Eastern Busway
EB2 and EB3 Residential

Construction Methodology Overview

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Eastern Busway

Quality Information

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Table of Contents

Table of Figures

Table of Tables

List of Abbreviations and Definitions

Abbreviation and Definitions	Description
AEE	Assessment of Environmental Effects
AUP(OP)	Auckland Unitary Plan (Operative in part) 2016
BSP	Bulk Supply Point
CCP	Community Consultation Plan
CEMP	Construction Environmental Management Plan
CNVMP	Construction Noise and Vibration Management Plan
CMA	Coastal Marine Area
CST	Combined Service Trench
CTMPs	Construction Traffic Management Plans
EB1	Eastern Busway 1 (Panmure to Pakuranga). Completed.
EB2	Eastern Busway 2 (Pakuranga Town Centre), including Reeves Road Flyover (RRF) and Pakuranga Bus Station.
EB3 Commercial/ EB3C	Eastern Busway 3 (Ti Rakau Bridge to Guys Reserve), including two new bridges, an offline bus route through Burswood and a new station at Burswood.
EB3 Residential/ EB3R	Eastern Busway 3 (SEART to Pakuranga Creek)
EB4	Eastern Busway 4 (Guys Reserve to a new bus station in the Botany Town Centre), including a link road through Guys Reserve.
EBA	Eastern Busway Alliance
ESCP	Erosion and Sediment Control Plan
ha	Hectare(s) = 10,000m^2
ITA	Integrated Transport Assessment
ITS	Intelligent Transportation System
km	Kilometre(s)
m	Metre(s)
m^2	Square Metre(s)
m^3	Cubic Metre(s)
MSE	Mechanically Stabilized Earth (walls)
NZCEP	New Zealand Code of Practice for Electrical Safe Distances
RRF	Reeves Road Flyover
SAP	Site Access Point
SEART	South East Arterial (Pakuranga Highway)
t	Tonne

1. Introduction

1.1 Overview of the Eastern Busway Project

The Eastern Busway Project (the Project) is a package of works focusing on promoting an integrated, multi-modal transport system to support population and economic growth in southeast Auckland. This involves the provision of a greater number of improved public transport choices and aims to enhance the safety, quality and attractiveness of public transport and walking and cycling environments. The Project includes:

- 5km of two-lane busway
- New bridge for buses across Pakuranga Creek
- Improved active mode infrastructure (walking and cycling) along the length of the busway
- Three intermediate bus stations
- Two major interchange bus stations.

The project forms part of the previous Auckland Manukau Eastern Transport Initiative (AMETI) programme (the programme) which includes a dedicated busway and bus stations between Panmure, Pakuranga and Botany town centres. The dedicated busway will provide an efficient rapid transit network (RTN) service between the town centres, while local bus networks will continue to provide more direct local connections within the town centre areas. The project also includes new walking and cycling facilities, as well as modifications and improvements to the road network.

The programme includes the following works which do not form part of the Eastern Busway Project:

- Panmure Bus and Rail Station and construction of Te Horeta Road (completed)
- Eastern Busway 1 (EB1) – Panmure to Pakuranga (completed).

The Eastern Busway project consists of the following packages:

- Early Works Consents – William Roberts Road (WRR) extension from Reeves Road to Ti Rakau Drive (LUC60401706); and Project Construction Yard at 169 – 173 Pakuranga Road (LUC60403744).
- Eastern Busway 2 (EB2) – Pakuranga Town Centre, including the Reeves Road Flyover (RRF) and Pakuranga Bus Station **(this Assessment)**
- Eastern Busway 3 Residential (EB3R) – Ti Rakau Drive from the South Eastern Arterial (SEART) to Pakuranga Creek, including Edgewater and Gossamer Intermediate Bus Stations **(this Assessment)**
- Eastern Busway 3 Commercial (EB3 Commercial) – Gossamer Drive to Guys Reserve, including two new bridges, and an offline bus route through Burswood
- Eastern Busway 4 – Guys Reserve to a new bus station in the Botany Town Centre, including a link road through Guys Reserve.

The overall Project is shown in Figure 1 below.

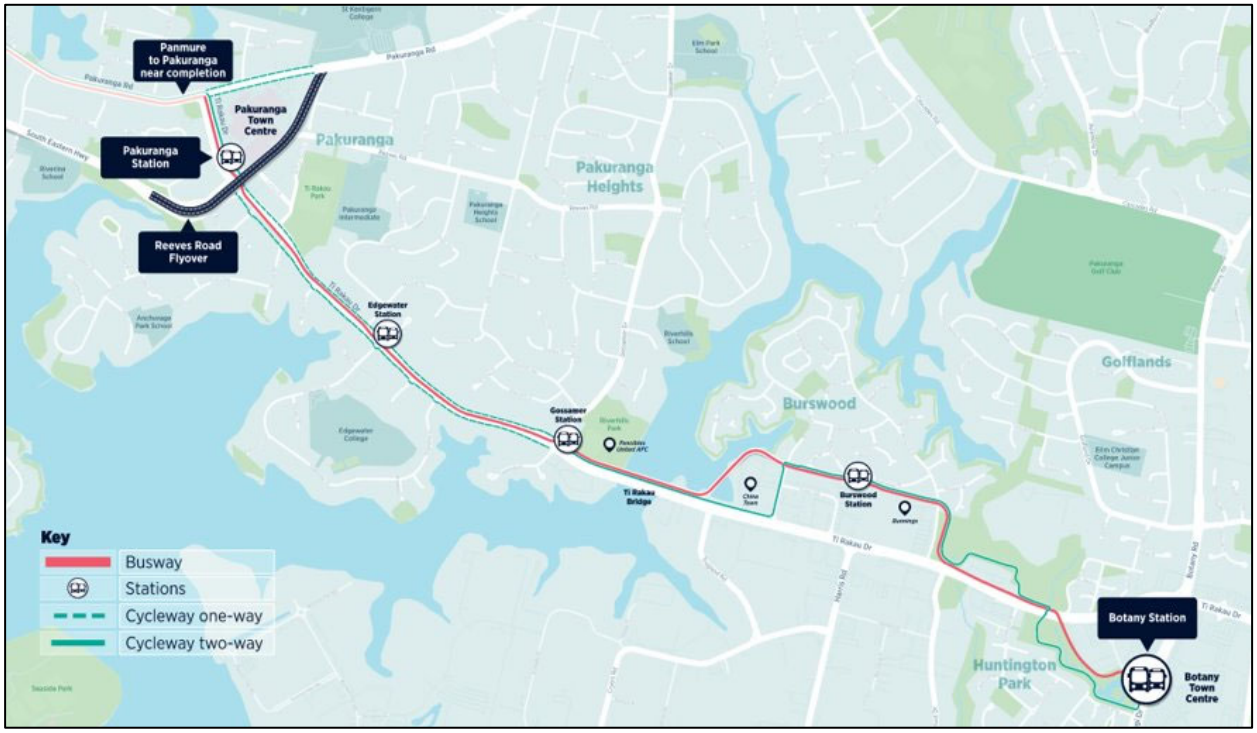


Figure 1. Project alignment

2. Proposal Description

2.1 Eastern Busway 2

The EB2 section of the Project commences from the intersection of Ti Rakau Drive and Pakuranga Road, connecting with EB1, and traverses west along Ti Rakau Drive to the intersection of SEART. The north-south extent of EB2 is between SEART and Pakuranga Road along Reeves Road and William Roberts Road. The main components of EB2 are described below.

2.1.1 Busway and Pakuranga Town Centre Bus Station

A segregated dedicated two-way busway is proposed along Ti Rakau Drive to provide prioritised access for bus services between Pakuranga Town Centre and Botany. From Pakuranga Road to SEART, the busway will run on the northern side of Ti Rakau Drive.

The proposed Pakuranga bus station is a key facility for services running to and from the Panmure Station Interchange, Howick, Highland Park, Eastern Beach, Bucklands Beach and Sunnyhills. The bus station will be located along the northern side of Ti Rakau Drive, on land currently occupied for Pakuranga Plaza and 26 Ti Rakau Drive. The bus station will feature two platforms and will contain a mixture of street furniture and structures, including bus shelters, electronic messaging signage and seating. New proposed pedestrian crossings will provide connections to the bus station and Pakuranga Plaza. Modifications to the Ti Rakau Drive median strip, landscaping, and general traffic lane reconfiguration will enable safe and efficient bus movement for the busway once it becomes operative.

2.1.2 Reeves Road Flyover (RRF)

The RRF will provide two general traffic lanes in each direction connecting SEART to Pakuranga Road, to reduce local traffic congestion along Pakuranga Road and Ti Rakau Drive. The RRF will start opposite Paul Place Reserve, pass over Ti Rakau Drive and Reeves Road, before finishing at a new intersection with Pakuranga Road. Traffic lanes for the RRF will be elevated and run through the centre of SEART, requiring the relocation of the SEART off-ramp to the north of the existing off-ramp.

