construction staff vehicles and trucks transporting building supplies and equipment for the tunnel control building. • Concrete trucks delivering concrete for the tunnel linings (approximately 8 deliveries/day) • Trucks turning around to access SAP 4	Visibility at SAP 3 will be improved by thinning vegetation on the inside of the adjacent corners.
SAP 4 **Zone 5**	SAP 4 will enable access to the northern bridge abutment and the cut and fill between the bridge and the tunnel. Early access to this area is critical to completing the southern haul route.	SAP 4 will be located on the inside of a bend in a steep, slow speed area. Safety improvements will include: • LED warning signs on each approach that illuminate when a vehicle is approaching on SH3 and a vehicle is exiting or entering SAP 4. • A left in/left out restriction will apply at SAP 4
SAP 5 **Zone 6**	SAP 5 will be the primary access to the northern end of the southern construction region for: • the southern bridge abutment and laydown area; and • earthworks cuts immediately south, from which material will be transported north to construction zone 3.	SAP 5 is located on the outside of a corner, where approach speeds and visibility are constrained by the road's geometry. Vehicle activated LED warning signs will be provided for this access.
SAP 6 **Zone 7**	SAP 6 will be a minor access point for preparatory works in zone 7 (environmental controls, vegetation clearance etc), when access via SAP 5 is not practical.	Vehicle activated LED warning signs will be installed.
SAP 7 **Zone 7**	SAP 7 is will provide access to an area that will potentially be used as a spoil disposal site and/or laydown area. SAP 7 will provide the exit from the one-way loop.	Vehicle activated LED warning signs will be installed in conjunction with SAP 8.
SAP 8 **Zone 7**	SAP 8 will be the corresponding entry to the spoil disposal area / laydown area for SAP 7.	SAP 8 will have LED warning signs to indicate when a vehicle is waiting to turn right into the

SAP and work Zone	Purpose	SAP Operation
		site, operating in conjunction with SAP 7.
SAP 9 Zones 7 and 8	SAP 9 is located at the southern end of the Project where the new alignment meets SH3. • It will initially facilitate earthworks access in zone 7. • Following haul road establishment it will be a primary access point for the southern construction region, and pavement and surface works.	SAP 9 has good sight distances in each direction. No upgrades are proposed.
SAP 10 Zone 10	SAP 10 will provide access to the fill site just south of the Project. If used, trucks will turn right into the site and left out.	No upgrades are proposed other than sealing the first 10m of the accessway.
Stopping Bay 1	A stopping / pullover bay will be located on the southern approach to the site, for trucks to wait if site access is not immediately available. Truck drivers will have radio contact with site crews to check site access prior to entry.	The stopping bay will comprise a 4m wide and 100m long sealed shoulder.

All SAPs will be signposted and secured with gates and security fencing so that access will only be possible for those authorised to access the site (including workers, and movement of materials and plant). Access points will be locked overnight when not in use. All site accesses will be developed so as to ensure good visibility to and from the accesses in keeping with the approach design speeds.

SAPs will be managed in accordance with the Transport Agency Code of Practice for Temporary Traffic Management (CoPTTM) and the CTMP (refer Volume 5). Appropriate controls such as flashing beacons and speed restrictions will be implemented as required. Where appropriate, access points will be sealed for the first 10m to prevent the tracking of debris onto the SH3 network.

5.7.3 Haul roads / access tracks

Temporary construction access tracks and haul roads will be required along the length of the alignment to transport, plant, machinery, personnel, construction materials and fill material throughout the Project area and between construction zones.

Where possible, haul roads will be constructed on the permanent alignment to minimise the extent of disturbance and vegetation clearance. Access tracks and haul roads are shown on the construction staging drawings and in further detail on the erosion and sediment control conceptual plans in Volume 2.

Construction of the access tracks is detailed in Section 5.13.2.

5.7.4 Temporary traffic management

The offline location of the alignment from the existing SH3 corridor will enable most construction activities to occur without disrupting passing traffic. Aside from the SAPs

described in Section 5.7.2, the only locations where the public will be affected by the proposed construction works are the northern and southern tie-ins to the existing SH3 at the completion of the Project.

The tie-ins will involve reconstructing the existing SH3 carriageway to provide a new shape (camber) and pavement through replacement of basecourse and/or cement stabilisation. These works are similar to standard pavement rehabilitations routinely undertaken across the State highway network. Works will occur on one side of SH3 at a time, with stop/go control of traffic in place. Given the relatively low volume of traffic on SH3 (2,300 vehicles per day), a stop/go operation will be able to clear waiting traffic every time, without a build-up of queues as can occur on busier roads.

All construction works involving temporary traffic management will be undertaken in accordance with the CTMP (refer Volume 5). The CTMP has been prepared in accordance with the CoPTTM, and outlines the requirements for safe and efficient traffic management during construction in order to reduce adverse effects on the State Highway network. Specifically, the CTMP addresses:

- SAPs and associated traffic controls;
- Temporary speed limits during construction;
- Delineation devices, such as cones;
- Advance signage;
- Maximum delays permitted during traffic management control; and
- Notification to road users of potential disruptions on the State highway network as a result of the Project.

5.7.5 Construction material sources and transportation

Materials required for construction of the Project, along with the source and transport requirements, are outlined in Table 5.3.

Table 5.3 - Construction Materials

Material	Source
Bulk Fill	• Earthworks will be mostly managed on-site, avoiding the transport of bulk fill via SH3 and the local road network. Up to approximately 87,000m^3 of cut material may be transported to the fill sites on the southern side of the Project, involving approximately 80 truck movements per day over six months.
Aggregates	• Aggregates for access tracks, drainage fill and pavements will be imported to site from quarries within the Taranaki region depending on material type (size quality etc.) and haulage distance to site. • Aggregate will be transported to site by truck and trailers along SH3. Trucks will access the site via the SAPs outlined in Section 5.7.2. Aggregate deliveries will average around 10 deliveries per day over the duration of construction. The peak will occur when pavements are being laid with up to around 60 deliveries per day.

