EAST WEST LINK

ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

DECEMBER 2016

NZ TRANSPORT AGENCY
WAKA KOTAHI

East West Link

New Zealand Government

Quality Assurance Statement		
Rev. Nº	**Date**	**Description**
0	December 2016	Final for Lodgement

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ABBREVIATIONS AND GLOSSARY OF TERMS

Glossary of Abbreviations and Defined Terms

The table below sets out the technical terms/abbreviations used in this report.

Abbreviation (if applicable)	Term
AADT	Average annual daily traffic
AEE	Assessment of Effects on the Environment
AMA	Auckland Motorway Alliance
AMETI	Auckland Manukau Eastern Transport Initiative
ARLTP	Auckland Regional Land Transport Plan 2015-2025
ARP: ALW	Auckland Council Regional Plan: Air, Land and Water
ARP:C	Auckland Council Regional Plan: Coastal
ARP: SC	Auckland Council Regional Plan: Sediment Control
AUP (OP)	Auckland Unitary Plan (Operative in Part)[1]
Austroads	The association of Australian and New Zealand road transport and traffic authorities.
BoI	Board of Inquiry
BPO	Best Practicable Option
CAQMP	Construction Air Quality Management Plan
CBMP	Concrete Batching Management Plan
CCO	Council Controlled Organisation
CBD	Auckland Central Business District
CEMP	Construction Environmental Management Plan
CESCP	Construction Erosion and Sediment Control Plan
CHI	Cultural Heritage Inventory
CLG	Community Liaison Group
CLMP	Contaminated Land Management Plan
CMA	Coastal Marine Area
CNVMP	Construction Noise and Vibration Management Plan
COPTTM	Code of practice for temporary traffic management
CPA	Coastal Protection Areas
CTMP	Construction Traffic Management Plan
CTMPF	Construction Traffic Management Plan Framework
DOC	Department of Conservation
dB	Decibel
ECOMP	Ecological Management Plan
EPA	Environmental Protection Authority

[1] Subject to legal status of district and regional plans at the time of lodgement.

Abbreviation (if applicable)	Term
EWL	East West Link
GDP	Gross Domestic Profit
GSMP	Groundwater and Settlement Management Plan
ha	hectares
HAIL	Ministry for the Environment's hazardous activities and industries list
HMP	Heritage Management Plan
HNZPT	Heritage New Zealand Pouhere Taonga
NZAA	New Zealand Archaeological Association
$L_{Aeq\ (t)}$	The average noise level during the measurement period
$L_{A90\ (t)}$ or $L_{A95\ (t)}$	The background noise level during the measurement period
$L_{A10\ (t)}$	The average maximum noise level during the measurement period
L_{Amax}	The highest noise level which occurs during the measurement period
LTMA	Land Transport Management Act 2013
m	metres
MACA Act	Marine and Coastal Area (Takutai Moana) Act 2011
MCA	Multi Criteria Analysis process
MHWS	Mean High Water Spring
Minister	Minister for the Environment or Minister of Conservation
NES	National Environmental Standard
NESAQ	Resource Management (National Environmental Standard for Air Quality) Regulations 2004
NES Soil	National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health
NIMT	North Island Main Trunk
NPS	National Policy Statement
NPSET	National Policy Statement for Electricity Transmission
NPSFM	National Policy Statement for Freshwater Management
NPSUDC	Proposed National Policy Statement for Urban Development Capacity
NUMP	Network Utilities Management Plan
NZCPS	New Zealand Coastal Policy Statement 2010
NoR	Notice of Requirement
The Transport Agency	The NZ Transport Agency
ONF	Outstanding Natural Feature
ONL	Outstanding Natural Landscape
PPFs	Protected Premises and Facilities
PWA	Public Works Act 1981
RMA	Resource Management Act 1991
RPS	Regional Policy Statement
SEA	Significant Ecological Area

Abbreviation (if applicable)	Term
SH(x)	State highway (number)
TMP	Traffic Management Plan
TSS	Total suspended solids
ULDF	Urban and Landscape Design Framework
ULDP	Urban and Landscape Plans
μPa	A unit of measure to quantify internal pressure and stress
NLTP	National Land Transport Programme

The table below sets out the defined terms used in this report.