2.1.3 Walking and Cycling Facilities

EB2 includes improvements to active transport infrastructure and connections. This includes a new cycleway, improved footpaths, and new pedestrian crossings. These works will improve the safety and connectivity of walking and cycling links across Pakuranga Town Centre.

2.1.4 Supporting Works

A range of works will be undertaken in support of the EB2 package. This includes the relocation of network utility services, new street lighting, earthworks, removal of vegetation, landscaping, stormwater upgrades, environmental restoration and mitigation and temporary construction sites.

2.2 Eastern Busway 3 - Residential

The EB3R section of the busway is a continuation of EB2 from the intersection of SEART and Ti Rakau Drive, with the proposed dedicated busway proceeding centrally along Ti Rakau Drive towards Gossamer Drive and Riverhills Park in the east. EB3R will largely occur within land vested as road or land currently owned by Auckland Transport. The construction of EB3R will take a staged approach to minimize

disruption to the existing road network and its users. The main components of EB3R have been described below.

2.2.1 Edgewater and Gossamer Intermediate Bus Stations

EB3R includes two intermediate bus stations on Ti Rakau Drive, located within the vicinity of Edgewater Drive and Gossamer Drive. Both stations will have separate platforms for eastbound and westbound bus movements. A range of street furniture and structures will also be constructed, such as modular bus shelters pedestrian linkages, electronic messaging signage, seating and cycling storage facilities.

2.2.2 Western Bridge Abutment

EB3R includes construction of the western bridge abutment for a new future bridge across Pakuranga Creek. The abutment will be located within the area that is currently the southeastern section of Riverhills Park. Only the bridge abutment is included in the EB3R package of works. The remaining parts of the bridge will form part of the EB3C approval package.

2.2.3 Walking and Cycling Facilities

Provision has been made for walking and cycling along the route of EB3R. This includes footpaths and uni-directional cycleways located on either side of Ti Rakau Drive from SEART to Gossamer Drive. Signalised pedestrian crossings will be provided at key intersections along Ti Rakau Drive, including adjacent to the proposed Edgewater bus station.

2.2.4 Associated changes the road network

The proposed changes to the road network include lane arrangement and intersection reconfigurations and changes to the parking arrangement and access to Edgewater Drive Shops. Changes are also proposed to the access arrangements for residential properties along the EB3R alignment. New westbound lanes for general traffic will be established within the land which has been acquired by Auckland Transport and will be vested as road once it becomes operative, as the busway alignment replaces the existing westbound lanes.

2.2.5 Supporting Works

A range of works will be undertaken in support of the EB3R package. This includes the relocation of network utility services, new street lighting, removal of vegetation, earthworks, landscaping, stormwater upgrades, environmental restoration and mitigation and temporary construction sites.

3. Specialist Assessment

3.3 Development of Construction Methodology

The construction methodology and activities outlined in this section have been developed through an iterative process by the Eastern Busway Alliance (EBA) that has involved several rounds of multidisciplinary reviews and workshops. The intention of this methodology is to balance the cost, programme implications and likely adverse impacts of various construction activities to achieve a methodology that, as far as practical, avoids or where avoidance is not possible, minimises construction impacts. This includes consideration of the following:

- The location and extent of construction compounds, satellite offices, laydown areas and construction egress points
- Minimise disturbance and vegetation clearance where possible
- Minimisation of land acquisition and significant adverse construction impacts on neighbouring properties
- Construction programme and timing of particular activities to take advantage of seasonal weather conditions
- Auckland Transport's construction guidelines and standards relevant to the avoidance and minimisation of adverse effects on the environment.

The methodology aims to maximise flexibility so as not to unduly restrict or constrain construction activities, while aiming to avoid adverse construction impacts and taking into consideration social, environmental and cultural constraints. The construction methodology will be further refined and developed during the detailed design phase of the Project. This will be undertaken with consideration of the designation and resource consent conditions, environmental management plans, as well as balancing cost and programme, environmental and social outcomes.

3.4 Anticipated Construction Programme

Construction of the Project is expected to be completed by 2027. This date is dependent on funding processes and property acquisition. Many elements of the Project may be undertaken concurrently during the construction period.

Figure 2 below shows the approximate timing of the proposed works and how the different elements may progress within the EBA construction timeframe. It is reiterated that while there are some dependencies between construction elements, the specific staging and phasing of the work will be dependent on the methods of procurement, land acquisition, and the availability of resources (such as materials and construction equipment).

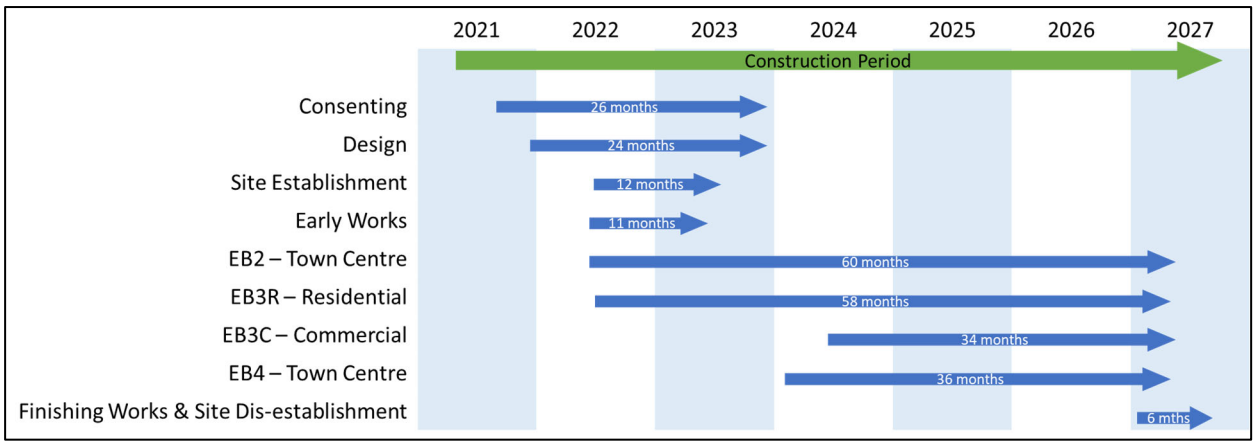


Figure 2 - Indicative construction timing of the Project

4. General Construction Aspects

This section contains a description of the following general construction aspects across the whole Project:

- Enabling works
- Site establishment works
    - Traffic / public management
    - Existing utility services location
    - Site access points (SAP's) & fencing
    - Construction laydowns, compounds and satellite office
    - Main laydown and site deliveries
- Protection and/or relocation of existing network services
- Construction activities
    - Erosion & sediment controls
    - Building removal & site clearance
    - Earthworks
    - Civil works
        - Utilities relocations
        - Drainage & ducting
        - Traffic services
        - Urban design & landscaping
    - Pavement works
        - Shared paths
        - Bus lanes
        - Traffic lanes
    - Structures
        - Bridges
        - Retaining walls
    - Night Works
- Dis-establishment
- Testing and commissioning.

4.1 Enabling Works

Prior to the main phase of construction commencing, there are several activities that are required along the alignment. These include:

- Site investigations and data collection of the existing ground levels & features, pavements, traffic services, lighting, signage, ITS & signal systems, drainage, soil types, potential contaminated lands, and ground water
- Investigation, location, and protection of existing network utility services
- Property dilapidation surveys of existing houses, buildings, and structures
- Removal of buildings and houses as required including utilities disconnections
- Retaining the utilities connections for continuity of services for properties not impacted
- Site establishment activities in preparation of the main construction works including haul road construction and laydown areas.

4.2 Site Establishment

4.2.1 Traffic / Public Management

The safety and protection of the public, traffic, and construction team is paramount, and all site operations are focused on zero harm to all involved, associated with travelling through this Project.

Traffic management is a key component in achieving zero harm, as it allows the public and traffic to be separated from construction operations, by managing/maintaining the public and traffic flow entering, travelling through, and exiting the construction zones within the Project area. Construction Traffic Management Plans (CTMPs) will be implemented throughout the Project to manage traffic during construction.

Through the CTMPs and through communications detailed within the Community Consultation Plan (CCP), the local community and public/traffic travelling through the construction corridor will be regularly updated on temporary traffic management operations.

Temporary traffic management operations include, but are not limited to:

- Footpath closures / deviations / detours
- Pedestrian crossing closures / deviations / detours
- Cycle lane and / or path closures / deviations / detours
- Bus diversions/temporary bus stops
- Property access closures / deviations /detours
- Parking closures (off-street and on-street)
- Shoulder and lane closures / deviations
- Road closures / detours
- Site access arrangements
- Temporary speed limits
- Temporary traffic services, including line markings, signals, streetlights and signage
- Wider network performance - communications to encourage alternative routes.

