Eastern Busway
EB2 and EB3 Residential

Erosion and Sediment Control Effects Assessment

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Eastern Busway

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List of Abbreviations and Definitions

Abbreviation and Definitions	Description
AEE	Assessment of Effects on the Environment
AUP(OP)	Auckland Unitary Plan (Operative in part) 2016
BPO	Best practicable option
CEMP	Construction Environmental Management Plan
CMA	Coastal Marine Area
EB1	Eastern Busway 1 (Panmure to Pakuranga)
EB2	Eastern Busway 2 (Pakuranga Town Centre)
EB3 Commercial/ EB3C	Eastern Busway 3 (Gossamer Drive to Botany)
EB3 Residential/ EB3R	Eastern Busway 3 (Pakuranga Highway to Gossamer Drive)
EB4	Eastern Busway 4 (link between Ti Rakau Drive and Te Irirangi Drive, Botany Town Centre Station)
EBA	Eastern Busway Alliance
ESCP	Erosion and Sediment Control Plan
HNZPT	Heritage New Zealand Pouhere Taonga
HNZPTA	Heritage New Zealand Pouhere Taonga Act 2014
km	Kilometre(s)
m	Metre(s)
m^2	Square Metre(s)
m^3	Cubic Metre(s)
MCA	Multi Criteria Analysis
NES - CS	Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011
NES - FW	Resource Management (National Environmental Standards for Freshwater) Regulations 2020
NPS - FM	National Policy Statement for Freshwater Management 2020
NZCPS	New Zealand Coastal Policy Statement 2010
NoR	Notice of Requirement
RTN	Rapid Transit Network
RRF	Reeves Road Flyover
RMA	Resource Management Act 1991
SSESCP	Site Specific Erosion and Sediment Control Plan

Executive Summary

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 will be delivered in several stages.

This report addresses the Eastern Busway 2 (EB2) – Pakuranga Town Centre, including the Reeves Road Flyover (RRF) and Pakuranga Bus Station and Eastern Busway 3 – Residential (EB3 Residential) – Pakuranga Highway to Gossamer Drive, including Edgewater Bus Station stages. Both stages will include upgrades of stormwater infrastructure, including new outfalls, three of which will either be within or require works in the coastal marine area

Best practice erosion and sediment control (ESC) methods will be implemented, in accordance with Auckland Council Guideline Document 2016/005 *Erosion and Sediment Control Guideline for Land Disturbing Activities in the Auckland Region* (GD05).

The land has a generally low gradient and correspondingly reduced risk of erosion during rainfall. The works will comprise significant areas of reworking existing developed land (paved and buildings) such that subgrades exposed may be non-erodible hardfill. Overall, works will be staged to minimise areas exposed to erosion at any one time.

The management of construction water proposed for the Project will be in accordance with current best practice, can be successfully implemented and provides certainty in mitigating any actual and potential adverse effects. This conclusion is based on a review of the existing design information, and experience from other similar and adjacent roading projects in Auckland.

The assessment has acknowledged (EB2) and assumed (EB3R) the presence of natural wetlands within 100m of the works footprint. The conclusions of the assessment have taken account of potential effects on those wetlands associated with diversion and discharge of runoff treated sediment-laden runoff during construction.

It is concluded that the proposed works methodology will minimise actual and potential adverse construction effects to an acceptable and negligible level.

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 1-1 below.

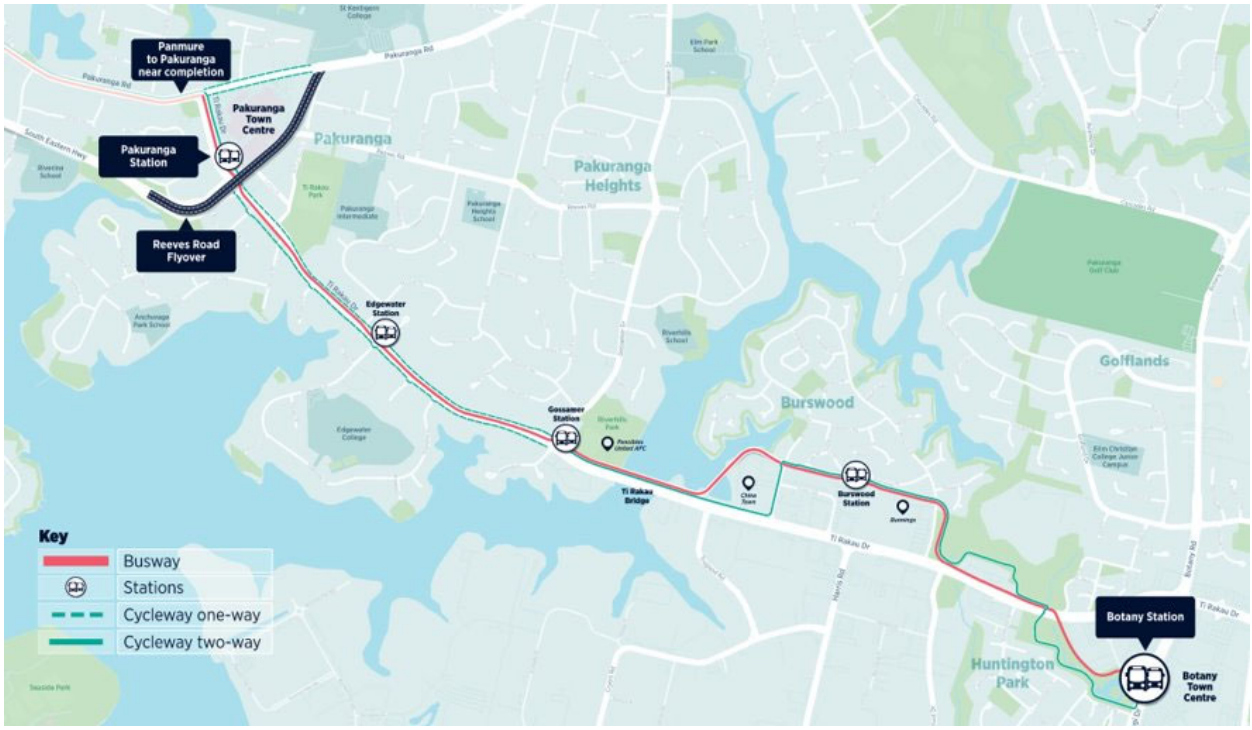

Figure 1-1. Project alignment

1.2 Project Objectives

The Project objectives are:

1. Provide a multi modal transport corridor that connects Pakuranga and Botany to the wider network and increases access to a choice of transport options
2. Provide transport infrastructure that integrates with existing land use and supports a quality, compact urban form
3. Provide transport infrastructure that improves linkages, journey time and reliability of the public transport network
4. Contribute to accessibility and place shaping by providing better transport connections between, within and to the town centre
5. Provide transport infrastructure that is safe for everyone
6. Safeguard future transport infrastructure required at (or in vicinity of) Botany Town Centre to support the development of a strategic public transport connection to Auckland Airport.

2 Proposal Description

The below is a summary of the works proposed within the EB2 and EB3R packages. Refer to the Assessment of Effects on the Environment (AEE) for additional detail on the works proposed.