Material	Source
Concrete	• Concrete for the bridge and tunnel construction will be delivered ready-mixed from New Plymouth. During tunnel lining, approximately eight truck deliveries per day can be expected, for around 12 months.
Pavement and surfacing Materials	• Chipsealing materials (bitumen and chip) and asphalt will be delivered to site as required for pavement and surfacing works. Based on typical production rates, surfacing days will require around 60 deliveries per day. Surfacing will occur over a total of around 20 days. • Asphalt required for bridge and tunnel surfacing will be transported from New Plymouth.
General construction items and consumables	• General construction items, such as culverts, geotextile, steel, barriers, fencing will be manufactured off-site and delivered to site as required (likely via SH3, from either New Plymouth or Hamilton). These materials will generally arrive on single unit trucks or semi-trailers. • Fuel will be delivered to site on a daily basis by mini tanker and transported on-site to plant and equipment. Potable water and trucks to remove sewage from on-site toilets will visit the site as required.

As these various activities will not overlap, an average of between approximately 30 and 80 truck deliveries per day is anticipated, depending on the stage of construction. However, the normal fluctuations of construction activity will require larger numbers of trucks at times during the construction period.

5.8 Water & Wastewater

5.8.1 Water

Water will be required for a number of construction activities. The bulk of the water will be used for dust suppression. Other activities, such as compaction of granular materials, ground improvements, structural work and vehicle washdown, will be secondary uses of water.

Surface water will be abstracted from the Mimi River in the south, and the Mangapepeke Stream in the north (downstream of the confluence of Mangapepeke Stream and an unnamed tributary). Abstraction volumes will likely range from 300m^3/day – 450m^3/day during dry weather:

- 300m^3/day is the likely estimate with dust control rationalised to locations of sensitive receptors (refer to the DMP in Volume 5 for further detail).
- 450m^3/day is the conservative upper limit where dust control is applied across the full construction site (regardless of the presence of sensitive receptors).

At these locations a screened intake and pump will be established in a deeper section of the stream. To raise the water level locally it may be necessary to establish a low weir across the streambed. If this is required, a temporary structure made from sandbags or similar temporary materials would be constructed either partially or fully across the stream bed. The structure would be constructed to enable fish passage.

Abstracted water will be pumped from both the north and south construction regions to holding tanks.

Abstraction will likely occur for a period of approximately 10 – 24 hours per day. The instantaneous abstraction rate will vary with pumping times, as summarised in Table 5.4.

Table 5.4 - Indicative daily volume and instantaneous flow rates

Total daily volume (m^3/day)	Volume from Mimi River (m3/day)	Instantaneous flow rate (l/s)		Volume from Mangapepeke Stream (m^3/day)	Instantaneous flow rate (l/s)	
		10hr	24hr		10hr	24hr
300	150	4.2	1.7	150	4.2	1.7
450	150	4.2	1.7	300	8.3	3.5

Water from sediment retention devices will be re-used in construction operations, as practicable.

Potable water will be brought to site via water tankers and stored on site in the construction yards in water tanks.

5.8.2 Wastewater and washwater

Wastewater or washwater will be managed as follows:

- All sewage will be removed from site via tankers for treatment at an approved treatment plant (i.e. no wastewater treatment or disposal will occur on site).
- Dedicated hardstand wash out areas for items such as tools and small equipment, and concrete washout water, will be provided on site in accordance with the CWMP. All washout areas will drain to sediment ponds for treatment.

5.9 Construction workforce and transport

Most of the construction workforce will likely reside in Waitara and New Plymouth, with a smaller proportion in Mokau, Tongaporutu, and Urenui. No accommodation will be provided on-site.

At peak periods, a total of 200 to 250 staff are expected to be on-site at any one time. By the nature of the workforce, some will travel to site by a single occupant vehicle, while others will choose to carpool with three to four people per vehicle. Carpooling and minivan transport will be actively encouraged.

Vehicle parking will be provided within the Project construction yards or dedicated areas within the construction area.

5.10 Site communications

Site communications will be via a series of dedicated radio channels. Each radio channel will be allocated to a particular area or work type. All emergency management and day-to-day activities will be managed through this system.

Cellphone coverage in the area is not reliable, so land-line telephone systems will be installed for wider communications. It is noted that Crown Fibre Holdings have announced

plans to upgrade mobile coverage in the area from Mt Messenger to Tongaporutu as part of a programme to upgrade mobile coverage at mobile blackspots for around 1,000km of State highways.

5.11 Construction lighting

Temporary construction lighting will be required at construction yards and active working areas to enable construction during the hours of darkness, especially during the winter period.

Construction lighting, including light spill will be managed through:

- Considering the selection, layout and arrangement of temporary lighting including shrouding and spectrum limits to minimise impacts on adjacent ecological habitats and any residential;
- Separation between the night time work and any residential boundary; and
- Reducing construction yard lighting to low levels for security purposes when yards are not in use.

Glare from any lighting will be kept below the recommendations in AS 4282 – 1997 "Control of the Obtrusive Effects of Outdoor Lighting".

5.12 General construction activities

5.12.1 Demolition

Any demolition required within the Project area (such as the removal of the small number of existing buildings or structures) will be undertaken in accordance with the Best Practice Guidelines for Demolition in New Zealand (NZDAA November 2011). The guideline include procedures for safely handling any hazardous substances, such as asbestos.

5.12.2 Vegetation clearance

Vegetation removal will be required for construction of the Project, however clearance will be limited to the minimum areas required for construction of the alignment and associated activities, such as spoil disposal sites, construction yards and access tracks. The erosion and sediment control conceptual drawings (Volume 2) show ecologically significant vegetation to be protected during construction. This vegetation will be confirmed during site surveys prior to the commencement of construction.

Vegetation clearance will be undertaken in accordance with the CEMP and the ELMP (Volume 5), including bat, lizard and tree felling protocols. It is anticipated that vegetation clearance, cultural harvest and use protocols will be developed in collaboration with Ngāti Tama prior to the commencement of construction.

Prior to any vegetation clearance, a pre-clearance ecological survey will be undertaken to identify trees and areas of habitat where fauna are residing and a constraint map will be produced for each zone, showing the survey findings (e.g. trees to be protected, and general vegetation types to be cleared – native, exotic etc).