4.2.2 Existing network services location

As part of the enabling works, and before any setup or construction works commence on the Project, existing network services will be relocated and marked by either the provider themselves or specially trained utility location personnel.

Once identified, each service will be potholed or measured to determine the exact location and depth / height.

Potholing and measuring are permitted activities under the AUP(OP) and will be supervised by the network utility provider(s) and follow the Auckland Council codes of practices for working around live services.

4.2.3 Construction laydowns, compounds and satellite office

4.2.3.1 *Laydown Yards*

Laydown yards will be set up on areas cleared for the temporary storage of equipment and supplies. They will be covered with rock and/or gravel to ensure accessibility and safe manoeuvrability for transport and

on/off-loading of plants. One main laydown yard will be established at 169/171 Pakuranga Road with a designated stockpile area, which will predominantly serve the material and aggregate for the EB2/EB3R construction and provide temporary storage before hauling off-site.

The other satellite laydown yard at 220/222 Ti Rakau Drive for the Ti Rakau Bridge western abutment and all relevant works will also be constructed following the demolition of the existing houses on those sites. It provides a temporary storage area for the material and plant including a gantry crane. It will operate associated with the abutment construction period (refer to Section 4.4.7) thus lighting will be potentially required for night works.

4.2.3.2 *Construction Compounds and Satellite Offices*

Two areas within the EB2/EB3R footprint (5 Reeves Road & 2 Cortina Place) have been identified as key construction compounds/project offices (tool storage, site facilities, amongst others). Other smaller compounds/satellite offices will be set up utilising existing houses and buildings (earmarked for de-construction) and adjacent lands, as works progress along the alignment. These areas are described in the Assessment of Environmental Effects (AEE). These areas have been selected because of their proximity to key construction elements.

The description of the construction compounds and satellite offices is set out in Table 1.

The final construction compound and satellite office locations and activities may change depending on the final construction methodology and will be confirmed once properties are made available to the Project. However, the location, size and scale of these compounds will be governed by resource consent and designation conditions.

The construction compounds and satellite areas may contain the following (or similar) activities commonly associated with construction:

- Temporary site buildings – workers' facilities
- Satellite offices and meeting rooms
- Plant and equipment maintenance facilities
- Fuel storage and minor refuelling facilities in accordance with Hazardous Substances & New Organisms (HSNO) regulations 1996 – 20ft max bunded containers
- Material laydown areas including stockpiling of materials and spoil
- 10ft, 20ft & 40ft material storage containers
- Wheel washing and cleaning facilities
- Lighting / fencing / security temporary mesh panels 1.8m high/ hoarding
- Vehicle parking
- Plant and equipment parking.

In addition to these compounds & satellite offices, typical construction activities (such as stockpile, laydown and assembly areas, plant and equipment storage, amongst others) will occur throughout the construction footprint.

Figure 3 below shows the proposed stockpile yard location (the proposed construction yard at 169-171 Pakuranga Road) for EB2 and EB3R, and the routes (1-6) for construction traffic travelling to and from the stockpile location.

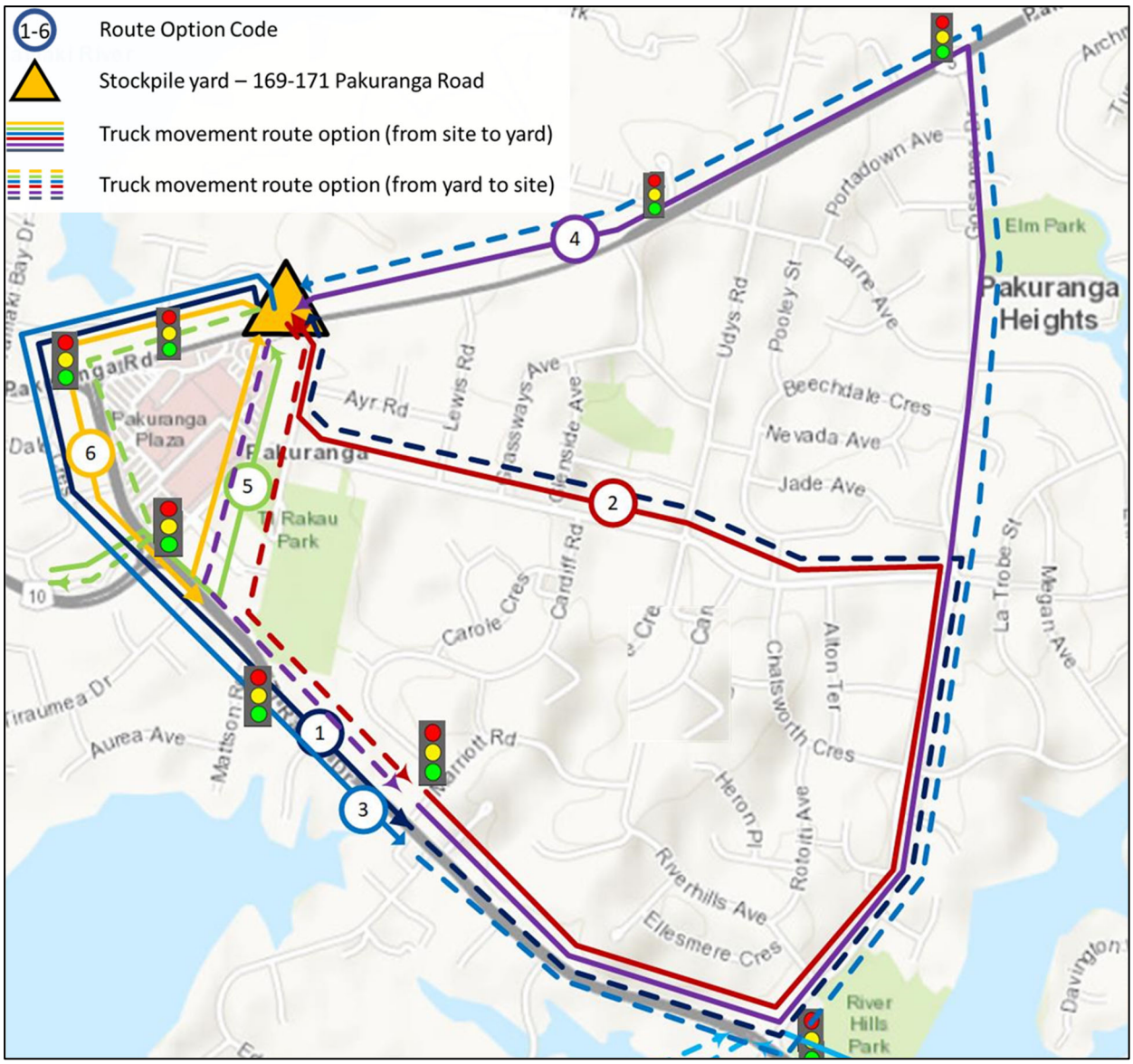


Figure 3 - Proposed stockpile location and routes

Compounds and storage sites will also be regularly monitored for environmental compliance in line with the Erosion and Sediment Control Effects Assessment.

As night-time works are required on occasions across all zones of the Project, the compounds and satellite offices will operate both during the day and sometimes during the night depending on activities required (e.g. night-time closures for bridge beam lifts).

Site establishment activities for the construction compounds and satellite office areas will include site clearance, ground preparation, and establishing erosion and sediment control measures prior to any construction activities occurring. Upon completion of the works, the construction compounds and satellite offices will be disestablished.

The main compounds and satellite offices will be provided with water, telecommunications and power connections, and where required wastewater connections. In most cases, these services are able to be connected directly to the existing adjacent networks. Where there is no existing network adjacent to the yard, a temporary connection will be made. These temporary connections will be removed upon completion of construction.

Within each satellite compound, designated carparking areas will be set up for construction staff and visitors. Parking on side streets by construction staff will be discouraged and monitored to ensure minimum disruption to the community and users of sports fields, public reserves, and townships on event/opening day(s).

The final location of construction compounds and satellite offices and the activities undertaken within each area will be confirmed as part of the preparation of the Construction Environment Management Plan (CEMP).