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 east 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

Chapter Summary
The Project construction elements that are relevant to this assessment are: • *Earthworks* • *Reworking of existing hardstand areas* • *Structures* • *Stormwater outfalls including coastal outfalls and erosion protection* • *Trenching and drainage* • *Service relocation* • *Laydown areas and site compounds* *The works will be undertaken in accordance with industry best-practice methods and design guidelines, Project-wide management plans and site-specific management plans that will be developed and certified as works progress.*

3.1 Assessment Content

This Erosion and Sediment Control (ESC) Effects Assessment provides the assessment of the land disturbing activities and associated erosion and sediment control and effects associated with the construction of the EB2 and EB3R sections of the Eastern Busway Project.

Its purpose is to inform the AEE relating to the Notice of Requirement, and required regional consents and consents required under National Environment Standards for EB2; and the AEE and district and regional consents applications for EB3R and identify the ways in which any adverse effects will be mitigated.

This ESC Report has been prepared in accordance with Auckland Council Guideline Document 2016/005 *Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region* (GD05). It addresses the following earthwork activities that occur across the EB2 and EB3R sections:

- Establishment of the erosion and sediment controls
- General earthworks and trenching activities associated with drainage and services
- Land disturbance associated with construction of structures
- Coastal works associated with the installation of stormwater outfalls and erosion protection
- Final landscaping and stabilisation.

3.2 Specific Project Elements

3.2.1 Earthworks

The work areas are separated into two project stages (EB2 and EB3R) comprising a total of approximately 50,000m^3 of cut and approximately 54,000m^3 of fill, and involving approximately 4.8km of the local road network. These volumes incorporate all works proposed.

The works are to occur on a generally flat grade based on existing site contours. Refer to Tables 3.1 and 3.2 below for a breakdown of estimated earthwork areas and earthwork volumes within EB2 and EB3R.

The construction methodology will involve the trimming and widening of berms, the excavation and formation of new carriageway including the construction of a new Pakuranga Highway off ramp

(referred to as the SEART) and Reeves Road flyover bridge abutment ramps, the removal of the central medians, minor cutting of batters, placement of fill and associated drainage, structure placement, and installation of stormwater outfalls (both in the CMA and on-land).

The three main earthworks areas are, the SEART and Reeves Road Flyover (and associated abutments) located in EB2, and the widening of Ti Rakau Drive, in EB3R.

In addition to the widening of Ti Rakau Drive through EB3R, the residential demolition operations will clear each section to the residential boundary, beyond the design earthworks footprint. Exposed surfaces within this area will either be seeded and mulched or covered with geotextile and aggregate to provide stabilised construction space and access to accommodate the design earthworks and civil operations. The estimated area of the additional clearance area is indicated below.

The trimming and widening of berms and the removal of the central mediums, and minor drainage and services trenching operations, will be a cut and rapid cover operation. This will ensure that any exposed areas are minimised at any given time. This is a typical and accepted method for these types of projects and as such there is experience, and success, with undertaking these types of works on similar projects throughout Auckland.

Large portions of the works are civil operations that do not require earthworks. These works primarily involve milling and resurfacing of the existing road surfaces, Auckland Council utility reserve (Pakuranga Plaza carpark) and existing stabilised areas. Estimated milling volumes have been included in the table below.

For the other areas of more traditional cut to fill earthworks (stormwater pipeline installations, works within the formation of the SEART, the widening of Ti Rakau Drive, and the structural fill associated with the Reeves Road Flyover), cut material will be excavated and removed off site. The imported fill material will be primarily aggregate (regarded as a stabilised product), ensuring exposed areas are minimised at any given time.

The estimated earthwork areas and volumes are detailed in **Table 3-1** and **Table 3-2** below[12].

[1] Note: Within the tables, estimated earthworks duration includes the cut and earth fill programmed timeframes. The imported aggregate filling operations (aggregate defined as a stabilised product in GD05) have not been included in the estimated earthwork durations as that involves the placement of non-erodible material. In some instances, the days will be continuous, in others they will be staged. They have been provided to give context in regard to the duration of earthworks.

[2] The volumes include the works necessary for stormwater upgrades inside and outside the CMA. Specific calculations of volumes will be provided during detailed design.

Table 3-1 Earthworks Area and Volumes EB2

Area	Cut Material m^3	Fill Material m^3	Earthworks Area m^2	Estimated Earthworks Duration
SEART Off ramp	**4,000**	**4,400**	**17,000**	**14 days**
Reeves Road Flyover abutment ramps (north and south - MSE walls) and WRR cul de sac	**15,675**	**15,900**	**13,000**	**74 days**
Ti Rakau Drive Widening, Pakuranga Plaza	**1,500**	**400**	**5,000**	**15 days**
Ti Rakau Drive Widening, Pakuranga Plaza [Milling Operations]	**10,300**	Refer above	**N/A**	**N/A**
Main Site Compound and Laydown	**0**	**200**	**N/A**	**N/A**
Trenching Operations	**Cut to fill trenching operations estimated** **8,825**	**1,100**	**N/A**	**Trenching operations sequenced throughout project**
Total	**30,000**	**22,000**	**35,000**	**103 days**

Table 3-2 Earthworks Area and Volumes EB3R

Area	Cut Material m^3	Fill Material m^3	Earthworks Area m^2	Estimated Earthworks Duration
Ti Rakau Drive Widening, EB2 to EB3C including MSE walls (southwest side)	**10,800**	**16,000**	**34,500**	**38 days**
Ti Rakau Drive Widening, Gossamer Dr to EB3C including MSE walls (north side)	**1,600**	**15,100**	**6,500**	**9 days**
Ti Rakau Drive Widening, [Milling Operations]	**7,495**	**Refer above**	**N/A**	**N/A**
Residential boundary clearance area beyond earthworks design footprint	**N/A**	**N/A**	**27,000**	**N/A**
Trenching: water main and stormwater pipelines, combined service trenching (large and deep pipe work)	**Cut to fill trenching operations estimated** **7,600**	**900**	**N/A**	**Trenching operations sequenced through project**
Total	**20,000**	**32,000**	**41,000 (design EW)** **27,000 (additional clearance)**	**47 days**

With the exception of the new SEART off ramp, the widening of Ti Rakau Drive, and the structural fill associated with the Reeves Road Flyover and the MSE retaining walls, the Project includes a wide range of small earthworks activities that will be based on the "cut and cover" methodology, supplemented by traditional ESC measures.

The new SEART off ramp, the widening of Ti Rakau Drive, and the structural fill associated with the Reeves Road Flyover, whilst larger and more complex filling operations in regard to the project, will primarily use aggregate as the fill material, ensuring exposed areas are minimised at any given time.

A significant driver of this staged and progressive approach is the nature of the Project working adjacent to a live road network with limited construction space.

The indicative staging generally involves:

<u>EB2</u>

- Construction of the SEART (offline). Once completed traffic can be relocated to the new SEART

- Construction of the Reeves Road Flyover. The southern abutment works can now be undertaken offline as the traffic is redirected onto the new SEART. The northern abutment works can be undertaken off line
- Ti Rakau Drive and Pakuranga Plaza works to be tightly staged works (milling, resealing, services etc) dictated by traffic management requirements.

EB3R

- The widening of Ti Rakau Drive (west). Offline initial earthworks operation. Once completed traffic can be relocated to the new north bound lanes
- Ti Rakau Drive (central). The central lanes will now be milled, resealed, services and bus stations constructed
- Ti Rakau Drive (east). Milling, resealing, services to final south bound lane design.