Physical delineation (such as fencing or flagging tape) will be used to clearly mark the extent of vegetation clearance to be undertaken, along with vegetation to be protected. Vegetation

will be cleared only prior to construction works beginning in the area in order to reduce habitat effects and reduce the potential for erosion and sediment generation.

Exotic vegetation will be cleared by bulldozer or chainsaw, with cleared vegetation mulched and stockpiled for re-use in the landscape planting following the completion of construction.

Wherever practicable, native trees will be felled by a chainsaw and smaller native bush felled by bulldozers. The trees will be de-limbed and vegetation (branches) removed from the logs will be stockpiled adjacent to areas of remaining native vegetation.

5.13 Earthworks

The alignment has been designed to minimise the amount of earthworks required for the Project. Approximately 960,000m^3 of excavated (cut) material will be generated from the site. Of this, 890,000m^3 of material is to be placed in fill embankments on-site. As such, an excess of approximately 70,000m^3 structural fill will be disposed of within the designation boundaries either in spoil disposal sites or embankments. A further 75,000m^3 of unsuitable material is expected and will likely be disposed in spoil disposal sites (refer to Section 5.13.4 for further detail on the disposal sites).

The earthworks will generally comprise the following, outlined in further detail below and in Technical Report 13 (Volume 3) and the CWMP (Volume 5):

- Site establishment works – topsoil stripping, establishment of erosion and sediment controls, installation of permanent and temporary drainage;
- The establishment of spoil disposal sites;
- Gully clearing and filling;
- Bulk earthworks, including cut and fill activities and embankment construction; and
- Site reinstatement and rehabilitation following the completion of construction.

Cut and fill activities will include the following:

- A number of cut slopes (up to approximately 60m in height);
- A number of deep rock cuttings (up to approximately 60m deep);
- Low earth fill embankments (typically <3.5m high) across low-lying valleys within the Project area;
- Higher earth fill embankments (up to approximately 40m high) crossing the more elevated gullies in the Project area; and
- MSE fills in localised areas of the alignment where steep-sided embankments are necessary.

5.13.1 Establishment

Site preparation prior to the commencement of earthworks will require:

- Identification of the location of services, which may require diversion outside the area of excavation;
- Clearing of vegetation and stripping of topsoil; and
- Installing erosion and sediment control measures (refer to the CWMP in Volume 5).

The construction methods for earthworks include:

- Cut to fill within the earthworks zone;
- Cut to fill using the haul road; and
- Import fill from other zones.

5.13.2 Access tracks

Temporary access tracks will be established by placing a layer of geofabric on the existing ground and overlaying structural fill. On soft ground or in flood-paths, appropriately sized temporary culverts will be installed beneath the access track.

In areas of very weak ground, a bridging layer of logs may be used with the geofabric. This construction method will generally be applied in locations where the depth of weak ground means that removal is not practical (eg where depth is greater than 500mm).

If required to provide an all-weather access, access tracks and haul road running surfaces will be constructed using imported basecourse.

Diagrams of the proposed access track construction are presented in Figure 5.4 and Figure 5.5.

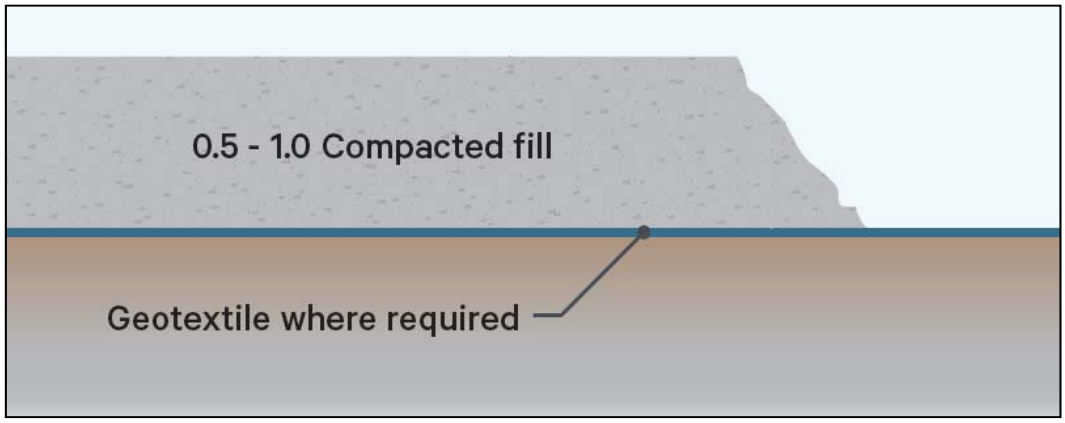


Figure 5.4 – Proposed construction of the access track

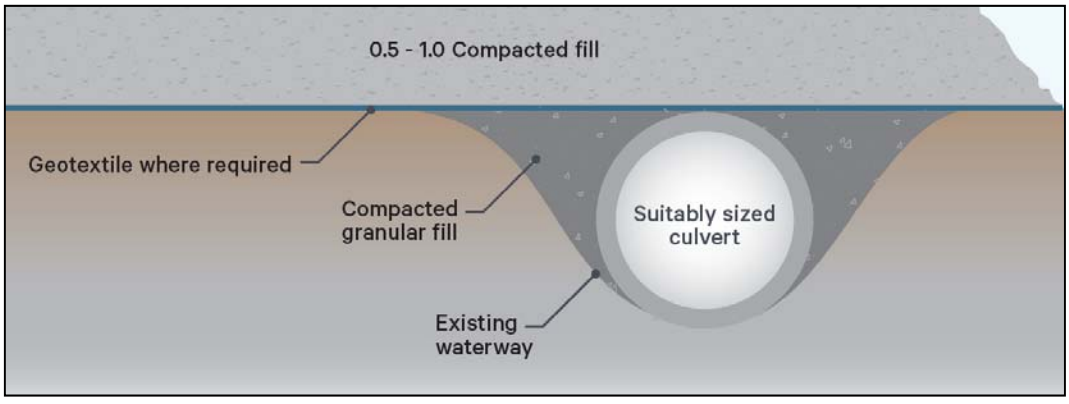


Figure 5.5 – Proposed construction of an access track over an existing waterway

When working uphill, erosion and sediment controls will be installed prior to the commencement of track construction and will remain in place during construction. Water from track construction will be channelled back along the side of the track to the previous sediment pond. When construction reaches the site of the next sediment pond, construction of that pond will commence while work continues on access track construction. During this time, the water will track back to the previous pond until the next pond is completed and stormwater from the access track can be diverted into it.