Term	Meaning
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Archaeological site	Defined in Section 6 of the Heritage New Zealand Pouhere Taonga Act 2014 as *"Means, subject to section 42(3),—* *(a) any place in New Zealand, including any building or structure (or part of a building or structure), that—* *(i) was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and* *(ii) provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; and* *(b) includes a site for which a declaration is made under section 43(1)."*
Auxiliary lane	A portion of the carriageway adjoining through traffic lanes, used for speed change or for other purposes supplementary to through traffic movement.
Average annual daily traffic	The total volume of traffic passing a roadside observation point over the period of a calendar year, divided by the number of days in that year (365 or 366 days). Measured in vehicles per day.
Best Practicable Option	Defined in section 2 of the RMA as: *"in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to –* *(a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and* *(b) the financial implications, and the effects on the environment, of that option when compared with other options; and* *I the current state of technical knowledge and the likelihood that the option can be successfully applied."*
Chainage	A distance measured along a straight line. For this project chainage is measured in metres and starts from the western extent of the Project.
Coastal Marine Area	Defined in Section 2 of the RMA as: *"means the foreshore, seabed, and coastal water, and the air space above the water—* *(a) of which the seaward boundary is the outer limits of the territorial sea:* *(b) of which the landward boundary is the line of mean high water springs, except that where that line crosses a river, the landward boundary at that point shall be whichever is the lesser of—* *(i) 1 kilometre upstream from the mouth of the river; or* *(ii) the point upstream that is calculated by multiplying the width of the river mouth by 5."*
Conditions	Conditions placed on a resource consent (pursuant to section 108 of the RMA) or conditions of a designation (pursuant to subsection 171(2)(c) of the RMA).
Contaminant	Defined in section 2 of the RMA as: *"any substance (including gases, odorous compounds, liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or he–t -* *(a) when discharged into water, changes or is likely to change the physical, chemical, or biological condition of water; or* *(b) when discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged."*

Term	Meaning
Contaminated land	Defined in section 2 of the RMA as: *"means land that has a hazardous substance in or on it that—* *(a) has significant adverse effects on the environment;* *(b) is reasonably likely to have significant adverse effects on the environment"*
Culvert	One or more adjacent pipes or enclosed channels running across and below road formation level.
Cycleway or cycle path	A separately formed path designed specifically for the use of cycles, to which motor vehicles do not have access.
Designation	Defined in section 166 of the RMA as: *"a provision made in a district plan to give effect to a requirement made by a requiring authority under section 168 or section 168A or clause 4 of schedule 1."*
Design life	The period during which the performance of a pavement, e.g. riding quality, is expected to remain acceptable.
Design speed	A speed fixed for the design of minimum geometric features of a road.
Design year	The predicted year in which the design traffic would be reached.
Effect	Defined in section 3 of the RMA as: *"(a) Any positive or adverse effect;* *(b) Any temporary or permanent effect(c) Any past, present, or future effect;* *(d) Any cumulative effect which arises over time or in combination with other effects –* *Regardless of the scale, intensity, duration, or frequency of the effect and also including –* *(e) Any potential effect of high probability; and* *(f) Any potential effect of low probability, which has a high potential impact."*
Environment	Defined in section 2 of the RMA and includes: *"(a) Ecosystems and their constituent parts, including people and communities;* *(b) All natural and physical resources;* *(c) Amenity values; and* *(d) The social, economic, aesthetic and cultural conditions which affect the matters stated in paragraphs (a) to (c) of this definition or which are affected by those matters."*
Earthworks	Means the disturbance of land surfaces by blading, contouring, ripping, moving, removing, placing or replacing soil, earth, or by excavation, or by cutting or filling operations.
Hui	Meeting or workshop with Mana Whenua: • Te Ākitai Waiohua • Ngāti Te Ata Waihoua • Ngāti Pāoa • Ngāti Maru Runanga • Te Kawerau a Maki • Ngāi Tai Ki Tāmaki • Ngāti Whatua Ōrakei • Te Runanga o Ngāti Whatua • Te Ahi Waru • Ngāti Tamaoho
Kaitiakitanga	Guardianship