Due to the gentle slopes of the area, the relatively small area of earthworks proposed and the staged nature of the works incorporating progressive stabilisation, the risk of significant sediment discharges is low. Notwithstanding this, the potentially higher risk areas and activities within the extent of works are identified as:

- Those works required immediately adjacent to the CMA (associated with the new and upgraded stormwater outfalls and coastal channel erosion protection works located off the SEART and Ti Rakau Drive) which are in the Sediment Control Protection Area (SCPA)[3]
- Pumping of any sediment laden water from excavations.

3.2.2 Stream Works

Three existing stormwater outfalls to the south-west and south of Ti Rakau Drive will be extended and upgraded as part of the EB3R works. It has been identified that the channels immediately downstream of the existing outfalls are short sections of terrestrial stream, before entering the CMA. These outfalls are located at:

- Rear of 63 Ti Rakau Drive
- Rear of 83 Ti Rakau Drive
- Rear of 97 Ti Raku Drive.

Another outfall will be upgraded to the rear of 171 Ti Rakau Drive. The channel below that outfall is not a stream.

The culvert extension works are associated with pipe extension and new head wall and erosion protection works. These works will be programmed to be undertaken in one week at each site. A general methodology would entail:

- Within a period of forecast fine weather
- Dam and divert or dam and over pump (if a 1-day operation)
- Install a downstream dam, de-fish the area as required (under ecology advice), and remove the clean water from the works area
- Muck out the area (all material to be loaded directly onto a truck and removed off site), backfill with hardfill as required and install the culvert/ headwall / erosion protection

[3] Sediment Control Protection Area under the AUP: OP is an area within 100m of the CMA or within 50m of a watercourse or wetland of 1000m^2 or greater.

- Any dirty water would be collected and either taken off site or to a sediment control device onsite for treatment (this would be confirmed during the site specific ESCP process)
- Once completed remove the dams.

3.2.3 Coastal Works

The Coastal works comprise:

EB2

The installation of two new stormwater outfalls and channel erosion protection as part of the EB2 works, to be located on the south side of SEART.

EB3R

A new stormwater outfall, located to the rear of 1/155 Ti Rakau Drive, and one at Riverhills Park.

The coastal works will adopt the following general methodology.

- Installation of tracks into the outfall sites, using cut and cover methodology. Cover will comprise geotextile and aggregate surfacing and geotextile cover of cut batters
- Clearance of vegetation from the works footprint
- Excavation of unsuitable substrate, trenching and placement of final pipe sections and pre-cast concrete wingwall outfall structures (craned in from land)
- Excavation of unsuitable substrate and placement of geotextile and rock riprap beyond the outfall.

All works within the CMA will be timed to occur when the tide is below the works area and the works sites will be isolated by bunding or silt fences. In addition, the channel protection works will require temporary damming and diversion of any upstream flows during the works.

3.2.4 Services Relocations

EB2 / EB3R traverse 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 to local reticulation services. Examples of these services include:

- High voltage transmission lines
- High pressure gas transmission pipelines
- Bulk water supply and wastewater infrastructure
- Fibre optic communication cables and telephone lines
- Electricity and gas distribution.

The relocation of the services will be staged and sequenced working in consultation with the utility providers. The majority of the work is located within existing road reserve or land to be vested as road reserve. Where trenching or land disturbance is required, the works will generally be a cut and cover operation. For the larger trenching operations, the works will be undertaken in accordance with the trenching and drainage works described below.

3.2.5 Trenching and Drainage

There are several deep trench stormwater and water lines to be installed. The trenching operations will be staged operations and will comprise a cut to waste trenching excavation, civil works and a stabilised backfill.

Dewatering, from the trenching operations will be managed via treatment containers / tanks or a lamella with the ability to include chemical treatment to enhance settlement and sediment retention. The treated water will then discharge to the stormwater network.

3.2.6 Structures

The Reeves Road Fly Over is part of the EB2 works. The bridge is a 587m structure, consisting of 16 3000mm diameter piles. The bridge itself will be constructed from reinforced in-situ and precast concrete components. In-situ decks will be poured on top of precast concrete girders, supported on in-situ concrete piers and columns, which will be position above reinforced concrete bored piles. Abutments will be mechanically stabilized earth walls (MSE) with deck end spans resting upon them.

The pile excavations will comprise of a cut to waste operation. The material excavated from the pile casings will be directly removed off site. Dewatering of the pile excavations will be managed via treatment containers / tanks or a lamella with the ability to include chemical treatment to enhance settlement and sediment retention. The treated water will then discharge to the stormwater network.

MSE retaining wall structures will be installed as part of the Reeves Road Flyover abutments, and along sections of Ti Rakau Drive and including adjacent to Riverhills Park.

Included in the EB3R works is the construction of the Ti Rakau Drive Bridge western abutment and associated permanent rock armouring benching works. The Ti Rakau Drive Bridge western abutment has been included in the EB3R construction works in order to minimise the disruption to the users of Riverhills Park and aids the construction team in progressing construction of the stages more efficiently.

It is noted that the proposed Ti Rakau Drive Bridge itself, remains in the consenting package for EB3C.

3.2.7 Construction Laydown Yards, Compounds and Satellite Offices

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 of the site disposal 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 with the demolition of the existing houses. It will provide a temporary storage area for the material and plants including a gantry crane.

Two areas within the EB2/EB3R footprint (5 Reeves Road & 2 Cortina Place) have been identified as key construction compounds/project offices. 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.

For further descriptions of the construction compounds and satellite offices, refer to the Construction Management Plan Overview.

3.2.8 Construction Programme

The EB2 and EB3R works are planned for a 4-year construction programme, with EB2 and EB3R working concurrently. More detail in regard to the estimated program can be found in the Construction Management Plan. The approximate timeframes are as follows:

- EB2: 3.5-year construction programme commencing approximately early-2023 through to early -2027
- EB3R: 3-year construction programme commencing approximately mid-2023 through to early-2027.

Actual earthworks operations will be staged throughout this period and cumulatively will occur over a significantly shorter timeframe as indicated in the Tables 3.1 and 3.2 above.

3.3 Construction Water Management

3.3.1 Guideline Implementation

As noted, GD05 will be the minimum ESC standard applied for all earthworks undertaken during EB2 and EB3R. All ESC measures will be in place and operational before any site works activities for any specific area are undertaken.

All ESC measures will need to be retained and maintained in good working order until all site works (earthwork and coastal work activities) within that area have been completed and the site stabilised to minimise erosion and any further discharges of sediment from the site.

The construction methodology will involve the trimming and widening of berms, the excavation and formation of new carriageway, removal of the central median, minor cutting of batters, placement of fill and the undertaking of associated drainage, coastal works and structure placement. The trimming and widening of berms and the removal of the central median will be a cut and rapid cover operation ensuring exposed areas are minimised at any given time. This is a typical and accepted method for these types of projects and as such there is experience, and success, with undertaking these types of works on similar projects throughout the Auckland roading and motorway network.

For the other areas of more traditional cut to fill earthworks, the formation of the new SEART off ramp, the widening of Ti Rakau Drive, and the structural fills associated with the Reeves Road Flyover abutments, cut material will be excavated and removed directly off site. The fill material will be primarily aggerate, ensuring exposed areas are minimised at any given time.