When working downhill, a narrow access track will be constructed initially to reach the next sediment pond site. The pond will then be constructed before the access track is widened to full width.

5.13.3 Gully clearing and filling

Gullies along the alignment will need to be cleared and filled as part of the early works to enable both construction access and subsequent construction of the alignment.

The gully filling methodology will likely be as follows:

- Clear topsoil and excavate unsuitable materials;
- Diversion of watercourses;
- Installation of temporary / permanent culverts; and
- Placement of fill within the gully to the level required for access track or alignment construction.

In some of the very narrow valleys, diverting the watercourse will not be practical. Instead, short sections of stream will be over-pumped while the stream bed is inlaid with a perforated pipe culvert wrapped in drainage metal and filtercloth. This process will be repeated in short steps working up the valley.

The gully areas will be subject to further filling during the main phase of construction works, in order to form the final contours of these areas.

All gully works will be undertaken in accordance with the relevant ecological and erosion and sediment control requirements outlined in the CEMP, CWMP and ELMP (refer Volume 5).

5.13.4 Spoil disposal sites

Construction of the Project will generate approximately 145,000m^3 of surplus fill material (structural and unsuitable).

Potential permanent spoil disposal sites are shown on the construction staging drawings and the erosion and sediment control conceptual plans in Volume 2 (referred to on the drawings as Provisional Fill Sites). Two spoil disposal sites are located in the southern construction region where earthworks will generate a surplus of material, thereby reducing haulage distances. Spoil disposal sites have also been identified in the northern construction region, allowing similarly for efficiencies of haulage and materials handling.

These spoil disposal sites could be utilised for both / either the permanent placement of spoil, and / or for the temporary storage of topsoil, and for spoil stockpiling on-site until alternative fill sites become available, or for spoil conditioning. The sites will have a

combined volume sufficient to accommodate surplus fill[28]. The decision as to how much spoil to send to each site will be based on actual earthworks progress rates, and the most efficient site relative to the cut location at that time, along with considerations of the final use and form of the spoil disposal site, including any requirements of landowners.

Appropriate erosion and sediment controls will be installed for the respective disposal sites as outlined in the CWMP (refer Volume 5) and as shown on the erosion and sediment control conceptual drawings in Volume 2. Wet materials will be contained behind bunds to manage any discharge from the material.

Following completion of construction, disposal areas will be contoured, landscaped, and vegetated in accordance with the provisions of the ELMP and LEDF (refer Volume 5 and Technical Report 8b in Volume 3).

Where ephemeral streams or flow channels are located within the footprint of spoil disposal sites, subsoil drains will be aligned at the base of these fill sites. Following completion of works, water will either drain around the edge of the fill area or across the surface.

5.13.5 Temporary stockpiling

Topsoil or other unsuitable materials will be stockpiled on site until suitable permanent disposal sites have been developed. These temporary stockpiling areas may also be used to store construction equipment during the construction phase of the Project or for disposal.

Temporary stockpiling areas will be established in designated areas across the Project (refer to the erosion and sediment control conceptual drawings in Volume 2). Stockpiles will be constructed and bunded in accordance with erosion and sediment control and dust management requirements outlined in the CEMP. Temporary stockpiles will be removed at the completion of construction.

5.13.6 Cut slopes

Material will be excavated mechanically from cut faces and will be stockpiled or loaded directly onto trucks to be transported for use as fill elsewhere on the Project, or for disposal.

Figure 5.6 provides an indication of how access to the top of the cut slopes will be gained using temporary haul roads across the cut face of up to a 15° gradient.

[28] It is noted that the fill embankments described in Section 4.13 and in Sections 5.13.8 and 5.13.9 could be designed to accommodate additional fill if that is required during construction.

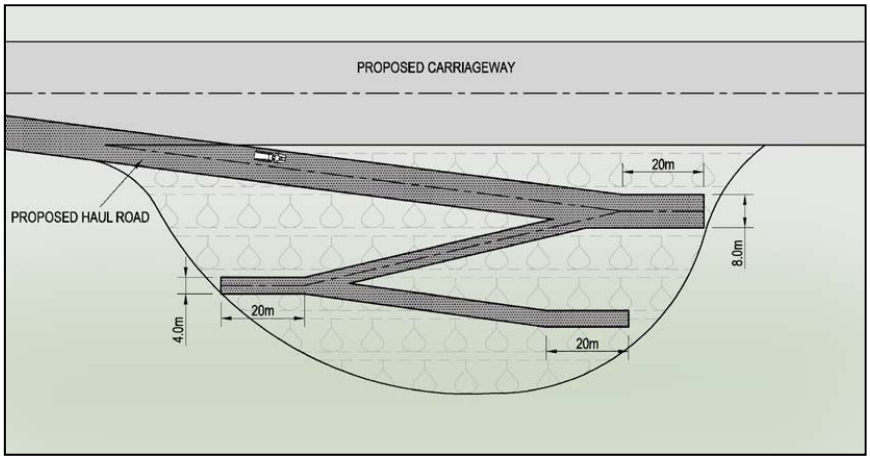


Figure 5.6 – Indicative haul road configuration for large cut slopes

At the cuttings, it is anticipated that a number of perched water tables will be present within the coarser sandstone layers. Based on the available information, preliminary modelling of possible groundwater seepage from the road cuttings indicates that in the order of 10 to 30m^3/day of groundwater could drain from the combined total area of cut faces along the Project alignment.