Table 1 - Construction compounds and satellite offices

Compound	Location	Compound specific activities	Approx. commencement date	Approx. duration of use
Compound 1 – Main Project Compound / Office	5 Reeves Rd	Main site office. The existing building located on this site will be used as the main project office with additional Portacoms to meet capacity requirements.	Q3 2022	60 months
Compound 2 – Reeves Rd Flyover Construction Compound / Satellite Office	2 Cortina Pl	Satellite office for Reeves Rd Flyover project team. Access will be off Cortina Pl, utilising the existing driveway as an entry point. The existing two-level commercial building will be utilised as the office until either the structure is de-constructed or handed back. Briefing area for bridge construction, plant for piling will be installed. With carparking.	Q4 2022	48 months
Compound 3 – Satellite Office / Carparking	14 Seven Oaks Dr	Satellite office / carpark for the construction of EB2. Access will be maintained off Seven Oaks Dr, utilizing the existing driveway crossing as the entry point. The existing house will be utilized as the office until de-construction of the structure is required.	Q4 2022	48 months
Compound 4 – Satellite Office / Carparking	143 Ti Rakau Dr	Satellite office for the construction of EB3R. Access will be off Ti Rakau Dr, utilizing the existing driveway as the entry point. The existing house will be utilized as the office until de-construction of the structure is required.	Q4 2022	48 months
Compound 5 – Satellite Office / Carparking	178 Gossamer Dr	Satellite office / carparking for the construction of EB3R. Access will be off Gossamer Dr, utilising the existing driveway as the entrance point. The existing house will be utilised as the office until de-construction of the structure is required.	Q4 2022	48 months
Compound 6 – Satellite Office	12 Bolina Crescent	Satellite office / carparking area for the construction of EB2. Access will be maintained off Bolina Crescent, utilizing the existing driveway as the entry point. The existing house will be utilized as the office until de-construction of the structure is required.	Q4 2022	48 months

4.2.3.3 *Main laydown and site deliveries*

Bulk deliveries of construction materials and the export of waste will predominantly be via the main construction laydown yard at the corner of William Roberts and Pakuranga Road (169/171 Pakuranga Road). Materials will be transferred between site specific locations and the construction yard in trucks throughout the Project duration (Refer to Section 4.2.3.2). The CTMP(s) will define the site traffic movements to and from the site. Specific deliveries for example retaining wall blocks, will be delivered directly to the site location.

For deliveries that would either disrupt the public and/or traffic flow on a regular basis, and/or for a long period of time, i.e. bridge beam deliveries, night deliveries will occur. Deliveries will typically commence in line with temporary traffic management plan approvals, often being between 22:00 hrs to 05:00 hrs.

When materials are stored on site and/or in laydown yards, they are to be either stored in clearly marked 'bins' or stockpiles, stacked in an orderly fashion to a safe height and size, housed in secure and/or specialist containers/drip trays and covered and protected from the elements as specified by the manufacturer.

4.2.4 Site access points (SAP's) and fencing

Each construction compound and site egress point will have a site-specific Site Access Point (SAP) management plan, and will also be managed through the Project's CTMPs. A SAP is a control interface point between the public and construction activities.

A SAP embraces either the construction of new permanent egress facilities (e.g. pull-off lanes, turning bays, signalled intersections, driveway crossings (amongst others) or is a temporary traffic management egress point onto and off the site. It is also an authorised entry / exit check point, and co-ordinates the entry and exit of deliveries and road worthiness of existing vehicles (clean tyres amongst others).

SAP's will be one of the first items constructed on site, along with safety and security fencing around works areas and compounds. The fencing will provide a physical barrier between the works and public.

SAP's consist of:

- Either a permanent or temporary traffic management egress setup
- Sealed entry way of the adjacent carriageway
- Lockable gate and perimeter fencing around the circumference of the compound or works area
- A sign-in / sign-out station, including safety and environmental protocols within
- Wheel washing facilities

The final locations of SAPs and the facilities and activities within each may change depending on the final construction methodology and sequencing of the works.

SAP's will be individually numbered to allow efficient wayfinding for site traffic planning and communications.

4.3 Protection and/or relocation of existing network services

The Project traverses a highly modified urban environment and as a result there are numerous network utilities within and crossing the alignment. These services range from major arterial networks (such as water supply mains, electricity transmission, telecommunications, and gas) to local reticulation services.

The key services within the Project include:

- High voltage transmission overhead lines (Section 4.3.1)
- High voltage transmission underground cables (Section 4.3.1)
- High pressure gas mains (Section 4.3.2)
- Water transmissions, bulk water supply and wastewater infrastructure (Section 4.3.3)
- Fibre optic communication cables and telephone lines (Section 4.3.4)
- Electricity and gas distribution (Section 4.3.5)
- Stormwater drainage (Section 4.3.6)

Discussions have been undertaken with network utility operators and agreements are being developed with each operator regarding their assets. Services will be either protected or relocated to the relevant provider's standards and where possible located within dedicated service corridors. Services will be constructed and tested in the realigned position to enable a short switch-over timeframe with minimal disruption to users.

Construction methodologies for each service will be developed in consultation with each operator. Options being considered include directional drilling for small services within existing corridors and trenching.

4.3.1 High voltage transmission lines (including towers)

There are three transmission lines either crossing or in close proximity to the Project.

Refer to Figure 4 below – continuous lines indicate overhead power lines (110kV) while discontinuous ones indicate underground cables (220kV).

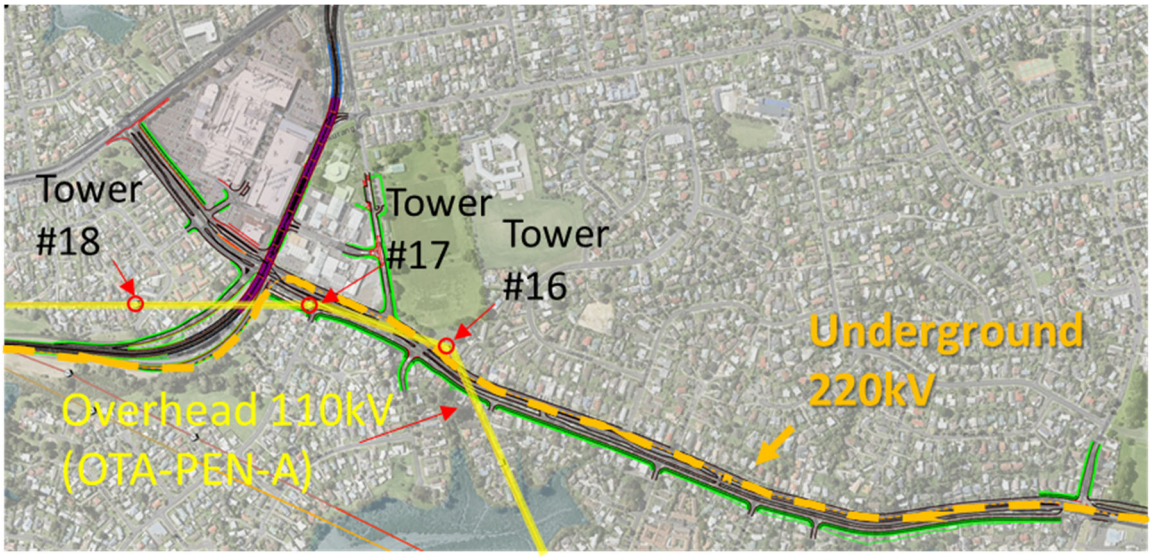


Figure 4 – High Voltage Transmission Plan

The New Zealand Code of Practice for Electrical Safe Distances (NZECP:34) specifies minimum approach distances to all overhead power lines for construction activities and the permanent road alignment. The design has sought to avoid transmission lines and cables wherever possible. However, there are locations where the lines are affected by both construction activities and the permanent works and as a result, works are required to realign the span between affected towers and increase the clearance under conductors by raising the height of the transmission towers.

Overhead conductors 110kV (OTA-PEN-A) span from existing tower #16 to #18. Auckland Transport is in discussions with Transpower regarding the specific design and proposed construction timing for realignment / modification of these transmission assets. Transpower is seeking the necessary consents for these works separately and will be responsible for carrying them out.

There is another major electrical transmission underground 220kV Transpower cable that runs under SEART and Ti Rakau Drive. This is a very critical and sensitive network which includes three high voltage ducts with several joint bays along the alignment. The major portion of the UG duct remains unaffected and does not require any relocation. However, there are potential locations of conflicts with proposed drainage and services crossings. The protection around joint bays and around the ducts may be required at the location of compromised covers.

4.3.2 High pressure gas pipelines

There is an existing DRS gas cabinet and 50mm diameter gas main of medium pressure running from the Pakuranga / Ti Rakau Drive intersection to Cortina Place. The gas cabinet houses the control unit which is located on Ti Rakau Dr near the Pakuranga Road intersection. This section of gas main requires relocation as it clashes with the new road alignment.

The section of the gas network running north on Pakuranga Road is not impacted and only requires protection.