Both EB2 and EB3R include a wide range of “small” earthworks activities, and a “cut and cover” approach will be implemented in addition to the traditional erosion and sediment control measures. Much of the work area across EB2/3R includes working on hardstand and/or hard fill locations and as such, an estimate of sediment yield is not warranted, as the corresponding risk of adverse sediment discharge is considered low.

While the Project is assessed later as having an overall low risk of significant sediment discharge, on a relative basis the potentially higher risk areas and activities within EB2 and EB3R are identified as:

- Those works required immediately adjacent to the coastal marine area of the Tāmaki River (associated with the new and upgraded stormwater outfall structures on the southern side of SEART1 and on the southwestern side of Ti Rakau Drive) which are in the SCPA

- Any works 100m either side of the Tāmaki River which is in the SCPA
- Pumping of any sediment laden water from excavations.

- Figure 3-1 below indicates the locations of the coastal outfalls and the coastal marine boundary of the Tāmaki River.

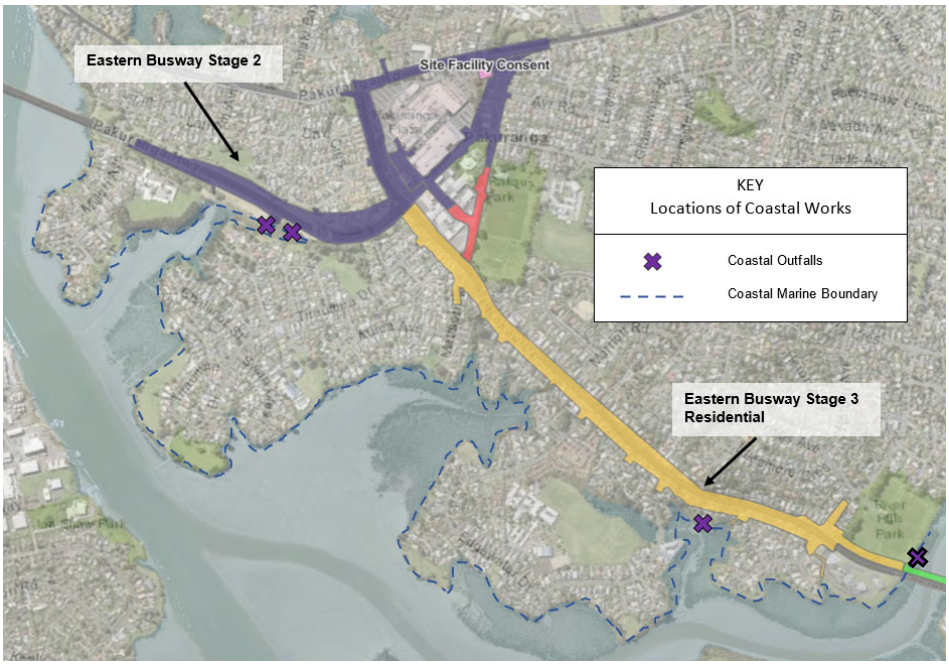

Figure 3-1 Location of Coastal Works

The duration and timing of works will be minimised as far as practical to minimise disturbed soils exposed to heavy rainfall. The total construction programme of approximately 48 months is estimated, with only a total of approximately 150 days of "bulk" traditional earthworks programmed throughout that construction period (excluding trenching operations).

The use of hard fill (aggregate) for the 'bulk" earthwork areas will ensure that the majority of the site is stabilised at any one time. This is used as a key risk reduction methodology and is consistent with the principle of progressive stabilisation.

The implementation of a monitoring programme (as per Section 3.4 of this report) supports the emphasis of good site management of exposed areas and the operation and maintenance of ESC. In addition, chemical treatment, where appropriate, will allow for improved treatment efficiencies of detention devices.

Prior to undertaking works within the winter period, a winter works approval will be required, and as such specific winter works details will be expected to be provided for this period. This provides certainty for Council that specific measures will be installed as necessary and certainty for the construction team that works can largely continue throughout the year to maintain as short a project duration as possible.

3.4 Management Plans

3.4.1 Project Erosion and Sediment Control Plan

As illustrated in Figure 3-2, Project ESC will be delivered through a cascade of management plans to ensure consistent outcomes and to achieve a high standard of environment management.

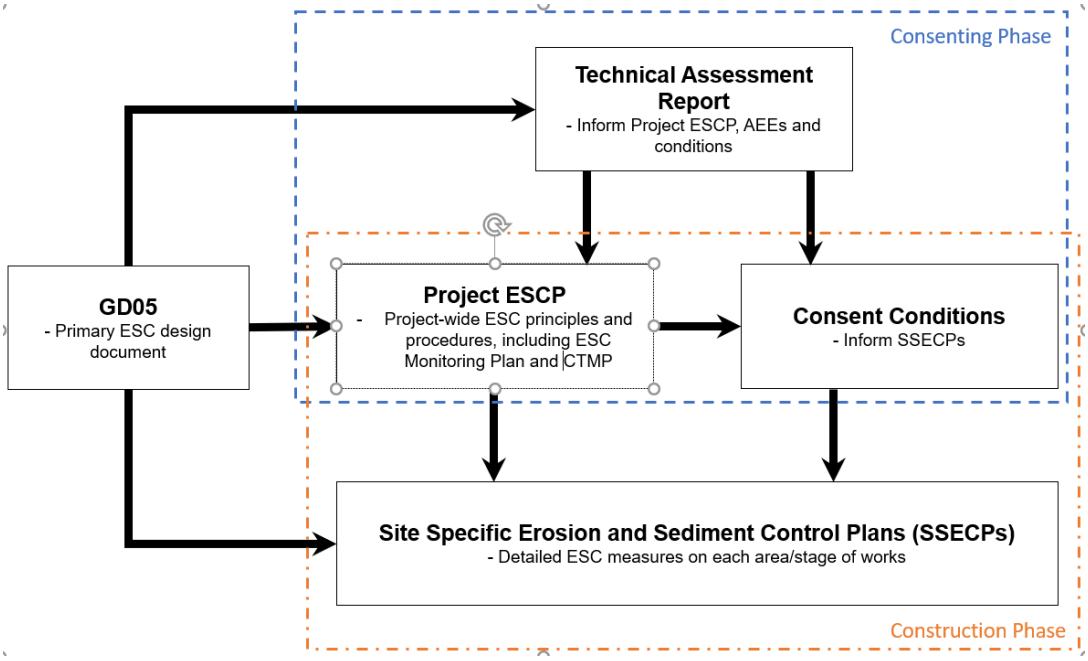

Figure 3-2 ESC Management Plan Hierarchy

A Project Erosion and Sediment Control Plan (Project ESCP) is provided in the EB2 and EB3R applications. The Project ESCP provides the overarching principles and design standards that will be implemented for the design construction, monitoring and maintenance of the ESC measures during the Project.

In conjunction with consent conditions and GD05, the Project ESCP will guide the development of Site Specific Erosion and Sediment Control Plans (SSESCPs) for each area of work.

3.4.2 Site Specific Erosion and Sediment Control Plans

SSESCPs are detailed erosion and sediment control plans which will be submitted for specific work areas, or activities, within EB2 and EB3R. These will be consistent with the principles of this ESC Report and GD05. They will be developed prior to the commencement of work in that area or that specific activity, and will provide the detailed design, specific erosion and sediment control measure location, staging and sequencing of works for the specific location or activities.