5.13.7 Rock cuttings

A combination of soil nails, rockfall drape and a catch-ditch will be installed to mitigate the effects of minor rock falls and slabbing failures within the rock cuttings (refer Section 4.13 and Figure 4.1). The soil nails and anchors for the rock drape will be installed as the cuttings are excavated to minimise the risks associated with manual work at heights.

5.13.8 Low earth fill embankments

The embankments located in low-lying valleys are expected to be underlain by a significant depth of very soft to soft, highly compressible alluvial soils (refer Technical Report 14 in Volume 3 for further detail). These embankments will be pre-loaded with surcharge fill material and wick drains (pre-fabricated vertical wick drains covered with a drainage blanket) installed, to accelerate settlement of the embankments and consolidate the ground below at a quicker rate. The surcharge fill will be approximately 1 – 2m high and will be in place for around six to nine months. Refer to Section 5.13.10 for further detail on surcharge fill and wick drain construction.

Staged construction may be required for the higher embankments on very soft soils. Where possible, surcharge fills will be placed on the central portion of the embankments and used to create the gentle 1V:4H batter slopes once preloading is complete.

Erosion and sediment controls will be in place throughout the pre-load period, as set out in the CWMP (refer Volume 5).

5.13.9 Higher embankments and MSE fills

Where higher embankments with steep slopes and MSE fills are located on soft alluvial soils, these will either be undercut and replaced with compacted fill (if excavation depths are

manageable), or a load transfer platform constructed at the base of the embankment using the likes of driven timber piles with geogrid and a gravel platform.

Higher embankments located in the more elevated gullies are expected to be underlain by a relatively thin cover of surficial materials, except in localised areas where former landslips have occurred or colluvial materials have collected at the toe of slopes or on level areas. The weak, surficial soils will be excavated and slopes benched ready for placement of cut to fill material from nearby cuttings and/or the tunnel.

Upon completion of cut to fill activities within each construction zone, any further earth moving required between zones is likely to be carried out after completion of the bridge and tunnel structures.

The ground conditions associated with these two embankment types are very different and this is reflected in the construction and treatment requirements for each.

5.13.10 Ground improvements

5.13.10.1 Wick drains/driven timber piles

As outlined in Section 5.13.8, wick drains will likely be required to assist with embankment construction in low-lying valleys within the Project area in order to speed up dissipation of excess pore pressures (to achieve foundation soil strength gain and allow staged construction to proceed quickly). This will minimise the amount and/or duration of surcharge preloading required. The proposed installation method involves constructing access tracks and embankments over the peat deposits in the valley floors, as follows:

- Top soil will be left in place;
- A high strength geotextile will be placed directly on the existing ground surface;
- The base of the embankment will be constructed using a granular rock fill, with engineered bulk fill placed above;
- Wick drains will then be installed into the existing ground; and
- Once the wick drains are installed, a further layer of fill will be placed to create the embankment or access track.

Figure 5.7 shows the typical wick drain installation method, while Figure 5.8 shows an indicative wick drain layout.

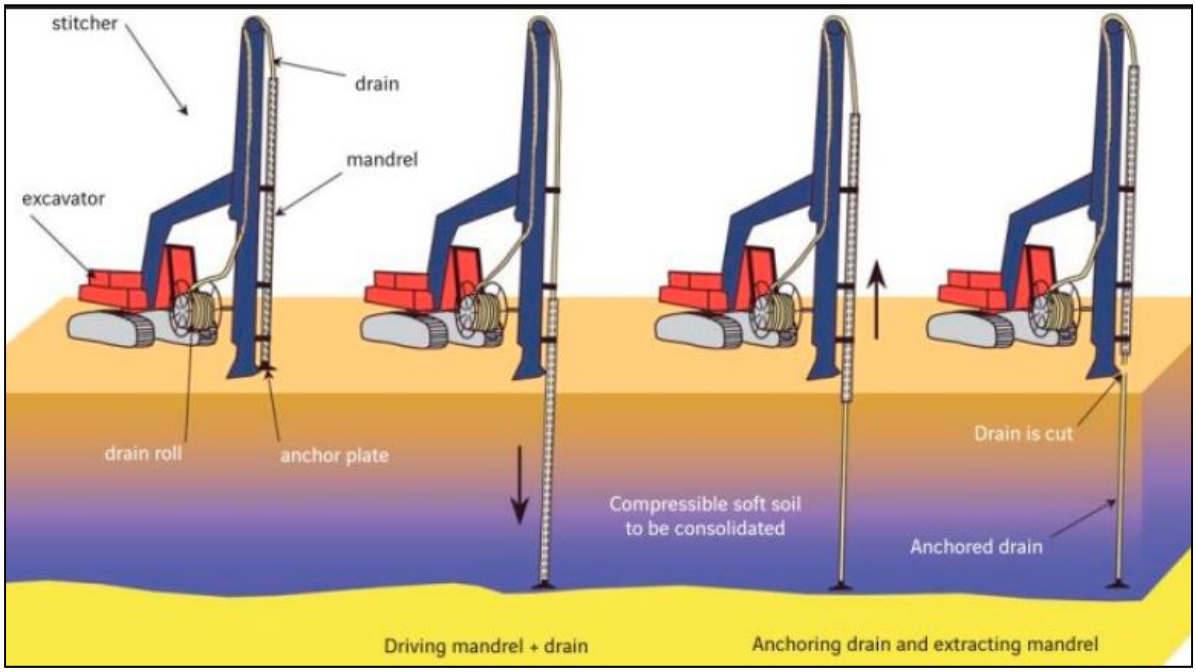


Figure 5.7 – Wick Drain Installation Method

Figure 5.8 – Indicative wick drain layout

In some areas, driven timber piles will be used instead of wick drains. Timber piles will only be used where the required length of pile is less than the economic length of timber piles (usually less than 12m). Timber piles will be driven into the ground to the required depth using an excavator or crane mounted driving hammer.