Figure 5 - High Pressure Gas Pipelines

Utility gas providers require minimum approach distances to their assets, for construction activities and the permanent road alignment works. The design has sought to avoid these gas mains wherever possible. However, there are locations where the gas mains are affected by both construction activities and the permanent works and as a result, works are required to either relocate these lines and / or protect and construct over them:

- IP10 150mm STEEL gas pipe – 194m – EB2, along 78-88 Pakuranga Road
- MP4 50 PE gas pipe – 326m – EB2, From Pakuranga Road/Ti Rakau Drive intersection to corner of 26 Ti Rakau Drive. Then along Cortina Place

4.3.3 Water and Wastewater infrastructure

There are two water transmission mains (Hunua 2 and Howick Loop main) owned by Watercare that are impacted by the project. The Hunua No.2 1070mm dia CLS transmission runs down the Project alignment within EB2 and EB3R, starting at SEART Off Ramp and finishing at Pakuranga Creek. Howick loop main 470mm dia. CLS runs along William Roberts Road from the bulk supply point (BSP) chamber located at the southwest corner of Ti Rakau Park to the northern extent of William Roberts Road.

A do minimum scope strategy has been adopted through which the mains will be protected, and only the pipe sections that are directly impacted by the Project alignment will be realigned.

There is an existing air valve line chamber on the Hunua 2 transmission main at the corner of Ti Rakau Drive and Mattson Road that will be impacted by the new alignment. The chamber will be relocated outside the carriageway in the berm, south of the new alignment. The associated pipe section will be realigned as per the chamber's new location and configuration. The pipe sections under the SEART and Gossamer intersection are the most affected due to less cover and construction loading. These pipe sections will be realigned horizontally and/or vertically to achieve cover requirements whereas the remaining impacted portions will be protected to be retained in place as is. The permanent pipe protection will be carried out as per Watercare requirements.

The existing Bulk Supply Point chamber will conflict with the extension of the William Roberts Road alignment and will be relocated to the Ti Rakau Park area. The associated pipe configuration and connection to the local network will be relocated as well as per the new location of the Bulk Supply Point. The northern alignment of Howick Loop is most impacted due to less cover which will require realignment whereas most of the southern portion will be protected.

Watercare has shown interest in upgrading the transmission mains to align with their master planning of network growth however a firm decision has not been made on the scope yet. This is currently being discussed separately while EBA is firstly analysing/progressing with the Do Minimum scope strategy. The additional site investigations including a Hunua 2 Pipe condition assessment are being carried out on site which will inform decisions around relocation or protection treatment.

Howick interceptor is a 1050mm diameter concrete gravity sewer main that runs from SEART along the EB3R alignment to the Gossamer intersection. This gravity main is a relatively deep network and not majorly impacted by the alignment. A few manholes that would fall under the new carriageway will require protection by raising/lowering the cover levels.

Other local water and wastewater reticulation is located within and adjacent to the road alignment. The water infrastructure will require relocation and / or some form of protection during construction. However, it is expected that the water and wastewater infrastructure will be kept operational during construction, or an alternative implemented with the agreement of the provider. The Project team is in discussions with Watercare regarding the relocation of water and wastewater assets.

4.3.4 Fibre optic communication cables

The Project conflicts with a number of below ground fibre and copper telecommunication cables and these will require relocation during construction. These networks are owned by Chorus, Vector and

Vodafone. Ducting will be installed to relocate these services with the existing cables kept operational until the new ducts are available (or alternative measures implemented as agreed by the utility operators). The relocations will be undertaken as part of the enabling work for the Project.

EBA is in discussions with Chorus, Vodafone, and Vector Communications Networks regarding the specific design and relocation of assets.

4.3.5 Electricity and gas distribution

Most of the local reticulation network in the Project area is underground with the exception of overhead infrastructure in isolated areas. The power network is owned by Vector which includes LV (400V), medium (11kV), and high voltage cables (33kV). There are some electrical substations and transformers as well in the network which will be impacted by the alignment and require relocation. Relocation of existing ducts will be required to avoid or manage conflict. Where required, the overhead lines will be undergrounded into common services trenches out of the direct earthwork / carriageway construction zones.

There are a number of low to medium pressure gas mains and a DRS gas cabinet within the Project area. Any affected services will be relocated or protected during construction. Such works can be managed for continuity of supply during construction.

EBA is in discussions with utility providers regarding the specific design and relocation of assets.

4.3.6 Stormwater drainage

There are many areas throughout the Project area where the existing stormwater network will need to be modified and upgraded to accommodate the Project. There are also several existing Auckland Council stormwater outfalls along the edge of the Pakuranga Creek which will be retained, diverted or upgraded as part of the Project. The methodology for these works will be undertaken in accordance with Auckland Council Healthy Waters' Network Discharge Consent.

EBA is in discussion with Healthy Waters regarding the design of proposed new stormwater assets and the impact of the Project works on the existing stormwater drainage assets (e.g. outfalls). Auckland Council will be involved in the detailed design of these assets. Stormwater drainage is described in the Stormwater Effects Assessment.

4.4 Construction Activities

4.4.1 Removal of buildings and other assets

Construction of the Project will involve the removal of houses, commercial buildings, and roadside furniture. The specialists will carry out the asbestos survey in the area prior to work commencement.

Where possible existing houses will be uplifted and removed for re-use elsewhere, and where houses and buildings need to be de-constructed, professional contractors will be engaged to dismantle each structure in a way that enables the maximum recycling of materials, such as timber framing, roof framing, roofing (either tin or tile), windows (either timber or aluminium), weatherboards, concrete foundations (crushed and recycled), bricks (either re-used or crushed and recycled), downpipes and gutters etc.

Roadside furniture will be protected and relocated as directed by the construction methodology and sequencing, and where possible items will be saved and reused as directed within the detailed design.

Should contaminated materials be identified pre or during de-construction, measures are to be adopted as set out within the Contaminated Land Effects Assessment.

4.4.2 Earthworks

Construction of the Project will involve clearing of obstructions and vegetation and earthworks within the construction footprint. The Project construction footprint consists of approximately:

- 10.3 ha of land-based works
- 0.5 ha of coastal works.

For the purpose of this methodology, it has been assumed that any existing vegetation located within the Project footprint will be removed where required to facilitate construction. This is addressed in the Arboricultural Effects Assessment.

The work areas are separated into two project stages (EB2 and EB3R) comprising a total of approximately 50,000m3 of cut and approximately 25,000m3 of fill for land works (involving approximately 4.8km of the local road network), with another 29,000m3 of fill for MSE walls construction (predominantly for EB2 – Reeves Road Flyover and EB3 – Riverhills/Ti Rakau Bridge West Abutment). Refer to Table 2 below for a breakdown of estimated earthwork areas and earthwork volumes within EB2 and EB3R.

Table 2 - Total cut and fill quantities for EB2/3R

Indicative Cut and fill volumes	EB2 Quantity (approx.)	EB3R Quantity (approx.)
Land Work – Cut	30,000 m3	20,000 m3
Land Work – Fill	10,000 m3	15,000 m3
MSE Walls – Fill	12,000 m3	17,000 m3

The fill material required for the project will be sourced from quarries with suitable material. Concrete and rebar required for structural components will be manufactured off-site. All other common components will be manufactured off-site and transported in as required, and may include amongst other things, precast components (such as culvert pipes, bridge beams, etc), surfacing materials (including bitumen), street furniture, and traffic services items (such as signage, lighting, signals, etc).

4.4.3 Erosion & Sediment Controls

Erosion and sediment control measures will be implemented for the Project. The erosion and sediment control measures are discussed in further detail in the Erosion and Sediment Control Effects Assessment and in summary will include:

- Appropriate staging of the works, to ensure earthworks are carried out in a staged manner to limit the area of exposed earth open to the elements at any one point in time
- Perimeter controls (predominantly earth bunds and drains) to divert clean runoff away from the land disturbance area and divert sediment laden runoff to the sediment retention devices
- Erosion protection, including but not limited to geotextiles, aggregate stabilisation, hay mulching, grassing
- Sediment control devices including, decanting earth bunds, container sediment units, sediment fences and silt socks.

4.4.4 Contaminated materials

There are several locations along the alignment where there is the potential of encountering contaminated soil and groundwater during construction. The activities undertaken in areas with contaminated soil and groundwater and the handling of contaminated material requires management during construction in order to minimise potential risks to human health and the environment.

The location and nature of contaminated material and the measures to be adopted during construction are set out in the Contaminated Land Effects Assessment. The assessment details the following:

- Containment handling and disposal of contaminated soil during construction
- Discharges of dust generated by land disturbance activities
- Discharge of potentially contaminated sediment from land disturbance activities
- Potential human health risks for the construction workforce.

4.4.5 Civil Works

Construction of the Project will involve the installation of new civil infrastructure throughout the alignment.