Term	Meaning
Leachate	Groundwater that resides within or has travelled through landfills and therefore has the potential to contain mobilised contaminants
Legibility	The ease of a place to be understood
Main Alignment	The components of the Project comprising the new four lane arterial road between SH20 at the Neilson Street Interchange in Onehunga, and State SH1 at Mt Wellington.
Mataaoho	The giant god of volcanoes
Mataawaka	Mataawaka are Māori living in Tāmaki Makaurau who are in not in a Mana Whenua group (i.e. they may associate with an iwi elsewhere in New Zealand
Maunga	Mountains
Maungakiekie	One Tree Hill
Mauinaina	Panmure
Mauri	The essential quality and vitality of a being or entity.
Mokoia	A fortified pā that was located in Panmure
Motorway	Means a motorway declared as such by the Governor-General under section 138 of the PWA or under section 71 of the Government Roading Powers Act 1989.
Multi-modal	In the context of this report, multimodal means several different modes of transport including walking and cycling, public transport and roads.
Pā	A Māori village, defensive settlement or hill fort
Pākehā	A New Zealander of European descent
Panuku	Panuku Development Auckland
Project	Means the East West Link Project as described in Part C: Description of the Project of the AEE.
Severance	The separation of residents from facilities and services they use within their community, from friends and relations, and from places of work as a result of changes in road patterns and traffic levels.
State highway	Means a road, whether or not constructed or vested in the Crown, that is declared to be a State highway under section 11 of the National Roads Act 1953, section 60 of the Government Roading Powers Act 1989 (formerly known as the Transit New Zealand Act 1989), or under section 103 of the LTMA.
Taonga	A treasured object of natural resource
Tainui Waka	Canoe that brought the Tainui people to New Zealand
Te Apunga o Tainui	McLennans Hill
Te Hōpua a Rangi	The Hōpua tuff crater
Te Pane o Mataaoho	Māngere Mountain
Te Tiriti o Waitangi	The Treaty of Waitangi
Water body	Defined in section 2 of the RMA as: *"fresh water in a river, lake, stream, pond, wetland, or aquifer, or any part thereof, that is not located within the coastal marine area."*

PART A

INTRODUCTION AND BACKGROUND TO THE PROJECT

1.0 Introduction

The NZ Transport Agency (the Transport Agency) has lodged Notices of Requirement (NoRs) and applications for resource consent for the East West Link Project (the EWL or the Project).

1.1 The Requiring Authority / Applicant

The Transport Agency is a crown entity responsible for providing an integrated approach to planning, funding and delivering transport in New Zealand. The overarching objective of the Transport Agency, as set out in section 94 of the Land Transport Management Act 2003 (LTMA) is to *"undertake its functions in a way that contributes to an effective, efficient, and safe land transport system in the public interest".*

The Transport Agency also has a strategic objective to provide significant transport infrastructure[2]. This includes the planning and delivery of the Accelerated Auckland Transport Programme, an accelerated a package of transport infrastructure improvements for Auckland focused on providing congestion relief, supporting economic growth and improving safety outcomes. The Project is part of that programme.

The Transport Agency is the requiring authority for the NoRs and applicant for the resource consents.

1.2 The East West Link Project

The Project addresses the heavily congested roads in the Onehunga, Penrose and Mt Wellington areas of Auckland. This area is one of the key economic drivers of Auckland – it is the main industrial, transport and distribution hub for the city and the upper North Island.

The Project will deliver a new four lane arterial road between State highway 20 (SH20) at the Neilson Street Interchange in Onehunga, and State highway 1 (SH1) at Mt Wellington (referred to as the Main Alignment), as well as an upgrade to SH1 between the Mt Wellington Interchange and Princes Street Interchange at Ōtāhuhu. It includes new local road connections to and within Onehunga and Penrose, as well as new or upgraded cycle and pedestrian facilities.