5.13.11 Construction water management

The Project will require the disturbance of land within the designation boundary for earthworks and vegetation removal. An overriding principle has been to minimise the land disturbance required in order to reduce construction-related sediment from entering

watercourses within the Project area and the downstream environment. To achieve this, construction works will be undertaken in accordance with the best methods and practice available at the time of construction to:

- Minimise the volume and area of the proposed earthworks required for the Project through the Project design matching expected soil types and geology while meeting the road geometry requirements;
- Minimise the potential for sediment generation and sediment yield while maximising the effectiveness of erosion and sediment control measures associated with earthworks; and
- Avoid or mitigate potential adverse effects on freshwater and marine water environments within or beyond the works boundary, with particular regard to reducing opportunities for sediment generation.

Principles and approaches for construction water management works are set out in Technical Report 13 (Volume 3) and the CWMP (Volume 5).

5.13.11.1 Erosion and sediment controls

Sediment control on the Project will involve the interception and treatment of sediment-laden runoff from the various construction areas along the Project, and will be carried out in accordance with the Transport Agency and Regional Council land disturbance guidelines[29]. Sediment control will be established through the use of recognised sediment control measures and site management practices.

The general sediment control measures to be used on the Project are set out in Technical Report 13 (Volume 3) and the CWMP (Volume 5) and include:

- Sediment retention ponds;
- Decanting earth bunds;
- Container impoundment systems;
- Silt fences and filter socks; and
- Chemical treatment (use of flocculants).

Typical details are shown on the erosion and sediment control conceptual drawings in Volume 2.

The CWMP will guide the overall approach for construction water management during construction. Given the scale of the Project, Specific Construction Water Management Plans (SCWMPs) will be developed for specific locations and activities, in accordance with the direction and principles of the CWMP. The SCWMPs will outline the location and activity specific construction methodologies and management measures to be implemented during works.

[29] Guidelines for Earthworks in the Taranaki Region (Taranaki Regional Council , 2006); Erosion and Sediment Control Guidelines for State Highway Infrastructure – Construction Stormwater Management (Transport Agency, 2014)

5.14 Works in streams

5.14.1 Stream realignments

Stream diversions will be required during construction to temporarily divert flows around working areas in order to allow construction works to progress or provide access to construction areas. Permanent stream diversions will also be required to divert streams around or through a permanent Project feature, such as an embankment, bridge or culvert. In both temporary and permanent cases, the stream diversion will be necessary in order to establish an 'off-line' environment to allow construction works to be completed outside of the active stream channel.

Stream realignments and works in streams are generally considered to have a greater potential for adverse effects than earthworks activities due to works being undertaken within the immediate receiving environment and the associated potential for direct impacts on a watercourse. Stream works will be carefully managed to minimise risk to the receiving environment in accordance with the CWMP and SCWMP.

A conceptual sequence of works required to complete a temporary or permanent stream diversion is outlined in the CWMP (Volume 5). SCWMPs will be prepared for each location / activity where works in streams are required and shall include the methodology for stream realignment works within the particular Project location.

5.14.2 Culverts and erosion control and protection structures

Temporary and permanent culvert construction will be required in a number of locations throughout the Project area. Temporary culverts will be provided to allow construction vehicles to cross watercourses and overland flowpaths. All temporary culverts will be removed when no longer needed.

Where works are required within a stream channel to construct the culverts, two main methodologies will be used: either using bypass pumping around the area of works or by creating a temporary stream diversion around the culvert footprint (refer to the CWMP for details).

Key considerations for culvert construction activities are discussed in the CWMP. SCWMPs will be prepared for all culvert installation and works in streams associated with erosion control and protection structures and shall include the methodology for culvert works in the particular Project location.

5.15 Drainage

The installation of the permanent stormwater drainage along the alignment will generally be completed during or prior to ground improvements and earthworks.

5.16 Bridge construction

5.16.1 Bridge foundations

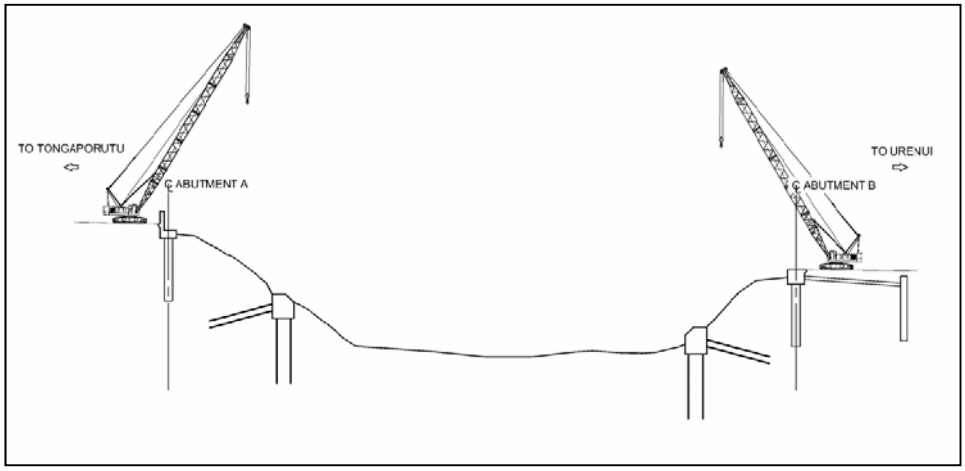
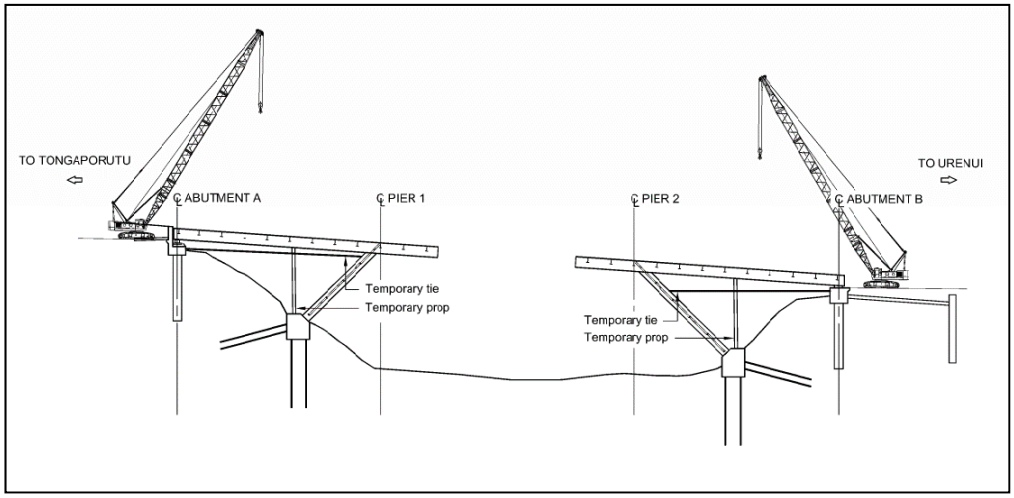
Bridge foundations will comprise either:

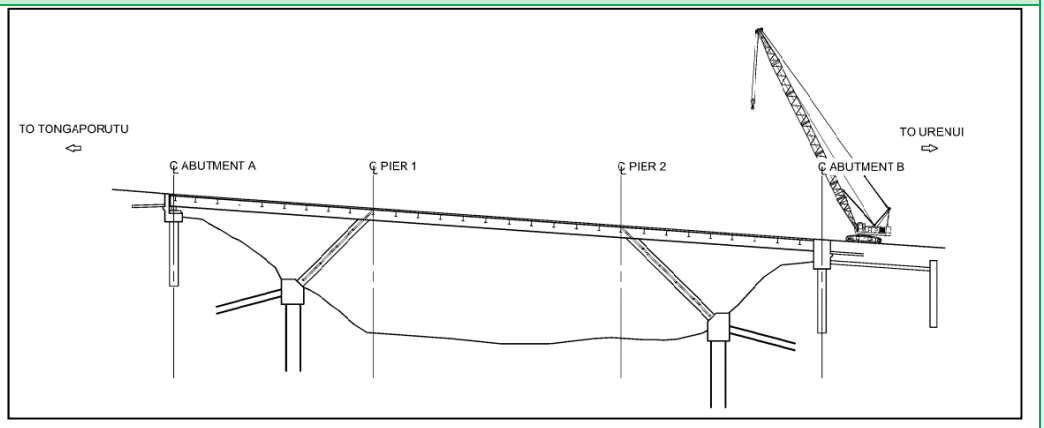
- Shallow pad foundations; or
- Piled foundations (combination of large diameter bored piles and small diameter micro-piles).

The proposed bridge construction sequence is outlined in Table 5.5.

Table 5.5 - Bridge Construction Works

Stage	Proposed Works
Stage 1	<u>Bridge Abutment Foundations</u> Construction of the bridge abutment foundations will be as follows: • Access to the bridge abutments for all plant and equipment (e.g. piling rig, service crane, excavators etc). • The drill rig or excavator will be positioned at the abutment locations. • The pile will be drilled and material excavated to the required depths, following which reinforcement and concrete will be installed. • If a pile cap is required, the pile cap will be excavated and the concrete will be placed connecting the piles to the pile cap. • All excavated spoil will be utilised as construction fill. <u>Bridge Pier Foundations</u> Construction of the bridge pier foundations will be as follows: • Micropiles or shallow foundations are proposed to limit the construction footprint of the piers. • Plant and equipment (drill rig and excavator) will be craned into place from the abutments to avoid impacts on the Mimi swamp forest. • Excavation for the piles will occur using a rotary drill ("wash-drill") technique, or with an excavator for the shallow foundations. • Reinforced piles and concrete/grout will be installed. • All excavated spoil will be utilised as construction fill.

Stage	Proposed Works
	 *Indicative Stage 1 Construction*
Stage 2	<u>Bridge Piers</u> • Erect braced piers at both ends • Place steel superstructure to both ends.  *Indicative Stage 2 Construction*
Stage 3	<u>Bridge Deck</u> • Erect central steel superstructure span • Complete temporary deck bracing • Remove temporary ties and props • Erect deck slab panels • Construction of in-situ deck and concrete barriers • Install expansion joint, barrier joints and barrier steel top rail.

Stage	Proposed Works
	 *Indicative Stage 3 Construction*

5.17 Tunnel construction

The new Mt Messenger tunnel will be located between Chainage 3400 – 3635 and pass under the ridge line east of Mt Messenger. Construction works in the tunnel zone will include earthworks at the northern and southern tunnel portals, and excavation under the ridge line to connect the northern and southern construction zones.

The tunnel will be constructed using a Roadheader similar to that shown in Figure 5.9.

Figure 5.9 – Tunnel construction using a Roadheader

A Roadheader is an excavation machine that has a boom mounted rotating, rock-cutting head on the front and operates on bulldozer style tracks. Roadheaders are designed to continuously operate and excavate rock, resulting in efficient tunnel construction.

The tunnelling works will be progressed generally as outlined in Table 5.6, as shown by Figure 5.10 and on the tunnel drawings in Volume 2.

Table 5.6 - Tunnel Construction Sequence

Construction Stage	Construction Activities
Stage 1	1. A tunnel construction yard will established at one end of the tunnel, followed by assembly of tunnelling equipment (including installation of the construction ventilation, water treatment and electrical systems).
	2. A working platform will be constructed for concrete delivery. A chute may be installed between this platform and a suitable location to allow concrete trucks to deliver concrete to the top of the chute. Otherwise, concrete will be delivered to either side of the tunnel via the site access tracks.
	3. A rockfall protection structure will be constructed, either from existing rock or a precast rockfall protection structures. Tunnel construction will commence by building one of the tunnel portals, using arched steel tunnel sets and rock-bolts and shotcrete, as required.
	4. Construction of the upper section of the tunnel will commence using a Roadheader. Tunnel support by rockbolting and shotcreting of the excavated material will be installed in stages as tunnel construction progresses. Dump trucks will remove tunnel spoil from the tunnel as it is generated for use as general construction fill.
	5. Access to the second portal will be constructed in preparation for the breakthrough of the upper tunnel section. This will be followed by construction of the second tunnel portal as per the method outlined in stages 3 and 4 above.
Stage 2	6. Construction of the lower section of the tunnel will commence using either a Roadheader and/or excavators to complete the lower part of the tunnel excavation and installation of lower ground support (rockbolts or shotcrete) as required.
	7. A temporary access track will be established as required to allow trucks direct access to the tunnel to transport construction materials through the tunnel to the adjacent construction zones.
Stage 3	8. The final construction stage will involve building the tunnel control room (approximately 12m in length, 5m in width and 4m in height) and installation of the water tank for the fire hydrant system. Works will also involve construction of permanent pavements and structures, and installation of tunnel furniture (e.g. lighting, automation/monitoring). Commissioning and testing of the tunnel system will follow the tunnel fit-out.