Installation of new civil infrastructure will also involve, but not be limited to:

- Stormwater drainage/outfalls (refer to Appendix C for the methodology relating to the construction of the two SEART outfalls within the CMA)
- Utilities relocation (water, wastewater, electrical, communication, gas etc.)
- Utilities protection (water, wastewater, electrical, communication, gas etc.)
- ITS ducting
- Street lighting
- Shared paths
- Traffic services
    - Barriers
    - Signals
    - Signage
    - Lighting
    - CCTV
- Bus stations
- Urban design
    - Artwork
    - Open spaces
    - Seating
- Landscaping
    - Planting & grassing

The construction activities will primarily occur within dedicated permanent work zones; however, some temporary activities/or permanent works within temporary occupation zones will need to occur under additional traffic management operations either through the day shift or at night. Those activities will involve but are not limited to:

- Streetlight pole installation
- Gantry / large signage
- Cranage needs for urban design items
- Connections to existing services located in live traffic.

Though construction sequencing and traffic management switches, temporary traffic diversions will be employed as per the Project's CTMP(s).

4.4.6 Pavement Works

Construction of the Project will involve the construction of new pavements and the widening and upgrading of existing carriageways.

Where temporary traffic management is required to enable efficient construction of pavements including tying into existing pavements or surfacing overlays, provision for existing traffic movements will be maintained for all road users including general traffic, busses, heavy vehicles cyclists and pedestrians. Construction of new pavements will involve:

- Subgrade preparation, including subgrade improvement works after civils activities and site access use, plus final trimming ready for granular layers
- Installation of geogrids and or geotextiles
- Placement of the subbase granular layer
- Alternatively, placement of lean mix concrete as subbase layer
- Installation of pavement drains and kerbing
- Placement of the basecourse granular layer
- Membrane chip-seal sealing of the basecourse
- Placement of structural asphalt layers
- Construction of subsoil drainage.

Widening and upgrading of pavements will involve:

- Removal and reconstruction of edge kerbing and pavement drainage as required
- Construction of new widened pavement areas, as detailed above
- Removal of existing carriageway running surface, through use of a road planer (miller)
- Removal and replacement of existing carriageways structural asphalt, through 'mill & fill' operations.

Note, that traffic will traverse both the new and widened/upgraded carriageways on structural asphalt layers until the other related infrastructure works are completed following the construction sequences to deliver a full section of the Project with its final configuration.

Once each section completes the scope of non-pavement works, the final surfacing/line-marking works will be carried out (mostly during the night shift to minimise the traffic disruption), including:

- Temporary traffic management setups
- Profile milling of the top of the structural asphalt layer to create a level surface to the required design shape
- Membrane seal / 'tack-coat' to the structural asphalt layer
- Placement of running course surface layer
- Line marking to the final lane configuration.

4.4.7 Structures

Construction of the Project will involve the construction of two major structures, being:

- Reeves Road Flyover (RRF)
- Ti Rakau Bridge Western Abutment

Each structure will be constructed from reinforced in-situ and precast concrete components. In-situ decks will be poured on top of precast concrete girders for the RRF, supported on in-situ concrete piers and columns, which will be positioned above reinforced concrete bored piles (Appendix A). Abutments will be mechanically stabilized earth walls (MSE) with deck end spans resting upon them.

Reeves Road Flyover construction will involve:

- Temporary traffic management, including changes to existing lane configurations and walking routes, plus safe entry and exit points into the work zone for construction traffic
- Relocation and / or protection of existing network utility services
- De-construction of existing structures, full or part thereof
- Temporary works, including amongst others, crane pads, course ways (access routes), staging (across public walkways / traffic lanes), temporary pedestrian bridge across Ti Rakau Drive for construction staff and which will be 6.0m in height and 50m in length
- Mechanically stabilized earth walls (MSE), abutment and approach ramp construction
- Bored piles at each pier position with access routes to each pier for piling rigs and cranes
- Concrete pile caps, followed by columns and pier headstocks, constructed at each pier location, and abutment beams on top of each MSE abutment
- Bridge beam erection, one span at a time and installed at night to allow for lane closures for beam delivery and crane positioning for lifting or gantry launching
- Installation of new ducts for new services and ITS network
- In-situ deck pours, followed by ancillary works, including amongst others, barriers, movement joints, drainage, services and surfacing works.

As space is constrained along the alignment, retaining walls are proposed to contain cut and / or fill batters. These retaining walls generally, but are not limited to, three categories:

- Mechanically stabilised earth walls (MSE), mainly for approach embankments to bridge and flyover structures
- L shaped walls, (e.g. precast segments), tending to retain small heights
- Gravity walls, (e.g. mass blocks or components of), tending to retain small heights.

Construction of the Ti Rakau Bridge Western Abutment will involve:

- Site establishment – including temporary abutment construction lay down area for piling casing etc, access track from Gossamer Drive, as well as offline works and site clearance
- Pile abutment, build abutment beam, headwall and wingwalls
- Place rock armouring in front of the abutment (eastern side)
- Build mechanically stabilized earth walls (MSE), completing from east to west (i.e. working towards Gossamer Drive)
- Removal of temporary staging, compounds and access tracks, including reinstatement of grass areas and planting as required.

4.4.8 Night Works

Some activities are likely to require partial/full road closure, decreasing the number of lanes, or additional clearance for safety. Thus to minimise the impact on the public and traffic, these works will be undertaken at night. Night works will be intermittent or continuous. The intermittent night work can last 6 months to 12 months for the RRF construction. Any continuous night works in one single location with the same activity will occur for a maximum of one month (refer to Appendix B – Night Works). These works will be controlled by the Project's consent conditions and management plans[1]. This may include (amongst others) the following major construction activities:

- Temporary traffic management including installation of hard barrier lines
- Site investigation works within carriageway and roadside corridors
- Relocation of houses and buildings
- Tree removal
- Utilities cut-overs as required during periods of low operations
- Removal of street furniture and demolition of retaining walls within the road corridor
- Removal of grass and concrete medians and temporary pavement construction
- Traffic services (streetlights, signage, signals, road markings, ITS systems), investigations, protections, relocations and new installation works
- Delivery of bulk materials, plant, equipment and resources unable to be delivered, relocated or removed without effect on daytime public and traffic movements and flow
- Some aspects of widening works along the proposed route (earthworks, civils, pavements), including but not limited to, earthworks operations; retaining wall operations, drainage / ducting trenching works; pavement construction / upgrades; surfacing works and installation of street furniture:
    - Carriageway widening works effecting public and traffic flow in and around the Pakuranga township
    - Carriageway widening works affecting public and traffic flow along Ti Rakau Drive and connecting side roads
    - Carriageway widening works effecting public and traffic flow in and around the Botany township
- Some aspects of RRF construction including but not limited to temporary works installation, relocations and removal; beam deliveries and installation; major concrete pours; precast barrier and component installations
- Major intersection works. With the objective of minimising disruption, works at these locations will be grouped and concentrated in specific periods such as long weekends or holidays.

4.5 Dis-Establishment

As zonal works are completed, dis-establishment of construction support facilities will commence.

These activities include, but are not limited to:

- Dismantling and uplifting of site compounds, satellite offices and SAP egress points
- Making good temporary occupied land, through either landscape planting, grassing or agreed usage

[1] These management plans include the Construction Noise and Vibration Management Plan (CNVMP).

- Re-installation of facilities and traffic services temporarily removed or relocated
- Uplifting and removal off-site of construction plant and equipment, surplus materials and spoil, temporary works items and perimeter fencing, lighting and signage
- Uplifting, removal and making good temporary traffic management and pedestrian/cyclist deviations.

Where practicable these activities will be undertaken within dedicated works areas, but as dis-establishment works progress, activities will need to be undertaken within day and night-time lane and road closures.

4.6 Testing and Commissioning

Due to the complexity and length of the Project, opening of sections of roadway will be undertaken in stages over multiple, sometimes overlapping, timeframes. Refer to the construction summary programming in Figure 2 for targeted timings. Opening of the fully commissioned busway will be at the completion of all stages across all project zones.

As each zone (EB2/EB3R) is ready to be opened, the following steps will be followed to ensure a safe and efficient opening:

- Commissioning and acceptance testing of all systems and components where required
- Confirmation and sign-off that the zonal scope of works have been completed as designed and specified
- Completion of an independent safety audit
- Completion of public / traffic notifications of the opening and new lane layouts
- Removal of all construction support facilities, plant & equipment, and surplus materials & spoil from the site, including, the dismantling and uplifting of compounds, satellite offices and SAP's.

Once completed and over a single nightshift road closure, the following opening night activities will be undertaken:

- Uplifting and removal of temporary traffic management
- Installation of final line marking, and signage required
- Switching on of traffic services for the new layout, (e.g. signals, lightings etc)
- Uplifting and removal of any temporary traffic services.

5. EB2 and EB3R Construction Plant and Machinery

The following subsections provide an overview of the type of plant and heavy machinery that is anticipated to be required to undertake the construction activities described throughout this report (i.e. all stages).

5.1 Removal of Buildings

Removal of buildings would include relocation, de-construction or demolition.

Where possible existing houses and buildings will be uplifted and relocated for further use. When doing so, a specialist house removal contractor will be engaged to undertake the operation.