The implementation of SSESCPs will enable the construction teams to have ongoing input into the ESC design prior to and during construction, subject to compliance with the design and implementation standards specified in this report, and consent conditions when those are confirmed.

The SSESCPs will be short and succinct technical plans and will include:

- Contour information
- ESC measures for the works being undertaken within a particular construction area including supporting sizing calculation and drawings

- Chemical treatment design and dosing details (including bench test results)
- Catchment boundaries of works and devices installed
- Location of the work
- Details of construction methods
- Design criteria, typical and site-specific details of erosion and sediment control.

3.5 Site Management

3.5.1 Management Procedures

Management of construction water will seek to achieve the following objectives:

- Minimise the potential for sediment generation and sediment yield[4] by maximising the effectiveness of ESC measures
- Take all reasonable steps to avoid or minimise potential adverse effects on freshwater and marine environments within or beyond the EB2 and EB3R work boundaries, with particular regard to reducing opportunities for sediment generation and discharge of non-sediment contaminants.

The following principles will apply and will be reflected in the SSESCPs prior to construction activities commencing:

1. ESC construction water management measures will, where practicable, be undertaken and implemented with a hierarchy and priority order as follows:

   - Erosion control will be provided for in all circumstances by minimising sediment generation through a range of structural (physical measures) and non-structural (methodologies and construction staging – use of hardfill) erosion control measures
   - Sediment control will be implemented to treat sediment laden discharges.

2. Construction water management measures will be confirmed in the SSESCPs. All erosion and sediment controls will meet the minimum criteria of GD05 and the Project ESCP (refer to Section 3.4 above).

3. Progressive and rapid stabilisation, both temporary and permanent, of disturbed areas using mulch, aggregate and geotextiles will be on-going during the construction phase. Temporary stabilisation will apply particularly with respect to stockpiles (temporary only), ground improvement locations where topsoil is removed, concentrated flow paths and batter establishment. Stabilisation is designed for both erosion control and dust minimisation and will be progressively implemented, and will adopt the following protocols:

   - No areas of works should be stripped of vegetation unless they are to be subject to works within a 14-day period of the area being stripped. If areas are stripped and exposed to erosion and works are not to occur for at least 14 days, then temporary stabilisation will be implemented
   - Progressive stabilisation is to be implemented across both EB2 and EB3R. Setting timeframes for areas to be open before stabilisation is required will be established within the 14-day period. Stabilisation methodologies will be based on GD05 and will include mulch, geotextile and hard fill

[4] The amount of sediment discharged from the site during the works.

- Trenching activities will be staged and undertaken in a progressive manner. Excavated material will be cut to waste. All backfill material will be aggregate
- Preparation of earthworks areas when heavy rain is forecast to minimise erosion, through stabilisation and the installation of GD05 erosion control measures.

4. Minimising activities that could exacerbate erosion, and avoidance of activities such as stockpiling of material in flow paths.

5. All T-bar decanting earth bunds (DEBs) will be fitted with a mechanism to control (or cease) outflow during dewatering pumping activities to these structures if required. This mechanism could take the form of a manual decant pulley system or plug. When pumping to a DEB, pumping will be such that pump volumes will only be to the same level as that able to be fully captured within the retention structure and discharged out the designed decant structure.

6. Coastal works (for the stormwater discharge structures and channel erosion protection) and works in the vicinity of the CMA will be undertaken in a manner that recognises the higher risk of this activity, from a sediment generation and discharge perspective, and the sensitivity of the receiving environments. Works within the CMA will be undertaken outside of tidal inundation periods and / or will be bunded to isolate the works areas from tidal encroachment and / or protected via the use of silt fences.

3.5.2 As-built Certification

All ESC measures installed on site will be inspected and certified as compliant with the relevant SSESCP and GD05 prior to earthworks commencing in that area. The as-built certification will be submitted to Auckland Council. Any variation between the design and the measures on site will be rectified or justified prior to works commencing.

3.5.3 Monitoring

Comprehensive ESC monitoring will be undertaken for the duration of the earthworks. This will ensure that ESC measures operate with maximum efficiency and will allow for continuous improvement in response to monitoring feedback. This is outlined in Section 7 of the Project ESCP. Proactive monitoring will include regular site walkovers and inspection of construction water management devices prior to, during and post rainfall.

3.5.4 Training

Awareness and skills are essential to ensure consistent outcomes. Details of training is provided in the Project ESCP. All staff will be provided with environmental awareness training. Staff responsible for the construction and maintenance of environmental controls will be trained in those specific areas. Awareness training will also be required for all sub-contractors to ensure that controls are maintained operational at all times, or that damage is immediately reported if it occurs.

3.6 Design of Erosion and Sediment Control Devices

High level ESC drawings are attached to the Project ESCP in the EB2 and EB3R AEE applications. The control devices to be applied to EB2 and EB3R are summarised below.

3.6.1 Erosion Control – Construction Staging and Sequencing

The extent of exposed soil and length of time that area is exposed directly influences the sediment yield leaving a particular area. Earthworks and construction activities will be staged and sequenced in order to keep open areas to within acceptable limits allowing the construction to be carried out efficiently. Open earthworks areas will be progressively stabilised to reduce the potential for erosion to occur.

The use of hardfill significantly supports this approach.

3.6.2 Erosion Control - Cut and Cover: Stabilisation

Stabilisation will be undertaken with three key purposes:

- To assist with the reduction of overall disturbed areas of earth
- To minimise the open area extents to assist with a reduction in sediment generation and subsequent yield
- To minimise the open area extents to assist with a reduction in dust generation.

Due to the overall nature of the proposed works, which includes provision for a stabilised hard fill surface as soon as possible to allow for civil works to commence (resurfacing, drainage, curbing and traffic barriers etc), it is proposed to utilise a “cut and cover” erosion and sediment control methodology wherever possible and practical.

This method promotes progressively undertaking construction works, stripping topsoil and any unsuitable subsoils (to achieve suitable ground conditions) and then immediately backfilling with aggregate to the final required level. In addition to the aggregate, progressively and rapidly stabilising exposed areas will occur with measures including (but not limited to) straw mulch, pavement, geotextile cloth and vegetation establishment. This methodology will be used through the central median works, drainage activities and areas of minor shoulder widening.

For areas not filled with hardfill, mulching will typically be applied to slopes of less than 10 degrees, with alternatives such as geotextile or polymers considered as required.

Photo 1: Rapid stabilisation, cut and cover (geotextiles and aggregate) used on the Albany Highway project

3.6.3 Erosion Control – Clean water Control

Clean water diversions (CWDs) are diversion channels or bunds which provide for the controlled conveyance of runoff from the wider catchment. CWDs will be used on EB2 and EB3R to prevent runoff from the undisturbed catchment above the works from entering the construction area to ensure the works are sufficiently protected from flows from the natural catchment outside of the work area wherever practicable.

This will specifically be in the form of retaining the kerb and existing drainage as long as possible or in the form of Hotmix bunds which will be installed and utilised for diversion of flows from existing road surfaces. In accordance with GD05 the Hotmix bunds will be approximately 150mm to avoid flooding of the existing road network.

Photo 2: Hotmix Bund used to divert existing road runoff and separate works area, used on the North-Western Motorway.

3.6.4 Erosion Control – Stabilised Construction Entrance Way

Stabilised construction entrance ways are either a sealed entrance or a stabilised pad of aggregate placed on a filter cloth base and are located where construction traffic will exit or enter a construction site. Stabilised construction entranceways help to prevent site entry and exit points from becoming a source of sediment and also help to reduce dust generation and disturbance along public roads.