The Project will enhance connectivity to, within and around the Onehunga-Penrose commercial and industrial area, reducing travel times for all users, including freight, and enhancing walking and cycle paths.

The Project includes the naturalisation of the existing highly modified coastal edge, which provides opportunities for enhanced public access and water quality improvements, assisting to restore the mana of the Māngere Inlet.

1.3 Key Project components

The key components of the Project are shown on Figure 1-1 and summarised below. Further details of the Project are contained in *Part C: Description of the Project* of this Assessment of Effects on the Environment report (AEE).

[2] Objective 9 in the *NZ Transport Agency Statement of Intent 2015-2019*, Page 25.

Figure 1-1: Key components of the Project

The Project will run between Neilson Street in Onehunga at its western end and Princes Street in Ōtāhuhu at its eastern end. Key features as indicated in Figure 1.1 include:

A. **A new four lane arterial road** between SH20 at the Neilson Street Interchange in Onehunga and the on and off-ramps on SH1 at Mt Wellington Highway;

B. **SH1 widened** in each direction between Mt Wellington Highway and Princes Street to increase capacity to allow connection to the Project. Several bridges will either be upgraded or widened to facilitate this;

C. **Major upgrades to the Neilson Street Interchange** to enable direct access between SH20 and EWL through free flow ramp connections in all directions;

D. A **full pedestrian and cycling link** between Māngere Bridge and Onehunga through to Sylvia Park Town Centre;

E. **Local road improvements** at Galway Street, Captain Springs Road, Hugo Johnston Drive and a new access road for the existing ports; and

F. A **grade separated intersection** of Great South Road and Sylvia Park Roads to provide improved reliability and future resilience.

In addition, the Project will:

G. Landscape and recontour the **coastal edge of Māngere Inlet** to reflect the original foreshore which existed before extensive historic reclamation; and

H. Incorporate **stormwater treatment wetlands** located within new headlands on the foreshore of the Māngere Inlet.

1.4 The Transport Agency's environmental objectives

The Transport Agency has prepared a draft State Highway Environmental and Social Responsibility Environmental Plan for the period of 2016-2021 titled *Valuing our Future.* The document sets out how the Transport Agency will implement its Environmental and Social Responsibility Policy by identifying objectives, targets and actions to achieve the Plan.

These have been taken into account and have directly influenced the development of the Project.

The objectives of the Transport Agency in operating and improving the State highway network, and how these have been incorporated into the Project are summarised below.

Table 1-1: The Transport Agency's environmental objectives and EWL Project response

Objective	Comment	AEE Reference(s)
Enables kaitiakitanga	Mana Whenua have been consulted during the planning and design of the Project.	Section 9 Section 12.6
Recognises and values the natural environment	The natural environment is integral in the consideration of alternatives and in the development of the Project scope and details.	Section 8 Section 12
Responsibly manages human health and nuisance effects	Human health and nuisance effects were considered as part of the consideration of alternatives and have been taken into account in the design of the Project.	Section 8 Sections 12.11, 12.12 and 12.18
Enables connectivity, accessibility and multi modal transport	These are three very specific benefits of the Project.	Section 12.2

Objective	Comment	AEE Reference(s)
Contributes to the quality of the built environment, landscapes and to the road user experience	The built (industrial) and landscape (coastal) environments were integral components of the consideration of alternatives and taken into account in the design of the Project.	Section 8 Section 12.10
Recognises and values cultural and historic heritage	Cultural and heritage values are reflected in the Project urban and landscape design framework and in the design of the Project.	Section 15 Sections 12.6, 12.7, 12.8 and 12.9
Enables the reduction of greenhouse gas emissions	The EWL improves connectivity and accessibility for freight and enables a multi modal transport system reducing congestion and associated emissions.	Section 12.2
Is resource efficient	The Project approach is to minimise industrial land acquisition, recognising benefits of existing land resources. Minimise reclamation of the Coastal Marine Area and maximise opportunities for dual benefits where reclamation is proposed.	Section 6 Section 12.4
Continuously improves its management of environmental and social responsibility performance	Social and other effects on the environment were considered as part of the consideration of alternatives and taken into account in the design of the Project.	Section 8 Section 12.14

1.5 The NoRs and resource consents

The Project will traverse both land and the Coastal Marine Area (CMA). To enable the construction, operation and maintenance of the Project, new and altered designations are proposed and resource consents are sought.