Key plant & equipment will be:

- Plant & equipment to disconnect the structure from its foundations
    - 30t excavator with rock breaker attachments
    - Handheld concrete saws and chainsaws
    - Hydraulic jacks
- Specialist truck and trailer unit(s) to transport the structure off site (night operations).

Hydrant jacks

House on temporary bearers

Low loader house removal truck and trailer unit

Where relocation of a house or building is not possible, deconstruction operations will occur. This will involve the dismantling and removal of the structure's components off site, whilst salvaging and recycling as much as possible materials for reuse in the construction of the Project, i.e. hardfill for temporary accessways and timbers for formwork.

Key plant & equipment will be:

- 30t excavator
- 20t excavator
- 6-wheeler hiab truck
- 6-wheeler tip trucks
- Articulated truck and trailer units
- Rubbish skip trucks.

Prior to any relocation and / or deconstruction activities, existing house / building surveys will be undertaken to determine what option should be used, and whether asbestos and / or any other hazardous substance is present. If a hazardous substance is identified, a specialist subcontractor will be engaged to develop a specific method statement and to manage and remove the substance in accordance with Auckland Council standards. Any specific plant and machinery requirement would be indicated within those method statements.

Any decommissioning of services might require localised earthworks (trenching or removal of overhead assets) as well as temporary utility diversions.

5.2 Earthworks

Normal construction plant will be required for earthworks activities, including excavators, trucks, and compactors. Cut material to be removed from site will be loaded by excavators into trucks while imported fill will be delivered by trucks, spread out into layers by excavator or graders and compacted with rollers and compactors.

Key plant & equipment will be:

- 2t to 10t excavators
- 10t to 14t excavators – including track and rubber tyre machines
- 20t to 30t excavators - including track and rubber tyre machines
- Excavator mounted rock breakers
- 1t to 3t skid loaders
- 1t to 5t wheeled dumpers
- 4-wheeler & 6-wheeler watercarts
- 4-wheeler tip trucks, delivery trucks
- 6-wheeler tip trucks, concrete trucks, delivery trucks
- Truck and trailer tip trucks
- Articulated truck and trailer units
- 2t to 5t rollers & compactors
- 10t to 20t rollers & compactors
- 2.5t to 6t loaders
- 10t to 14t loaders
- 4Kw to 9Kw towable diesel light tower
- 10 to 15 cfm petrol compressors
- 250 to 500 cfm diesel compressor
- 10kg to 34kg air breaker heavy
- 2000 to 3000 psi water blaster towable
- 3 kVA to 8kVA portable generators

- 8kVA to 20kVA generators
- 50kg to 500kg plate compactors
- 60kg to 75kg tamping rammers
- 400kg to 650kg pedestrian rolling drum
- 10t to 25t roller static multi tyre
- Site utes and 3t site trucks.

5.3 Pavements

It is anticipated that graders, trucks, and compactors will be required for granular pavement layers. Ready mix concrete trucks and concrete placing plant will be used for the lean-mix concrete sub-base layer, while pavers and compactors will be required for the asphalt pavement layers and surfacing. Works associated with the paving and surfacing may also require removal or shaping existing pavements using an asphalt miller.

Key plant & equipment will be:

- 10t to 14t excavators – including track and rubber tyre machines
- 1t to 3t skid loaders
- 4-wheeler & 6-wheeler watercarts
- 6-wheeler tip trucks, concrete trucks, bitumen sprayers
- 8-wheeler bitumen sprayers
- Truck and trailer tip trucks
- Articulated truck and trailer units
- 14G to 18G Graders
- W100 to W150 Fi Wirtgen road miller
- W200 to W250 Fi Wirtgen road miller
- Vogele 2.5m to 13m asphalt pavers
- 2.5t to 6t loaders
- 4Kw to 9Kw towable diesel light tower
- 50kg to 500kg plate compactors
- 400kg to 650kg pedestrian rolling drum
- 5t to 10t smooth drum rollers
- 10t to 25t roller static multi tyre
- 4-wheeler road sweeper trucks
- Site utes and 3t site trucks.

5.4 Other Specialised Plant

Truck-mounted attenuators will be utilised throughout the duration of the works to deploy traffic management equipment and act as shadow vehicles when required. Traffic management barriers will be deployed and shifted with the use of truck mounted hi-ab cranes and flat deck trucks.

Hydro excavation and/or high air pressure excavation plant will be used for pilot holes and when working around services.

Key plant & equipment will be:

- 4-wheeler transporter truck

- Truck and trailer transporter
- 6-wheeler truck mount hiab
- 8-wheeler truck mount hiab
- Trombone semi-trailer hiab truck
- 4-wheeler traffic attenuator trucks
- 8-wheeler hydro excavation trucks
- 25t mobile crane – Kato CR250
- 40t mobile crane – Liebherr LTM1040
- 60t mobile crane – Liebherr LTM1040
- Piling fluid (Polymer/Bentonite/Water) plant.

Appendix A – Reeves Road Flyover Construction

Temporary pedestrian overbridge – providing construction access across Ti Rakau Drive for the Reeves Road Flyover

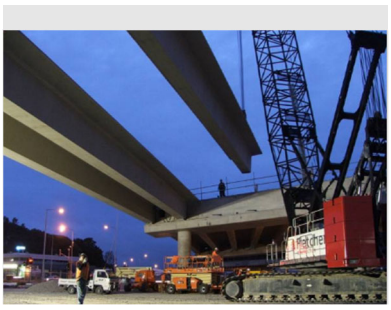
Piling & pile cap construction

Pier construction

Temporary works for superstructure

Beam delivery (nights)

Beam gantry launcher



Beam installation (nights)

Bridge edge barrier installation

Appendix B – Night Works

A.1 Night Work Construction Plan

Item	Zone	Category	Activity	Plant/Equipment	Project Timeline	Continuous Work within Zone of Influence	Location	Reasons to undertake work at night	Defined Location
1	EB2/EB3R	Traffic	Setting out hard barrier lines and general TTM	Traffic management plant/equipment, hiabs, loader, hand tools (fixing pins), generators, lighting towers	Jan 2023 to Apr 2027	0-2 weeks	Project Wide	Traffic constraints	Refer to 2.1.2, 2.2.2, 2.3.2 construction staging for EB2 and EB3R
2	EB2/EB3R	Site Clearance	Tree removal	Tree felling plant/equipment, trucks, lighting towers	Jan 2023 to Dec 2024	0-2 weeks	Seven Oaks, Gossamer, Ti Rakau Drive median, Project Wide	Traffic constraints, health and safety for road users when felling trees (exclusion zones)	Refer to A.2 Location 1
3	EB2/EB3R	Site Clearance	Demolition of street furniture, retaining wall, barriers	Excavator, saw cutting equipment, trucks	Jan 2023 to Dec 2024	0-2 weeks	SEART, Ti Rakau (Edgewater to Gossamer)	Traffic constraints	
4	EB2/EB3R	Pavement	Temporary pavement construction, removal of islands, grass medians	Profiler (milling machine), asphalt paver, trucks, bob Cat, excavator, compaction equipment (rollers 7-12 tonne roller), saw cutters	Jan 2023 to Dec 2024	0-2 weeks	Ti Rakau Drive (Pakuranga to Edgewater) Cortina Place (tentative)	Traffic constraints	Refer to A.3 Location 2
5	EB2/EB3R	Pavement	Asphalt paving (general) including maintenance	Profiler, asphalt paver, trucks, bob cat, sprayer truck, excavator, compaction equipment (rollers 7-12tonne roller), grader 12ft, saw cutters - floor saw, demo saw, tower lights, generators	Majority of work from 2024 to 2027	0-4 weeks	Project Wide, intersections and tie in of side roads	Traffic constraints, quality assurance	
6	EB2/EB3R	Pavement	Maintenance activities	Sweeper trucks, vacuum combi units (catch pit clearing etc), tractor and broom, hand held pneumatic drills and tools, generators, tower lights	Jan 2023 to 2029	0-1 week	Project Wide	Traffic constraints	
7	EB2/EB3R	Pavement	Island construction - placing precast	Loader, hiab, excavator, hand tools, generators, tower lights	2025 to 2027	0-4 weeks	Project Wide, Pakuranga Road, Ti Rakau Drive (Reeves to Gossamer)	Traffic constraints	Pakuranga Road North Bound Carriageway from Reeves to William Roberts Ti Rakau Drive East Bound Carriageway from Reeves to Gossamer
8	EB2/EB3R	Pavement	Road markings	Marking truck	Jan 2023 to Apr 2027	0-1 week	Project Wide	Traffic constraints	
9	EB2/EB3R	Structure	Concrete pours (pier piles, abutment piles, Crossheads, decks, pile caps if required, and lean mix subbase pavement)	Concrete trucks, pump, concrete placing equipment (screeds, vibrators, floats), hand tools, generators, tower lights	2023 to 2026	0-2 weeks (continuously, staged intermittently over the 2023 to 2026)	RRFO, Pavement Construction at Intersections and side road tie ins	Traffic, weather (temp), quality assurance (very strict specification requirements)	
10	EB2/EB3R	Structure	Barrier installation	Hiabs, cranes, loaders, trucks	2025 to 2027	0-6 months intermittent	RRFO	Safety due to workers below, access	
11	EB2/EB3R	Structure	Beam erection	Gantry, cranes, jinkers, loaders, hand tools, tower lights	2024 to 2026	0-1 week	Reeves/Ti Rakau Intersection	Traffic constraints, health and safety for exclusion zones lifting heavy loads overhead	
12	EB2/EB3R	Structure	Beam erection	Gantry, cranes, jinkers, loaders, hand tools, tower lights	2024 to 2026	0-12 months intermittent (not continuous)	RRFO	Traffic constraints, health and safety for exclusion zones lifting heavy loads overhead	
13	EB2/EB3R	Civil	Road crossings - utilities and stormwater	Saw cutter - floor saw and demo saw, excavator, compaction equipment up to 2t, trucks, hydroexcavator, generators, lighting towers	2023 to 2026	0-2 weeks	Project Wide	Traffic constraints	
14	EB2/EB3R	Utilities	Cut-ins and cut-overs	Small to medium mobile crane, excavator 20t, welders, watercarts, hand tools, generators, lighting towers	2023 to 2026	0-1 week	Ti Rakau Drive (SEART to Matson) Gossamer Drive near TR Intersection SEART Off Ramp (under overheads)	Quality assurance, Watercare driven, service disruption to community	
15	EB2/EB3R	Utilities	Traffic signals, street lighting, ITS, signal loop relocations	Hiab, small mobile crane, excavator, compaction equipment up to 2t, saw cutting - floor saw and demo saw	2023 to 2026	0-2 weeks	Project Wide	Traffic constraints	
16	EB2/EB3R	BLITZ	General long weekend BLITZ works - ducting, stormwater, pavement etc	Profiler, asphalt paver, trucks, bob cat, excavators, compaction equipment (rollers 7-12tonne roller), saw cutters - floor saw and demo saw, generators, lighting towers	2023 to 2026	0-4 weeks	Project Wide (TRD/Reeves Int, TRD/Gossamer Int, SEART/Pakuranga Int, TRD/Pakuranga Int)	Traffic constraints	
17	EB2/EB3R	Site Clearance	Relocation of houses	House removal truck (low loader), generators, lighting towers, hand tools	2022 to 2023	0-1 week	Project Wide	Traffic constraints	