No vehicles will be allowed to leave the construction site unless tyres are clean, so that construction vehicles will not contribute to sediment deposition on public road surfaces outside the works area. These are to be designed in accordance with GD05.

3.6.5 Sediment Control - Decanting Earth Bund

Decanting earth bunds (DEBs) are sediment retention devices where ponding of sediment-laden runoff can occur. DEBs provide time for suspended solids to settle out before the runoff is discharged to the receiving environment. The DEBs will be designed and installed in accordance with GD05. The key design criteria are set out below:

- DEBs will have a minimum storage volume sized at a ratio of 2% of the contributing catchment area with a maximum contributing area not exceeding 0.3 ha, and an ideal length to width ratio of 3:1, but not exceeding 5:1
- All spillways from the DEBs will be constructed to a minimum 2m wide by 250mm in depth
- DEBs will be fitted with T-floating decants with a mechanism to control outflow such as a manual decant pulley system to be used during pumping activities to these structures.

3.6.6 Sediment Control - Chemical Treatment

To maximise their efficiency, DEBs will receive chemical treatment to increase the settlement rate and retention of suspended solids from construction runoff. All DEBs will be chemically treated with a flocculant appropriate for the soil type and discharge location in a particular construction area. This will be based on bench testing of soils using a range of flocculants to be undertaken during the SSESCP development, which will include details of the flocculant type, dosing rate and floc system catchment tray area to be applied at specific locations. A Chemical Treatment Management Plan has been prepared and is appended to the Project ESCP.

3.6.7 Sediment Control – Silt Fences and Super Silt Fences

Silt fences and super silt fences are fabric fences reinforced with stakes and netting backing. They provide a physical barrier to flows leaving the area of earthworks.

The placement of silt fences and super silt fences will be based upon the criteria contained within GD05.

Photo 3: Silt Fences used to treat construction water, used on the North-Western Motorway.

3.6.8 Sediment Control - Pumping activities

Wherever possible, gravity flow into the various sediment retention measures will be used in preference to pumping. However, it may not always be possible to achieve gravity flow to sediment control devices during construction. Trenching is an activity that will be undertaken during the Project that may require dewatering by pumping.

If pumping is required, that will be discharged to a DEB or other treatment container. Water from the containment devices (DEB or treatment container) will not be discharged to the environment until the impounded water has a visual clarity of at least 100mm. That is consistent with GD05.

As noted, DEB decants will have a means to suspend the T-bar decants to prevent discharge while pumped water settles.

The pumping rates and volumes to DEBs or treatment container will be controlled so that the total pump volume can be fully captured within the retention structure.

Pumping may also be required for other activities such as bridge construction where pumping of sediment laden water may be required during foundation / piling construction. Pumping flows to a sediment retention structure ensures that any sediment laden flows are discharged to a treatment device prior to discharge to the receiving environment.

A Chemical Treatment Management Plan and Dewatering Procedures are included in The Project ESCP. All pumping and dewatering operations will be in accordance with the Project ESCP.

3.6.9 Stream Works

Stream works will be limited to the extension and upgrade of three stormwater outfalls within EB3R. A specific SSESCP will be prepared for those operations that will allow the works to be undertaken in the dry by bypassing any existing pipe baseflow around the works site and providing a stabilised flow path in the event that rainfall and elevated flows occur. Silt fences will also be used to contain runoff from the area surrounding the outfall during works, or alternatively all exposed ground will be covered to prevent erosion during rainfall.

Stabilised access will be constructed to allow the works to be completed. The stabilised access tracks will be completed as cut and cover operations. Geotextile will be placed over the grass, with aggregate placed over the geotextile. Any dirty water created during the operations will be contained and pumped to a containment device (DEB or treatment container) for treatment in accordance with the Project Chemical Treatment Management Plan and Dewatering Procedures

3.6.10 Coastal Works

Installation of new stormwater outfalls and a section of channel erosion protection will occur within the CMA. A specific SSESCP will be prepared for those operations that will allow the works to be undertaken in the dry, working around the tides and the use of coffer dams, silt fences and diversions to divert any upper catchment water.

Stabilised access will be constructed to allow the works to be completed. The stabilised access tracks will be completed as cut and cover operations. Geotextile will be placed over the grass, with aggregate placed over the geotextile. Any dirty water created during the operations will be contained and pumped to a containment device (DEB or treatment container) for treatment in accordance the Project Chemical Treatment Management Plan and Dewatering Procedures.

3.6.11 Dust Control

Dust will be managed onsite in accordance with GD05. This includes the use of water trucks to dampen exposed soil areas and stockpiled materials if they eventuate (although stockpiles are not expected).

The minor nature of the land disturbance works for EB2 and EB3R and the “cut and cover” methodology proposed will further minimise the likelihood of a dust nuisance.

Stockpiles will be located with the transfer compound areas and controlled by bunding and silt fences. Cut material will initially be loaded onto a 6-wheeler truck and taken to the transfer yard where the material will be transferred onto truck and trailer units for removal off project. Material may be temporarily stockpiled until there is enough material to fill a truck and trailer unit for removal.

Material to be removed off project (cut to waste) will be taken to authorised facilities. All material will be tested as required to ensure compliance with the authorised facilities acceptance criteria and conditions.

3.7 Reasons for Consent

Consent matters are set out in Section 7 of the EB2 AEE and Section 5 of the EB3R AEE. Reasons for consent are under both the Auckland Unitary Plan: Operative in Part (AUP(OP)) and the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES: FW). Consent matters relevant to this assessment relate to land disturbance, land disturbance in proximity to streams and wetlands, and land disturbance with the CMA.

4 Methodology and Analysis

Chapter Summary
This assessment is based on: • *the Project design drawings and engineering details* • *other specialist assessments* • *relevant design guideline* • *site walk-over* • *statutory assessment instruments.*

4.1 Assessment Methodology

This report follows an overall best management practice (BMP) approach to the construction activities which combines GD05 as the minimum design standard with appropriate staging and other controls, based on the characteristics of both EB2 and EB3R and the receiving environment.

The existing environment as outlined within Section 5 of this report was characterised through the following:

- Assessment of existing datasets and information available from numerous sources including Council
- Project technical reports
- Site inspection of the alignment in general.
- It is framed within the relevant AUP: OP matters of discretion, objectives and policies, and the relevant provisions of the National Policy Statement for Freshwater in relation to the NES: FW reason for consent.

4.2 Site Walk-Over

Site inspections have been undertaken on several occasions to assess different aspects of the Project through October and November 2021.

4.3 Design Guidelines

GD05 is the relevant ESC design guideline. This construction management principles and methodologies described in this report are based on, and consistent with, that guideline.

5 Existing Environment

The immediate receiving environment of EB2 consist of the road corridor of the Pakuranga Highway and Ti Rakau Drive. The wider area includes the commercial area of the Pakuranga Plaza and residential dwellings that line the western side of Ti Rakau Drive.

EB3R continues along Ti Rakau Drive, lined on both side by residential properties and several local shop clusters.

As discussed in further detail in the AEE the topography within and immediately surrounding both EB2 and EB3R is flat to gently undulating. There are relatively small slopes at the Pakuranga Highway where the grade rises to the Ti Rakau Drive intersection and at the eastern end of the Pakuranga Road near the William Roberts Road intersection. The majority of the works site will be across property that currently comprises commercial buildings, residential property or existing at grade road carriageway.