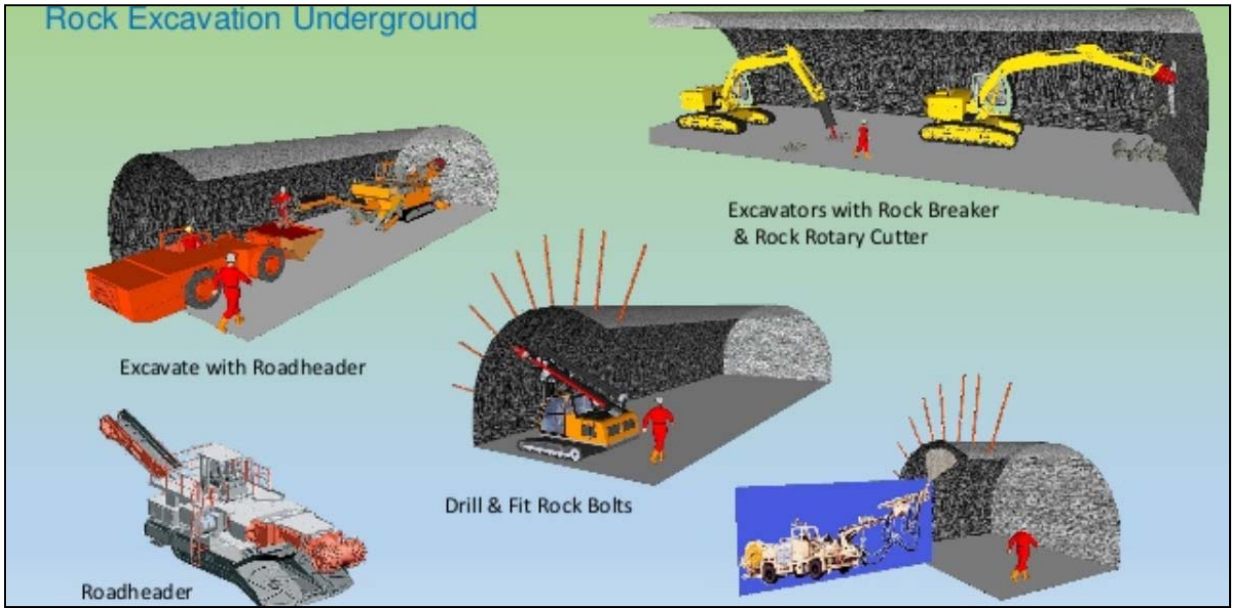


Figure 5.10 – Typical tunnel construction using a Roadheader

Given the nature of the ground conditions, any groundwater inflow to the tunnel is expected to be at low rates. If groundwater is encountered, it will be collected on-site and treated by container impoundment systems (CIS) to an acceptable standard prior to its discharge into clean water drains located within the adjacent construction zones. Sediment laden water generated from localised earthworks for the portal entrance will be collected and treated in accordance with the CWMP.

In the order of 10m^3/day of groundwater inflow is conservatively estimated for the fully excavated tunnel.

Any water associated with shotcreting will be collected and treated.

5.18 Pavement and surfacing

Upon completion of the bulk earthworks, drainage, tunnel and bridge construction, pavement materials will be laid along the alignment. This will likely occur in sections as construction works are completed. The carriageway will be completed to sub-base level to protect the sub grade and create the proposed alignment haul route for the bulk earthmoving activity and other construction traffic.

Pavement materials will then be placed on the carriageway to complete the road structure.

Once all works are complete within each section of the carriageway, traffic services, roadside furniture and landscaping will be installed.

5.19 Landscape Restoration

The approach to restoration of the landscapes and habitats affected by construction of the Project is described in the LEDF (Technical Report 8b, Volume 3) and ELMP.

The effects of work on the Mangapepeke and Mimi Valleys will involve a vegetation mitigation strategy that focuses on:

- Site rehabilitation – replanting/restoring disturbance effects of the new road alignment construction.
- Ecological restoration – a wider package of mitigation and offsetting.

This is summarised in Section 5.5 of the LEDF and in the landscape concept design drawings in Volume 2. The ELMP addresses ecological mitigation and restoration in detail.

5.20 Network utilities

In accordance with the Code of Practice for Utility Operators (which picks up the requirements of the various Acts and Regulations), Network Utility Operators will have the opportunity to lay new services in the new road corridor as it is constructed.

New ducts for fibre-optic cable may be installed during construction of the Project along the berm of the new alignment, under the new bridge, and through the tunnel. The details of these works, along with any other utility works, will be identified through the process mandated in the Code of Practice.

All excavation will be undertaken in accordance with the Alliance's 'permit to dig' system, which ensures sufficient checks have been undertaken to ensure there are no buried services that could be struck. The Alliance will continue to work closely with the relevant service providers to undertake any necessary protection and/or relocation works during construction.

5.21 Hazardous substances

Construction activities and site works include a range of construction machinery and plant, the majority of which will be motorised and require a regular supply of fuel and oils. Plant and machinery will require refuelling on-site, requiring the storage of fuel, oils and lubricants on-site. Other construction materials stored on-site will include items such as flocculants, cleaning products, and adhesives. These products can have adverse environmental effects if not appropriately managed.

The management of hazardous substances, including the transport, storage, handling and disposal will be undertaken in accordance with the Hazardous Substances and New Organisms Act 1996, associated regulations, and industry guidelines. The CWMP addresses the management of non-sediment contaminants (eg concrete), while the CEMP addresses the management of hazardous substances.