A.2 Location 1

A.3 Location 2

Appendix C – Construction Methodology of Outfalls within CMA

Construction Plan

Legend

6 wheeler Truck access – 400mm GAP 65 with a layer of BIDIM 44 and Tensar TriAx geogrid, cover only, no stripping of topsoil

20 tonne excavator access

Construction laydown area (Stockpile of pipes, metal and riprap

1. Set up ESCP in the work area
2. Place 400mm GAP 65 with a layer of BIDIM 44 and Tensar TriAx geogrid, cover only, no stripping of topsoil
3. Material delivery and stockpile

CMA Works – Outfalls

4. Set up ESCP in the work area
5. Remove any vegetation
6. Install haul road and laydown
7. Install any silt controls in CMA (this is normally a silt fence installed by hand 1m outside the extent of works)
8. Remove any mangroves
9. De-fish area (this may need to be done after every tide)
10. Set up temporary stream diversion to divert stormwater around the excavation
11. Excavate out silt (working from the bank towards the CMA)* using a 20T excavator
12. Cart silt to tip
13. Place compacted GAP 65, BIDIM44, and Tensar TriAx geogrid (this to be done as you excavate)* - refer to the typical cross-section once IFC design issued

14. Continue with Step 9 until the end of the construction area reached* - refer to the typical cross-section once IFC design issued
15. Lay geotextile
16. Place riprap working the way back to the headwall
    Note: If need be, remove Gap 65 platform as you go and replace it with geotextile and riprap
17. Install headwall base
18. Install headwall

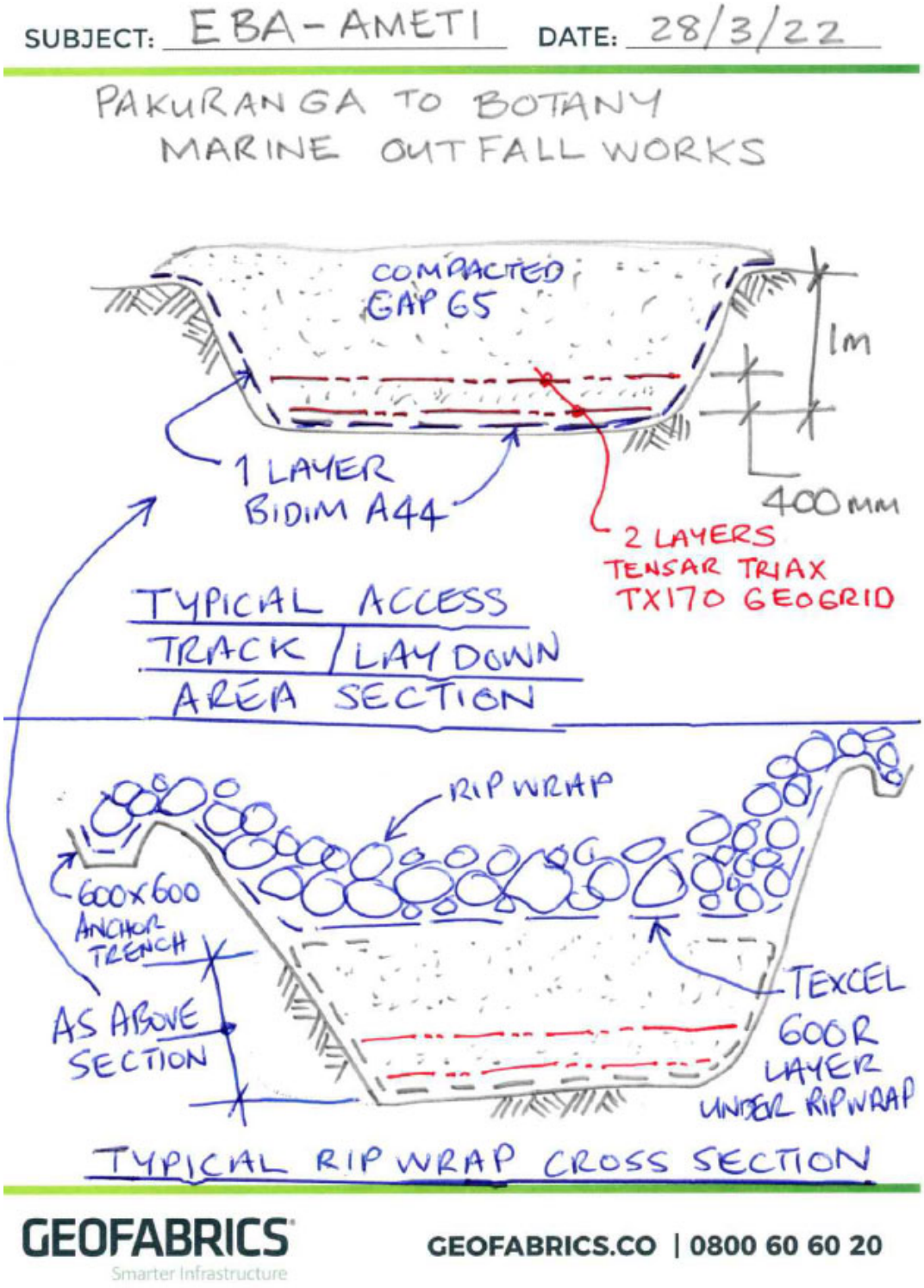
CMA Works – channel between outfalls – min 3.0m width (excavator access)

1. Excavate out silt (working from the bank towards the CMA)*
2. Use a 20T excavator
3. Make sure the bucket is clean from oil and grease
4. With the weed bucket remove any silt from the de-fished area
5. Have an archaeologist on standby
6. Load the silt on to a sealed truck
7. Cart the silt to the tip (managed fill)
8. Continue removing silt until you reach the competent ground
9. Construct a metal raft/causeway joining the two outfalls so you can sit the excavator on to dredge the new channel (GAP 65 + BIDIM 44 + Tensar TriAx geogrid – refer to typical cross-section - this to be done as you excavate) *
10. Construct the channel as you go from one outfall to the other

Remaining Pipes Installation

1. Install remaining pipes
2. Patch up headwall
3. Remove silt controls

Typical Cross-section (Reference Design)



Area measurement (approx.)