Commercial and residential properties bound the site.

Stormwater is serviced by reticulation and by overland flow paths that drain back via Ti Rakau Drive and the Pakuranga Highway to the Tamaki River. The Tamaki River is tidal at the location of the stormwater reticulation outfalls.

Sections of stream have been identified beyond three existing outfalls along Ti Rakau Drive that are to be upgraded.

Pockets of coastal wetland have been identified on the margins of the CMA that extend to the south of SEART. Those wetlands are within 100m of the proposed works footprint.

This assessment has also assumed that there may be areas of coastal wetland along the coastal margin adjacent to EB3R.

6 Assessment of Potential Construction Water Effects

Chapter Summary
Overall, the potential risk of an elevated sediment yield is low. The works comprise a mix of earthworks that expose erodible soil, and reworking of existing non-erodible surfaces. The works areas have generally low gradients, which further reduce the potential for sediment generation during rainfall. *The works will be staged such that the exposed areas are minimised at any one time and works areas will be progressively stabilised.* *The installation of the four coastal outfalls presents the highest relative risk. But again, those works will be manged to acceptably minimise the risk of sediment generation and discharge to the marine receiving environment though staging, isolating the works from tidal inundation, and progressive stabilisation.* *If undertaken in accordance with the methodology described in this report and consistent with the Project ESCP, it is anticipated that the works will have negligible adverse effects on the receiving environment.*

Overall, it is considered that the potential risk of an elevated sediment yield from the EB2 and EB3R works is low. This is primarily due to the low gradient[5] of the majority of the Project area across EB2 and EB3R, the relatively small area of exposed soil that will occur as distinct from exposed hardfill, and the staged nature of the works incorporating progressive stabilisation. A significant driver of this staged and progressive approach is the nature of EB2 and EB3R works adjacent to a live road network with limited space.

Notwithstanding the above, EB2 and EB3R works have the potential to result in some temporary changes to water quality during the construction phase as a result of the discharge of sediment from earthworks during rain events, from dewatering activities and the discharge of other construction related contaminants (such as oils, fuels and cement).

The assessment of these potential water quality effects is based on the GD05 BMP principles, and the specific erosion and sediment control measures assessed as appropriate and as detailed in the Project Erosion and Sediment Control Plan.

Managing site risk is a combination of:

- The competency and performance of the contraction team
- Timing and duration of works
- The quality construction, operation and maintenance of the ESC measures and other site management procedures and practices.

The SSESCPs will ensure ongoing construction team input into site management, and allow for flexibility with the specific ESC implementation. These SSESCPs will provide the detailed design, specific ESC locations, and the staging and sequencing of works for that location or activity. Each SSESCP will be developed prior to works commencing in the specific locations applicable to the SSESCP.

6.1 Erosion and Sediment Control Onsite Implementation

Draft erosion and sediment controls to be implemented on site are detailed within the plans provided in the EB2 and EB3R AEE applications. These plans indicate a GD05 compliant approach proposed for EB2 and EB3R and confirm that GD05 complaint controls can be constructed.

[5] Slope gradient and slope length are significant factors in erosion potential and sediment generation during rainfall.

In addition, as detailed above, the SSESCPs will be developed prior to the commencement of work and provide the detailed design, specific erosion and sediment control measure location, staging and sequencing of works for the specific location or activity.

Primarily the erosion and sediment controls are based around cut and cover methodologies, use of silt fences in locations where suitable, and the installation of DEBs where space provides.

In addition, clean water diversions (existing curbs and hotmix bunds) will be utilised along the sections of the alignment for the purpose of minimising dirty water catchment areas and keeping “offsite water” away from the earthwork activity.

Both EB2 and EB3R have waste cut material that is to be removed off site. This cut material will initially be cut to waste and removed to the transfer laydown yard (169 - 171 Pakuranga Road) compound for temporary stockpiling to be reloaded onto a truck and trailer for removal off site to an appropriate facility.

6.2 Eastern Busway 2

The EB2 works will comprise:

- Reworking of existing road and hard-stand areas
- Disturbance of soil and construction with hardfill, including formation of new off ramps and overpass embankments using hardfill
- Services installation via trenching
- Coastal outfall construction.

6.2.1 Existing road and hardstand areas

These works present a very low risk of sediment generation and discharge as erodible soils will not be exposed and these works areas have very low gradient. Where necessary, additional protection will be installed such as filter protection around live catch pits and measures to ensure that runoff is not directed towards private property in a manner that will cause nuisance or harm. Overall, the potential adverse effects of these works are very low.

6.2.2 Disturbance of soil and construction with hardfill / Overpass embankments

Areas beyond existing road and hardstand will need to be excavated prior to placement of hardfill base. Generally, these will be progressively stabilised but in addition, sediment control will be provided as described in Section 3 above and in the Project ESC, and as detailed in the relevant SSESCP. These works areas have a low gradient and individually, each works area is not extensive. The potential for sediment generation is relatively low and with ESC mitigation, the potential for adverse sediment effects off site is very low.

6.2.3 Services installation / Trenching

Trenching will be staged and isolated from surrounding works. If required dewatering will be undertaken in accordance with the Project ESCP and the relevant SSESCP. Water pumped from trenches will not be discharged from the site unless it meets a minimum standard of 100mm visual clarity. Alternative options will be available via tankering water off-site in the event that the clarity standard cannot be met. Experience in similar projects suggests that the 100mm standard will be able to be met.

Consequently, service installation, including trenching, can be managed to ensure that any residual discharge of sediment from the works is minimised to an acceptable level and offsite effects are negligible.

6.2.4 Coastal Works

EB2 requires works within the CMA, being the installation of the two new stormwater outfalls and connecting channel erosion protection. These are identified in the plans and can all be achieved with "the installation of coffer dams or bunds to isolate the works area, and within tide and weather windows.

These works will also require tracking into each site. That will be managed by progressive stabilisation with aggregate and geotextile such that the access is immediately protected from erosion.

The outfalls will be constructed one at a time to minimise the extent of works within the CMA at any given time. The connecting channel erosion protection works will require bunding to isolate the works area from the channel flows. A detailed staged construction methodology will be developed to allow the works to be undertaken "in the dry".

The ecological impacts of the works, including the area required for rip rap erosion protection beyond each pipe outlet and wingwall, is assessed by others. In terms of potential sediment effects, the works will be undertaken using proven techniques including isolating each worksite with coffer dams or bunds and working between tidal cycles. In addition, the works at each site can be minimised in duration by prioritising the excavation of sediment and placement of riprap to create a non-erodible surface, and likely coordination of the excavation of substrate and placement of wingwalls such that the time of exposure is limited to 2-3 days at each site.

Because the works sites will be isolated, the risk of the downstream discharge of remobilised existing contaminants is low. The material that is excavated from each outfall and rip rap area will be trucked off-site, and the works area stabilised prior to being exposed to tidal flows.

Given the proven and successful implementation of this methodology within various other projects, there is no reason to consider that it cannot be successfully implemented for the EB2 works. Accordingly, there is minimal risk potential of adverse sediment-related effects of the proposed coastal works if the works are undertaken as proposed.

6.3 Eastern Busway 3 Residential

The EB3R works will comprise:

- Reworking of existing road and hard-stand areas
- Disturbance of soil and construction with hardfill associated with road widening and cycleway construction
- Services installation via trenching
- Coastal outfall construction.

6.3.1 Existing road and hardstand areas

These works present a very low risk of sediment generation and discharge as erodible soils will not be exposed and these works areas have low gradient. Where necessary, additional protection will be installed such as filter protection around live catch pits and measures to ensure that runoff is not

directed to private property in a manner that will cause nuisance or harm. Overall, the potential adverse effects of these works are very low.

6.3.2 Disturbance of soil and construction with hardfill

Areas beyond existing road and hardstand will need to be excavated prior to placement of hardfill base. Generally, these will be progressively stabilised but in addition, sediment control will be provided as described in Section 3 above and in the Project ESCP, and will be detailed in the relevant SSESCP. These works areas have a low gradient and individually, each works area is not extensive. The potential for sediment generation is relatively low and with ESC mitigation, the potential for adverse sediment effects off site is very low.

6.3.3 Services installation / Trenching

Trenching will be staged and isolated from surrounding works. If required, dewatering will be undertaken in accordance with the Project ESCP and the relevant SSESCP. Water pumped from trenches will not be discharged from the site unless it meets a minimum standard of 100mm visual clarity. Alternative options will be available via tankering water off-site in the event that the clarity standard cannot be met. Experience in similar projects suggest that the 100mm standard will be able to be met.

Consequently, service installation, including trenching, can be managed to ensure that any residual discharge of sediment from the works is minimised to an acceptable level and offsite effects are negligible.

6.3.4 Stream works

EB3R requires stream works, being the upgrade and extension of three new stormwater outfalls. The construction activities can be isolated from the receiving environment through the installation of coffer dams or bunds to isolate the works area, and weather windows.

These works will also require tracking into the site. That will be managed by progressive stabilisation with aggregate and geotextile such that the access is immediately protected from erosion.

The ecological impacts of the works, including the area required for rip rap erosion protection beyond the pipe outlet and wingwall, is assessed by others. In terms of potential sediment effects, the works will be undertaken using proven techniques including isolating the worksite with coffer dams or bunds and diverting any upper catchment flows around the works area.

Because the work site will be isolated, the risk of the downstream discharge of sediment is low. The material that is excavated from the outfall and rip rap area will be trucked off-site, and the works area stabilised in a staged and progressive manner.

Given the proven and successful implementation of this methodology within various other projects, this methodology can be successfully implemented for the EB3R works. Accordingly, there is minimal risk of adverse sediment-related effects of the minor stream works if the works are undertaken as proposed.

6.3.5 Coastal Works

EB3R requires works within the CMA, being the installation of two new stormwater outfalls. The construction activities can be isolated from the receiving environment through the installation of coffer dams or bunds to isolate the works area, and within tide and weather windows.

These works will also require tracking into the site. That will be managed by progressive stabilisation with aggregate and geotextile such that the access is immediately protected from erosion.

The ecological impacts of the works, including the area required for rip rap erosion protection beyond the pipe outlet and wingwall, is assessed by others. In terms of potential sediment effects, the works will be undertaken using proven techniques including isolating the worksite with coffer dams or bunds and working between tidal cycles. In addition, the works can be minimised in duration by prioritising the excavation of sediment and placement of riprap to create a non-erodible surface, and coordination of the excavation of substrate and placement of wingwalls such that the time of exposure is limited at each site.

Because the work site will be isolated, the risk of the downstream discharge of remobilised existing contaminants is low. The material that is excavated from the outfall and rip rap area will be trucked off-site, and the works area stabilised prior to being exposed to tidal flows.

Given the proven and successful implementation of this methodology within various other projects, this methodology can be successfully implemented for the EB3R works. Accordingly, there is minimal risk of adverse sediment-related effects of the coastal works if the works are undertaken as proposed.

6.4 Cumulative Effects

The risk of significant adverse sediment-related effects of the EB2 and EB3R works is assessed as being very low. Consequently, the cumulative effects are also assessed as very low. As noted earlier, while the project is significant in scale, it is not a significant earthworks project and does not present a significant risk of sediment discharges. The coastal works can be carefully managed and staged to achieve an equally low impact on the downstream environment.

This conclusion includes consideration of potential adverse effects on the identified coastal wetlands. The management of runoff will appropriately minimise sediment discharges to those environments. On a hydrological basis, runoff from the catchment of those features will still reach the wetlands, via the sediment control devices. It is also pertinent that the wetlands are coastal features that are primarily hydrologically sustained by tidal inundation rather than terrestrial runoff.

7 Mitigation

Overall, it is concluded that the construction ESC and water management proposed for EB2 and EB3R is in accordance with current best practice, can be successfully implemented and provides certainty in mitigating any actual and potential adverse effects.

It is recommended that the following key elements from this assessment form part of the mitigation measures for the EB2 and EB3R construction works:

- All earthworks and land disturbance activities should be undertaken in general accordance with this report including the Erosion and Sediment Control Plans
- The approach to managing ESC and construction water discharges will be confirmed by the construction team prior to works commencing through the preparation (and certification by Council) of SSESCPs for specific activities of Stage 1A
- SSESCPs will include the following information:
    - Contour information
    - ESC measures for the works being undertaken within a particular construction area
    - Chemical treatment design and details
    - Catchment boundaries of works and devices installed
    - Location of the work
    - Details of construction methods
    - Design criteria, typical and site-specific details of erosion and sediment control
    - Design details for managing the treatment, disposal and/or discharge of contaminants (e.g., concrete wash water).
- A Chemical Treatment Management Plan should be prepared for EB2 and EB3R and submitted to Council prior to the commencement of works to confirm the chemical treatment set up and include all relevant batch dosing information as part of dewatering operations
- Any DEBs constructed should be chemically treated in accordance with the EB2 and EB3R Chemical Treatment Management Plan
- Prior to any coastal works (stormwater outfall works) commencing on the site, a final construction methodology should be included within the relevant SSESCP. Details to be provided should include, but should not be limited to timing, staging and sequencing of coastal works, and the erosion sediment control measures to be employed to mitigate the effects on the receiving environment
- Any exposed areas should be subject to a 14-day stabilisation period. If areas are stripped and exposed to erosion, and works are not to occur within a 14-day period, then temporary stabilisation will need to occur. Stabilisation methodologies will need to be based on proven options and will include mulch, geotextile and hard fill.

Through the implementation of the recommended key mitigation measures above, any ESC construction water discharges will be subject to best practice management and proven management conditions, which will enable any potential effects from EB2 and EB3R to be appropriately managed.

8 Recommendations and Conclusions

It is recommended that the earthworks associated with the EB2 and EB3R project implement the mitigation listed in Section 7 above. That represents construction industry best-practice, provides certainty in outcomes, and can be successfully implemented within these sites. These conclusions are based on site visits, a review of the existing design information, and experience from other similar and adjacent roading projects in Auckland.

Site-specific erosion and sediment control plans will allow ESC details to be confirmed concurrently with detailed design for each stage or area of works. These will be prepared by the project contractor and will be implemented in accordance with the Project ESCP and GD05.

Ongoing monitoring, maintenance and adaptation of the ESC measures for the duration of earthworks will ensure that the works achieve the anticipated environmental outcomes i.e., that the potential adverse sediment-related effects of the works will be temporary and less than minor.