There are two NoRs for the Project as listed in Table 1-2 and shown in Figure 1-2. The designation boundaries are shown in more detail in the designation plans attached to the NoR and in the drawings in *Volume 2: Drawing Set*.

Table 1-2: NoRs for the Project

NoR	Activities	RMA Section
NoR 1	New designation from SH20 at the Neilson Street Interchange to SH1 at the Mt Wellington ramps covering all land required to enable the construction, operation, occupation and maintenance of the Project.	168
NoR 2	Alteration to existing SH1 Auckland Unitary Plan (Operative in Part) (AUP (OP)) designation 6718 (State highway) to enable widening between Mt Wellington Highway and Princes Street and associated interchange upgrades and road widening works.	181

Figure 1-2: Notices of Requirement

There are various resource consents required for the construction, operation and maintenance of the Project as detailed in *Section 5.2: Applications for resource consent* of this AEE. The following types of consents are required:

- Land use in accordance with sections 9(1), 9(2), 9(3) and 89 of the Resource Management Act 1991 (RMA);
- Coastal permit in accordance with section 12 of the RMA;
- Water permit in accordance with sections 13 and 14 of the RMA;
- Discharge permit in accordance with section 15 of the RMA; and
- Land use consent in accordance with section 89(2) of the RMA.

The NoRs and consents are described in more detail in *Section 5.0: Designations and Consents* of this AEE.

1.6 Purpose and scope of this report

This AEE and the supporting documents (including *Volume 2: Drawing Set* and *Volume 3: Technical Reports*) have been prepared to support the NoRs and applications for resource consents (collectively referred to as “the Application”) which if confirmed and granted would authorise the construction, operation and maintenance of the Project under the RMA.

1.7 Structure of this report

This report, in conjunction with the technical reports, design drawings and supporting information, contains the information required by the RMA. This AEE is one component of the NoR and resource consent applications. The structure of the whole Application is set out in Table 1-3.

Table 1-3: Structure of the Application

Volume	Name	Contents
	Notices of Requirement	NoR forms including designation plans and schedules.
	Resource Consent Applications	Resource consent application forms.
1	Assessment of Effects on the Environment Report	AEE report.
2	Drawing Set	Design drawings for all aspects of the Project including the completed alignment, indicative construction drawings and landscaping.
3	Supporting Technical and Assessment Reports	Technical Reports assessing the effects of the construction and operation of the Project.
4	Urban and Landscape Design Framework	Urban and Landscape Design Framework for the Project.

1.7.1 Technical Report Supplementary Assessments - Great South Road Intersection

Technical reports supporting the Notices of Requirement and resource consent applications were completed in November 2016. Engagement with stakeholders and the wider community has continued in parallel, including design review in response to matters raised.

As a progression of the work to date, the design of the EWL/Great South Road/Sylvia Park Road intersection has been revised, from an at grade design originally proposed, to a grade separated design.

This AEE assesses the potential effects arising from the grade separated intersection at Great South Road. It incorporates information from supplementary technical assessments which were prepared in December 2016 to address the change from an at grade to a grade separated design at Great South Road. Grade separation of the east west through movements at this intersection will provide improved reliability and future resilience.

The AEE and all supporting drawings in *Volume 2: Drawing Set* describe or show the grade separated intersection at Great South Road. The intersection is described in further detail in Section 6.6.3 of this AEE.

Each technical specialist has reviewed their original assessment (November 2016) to determine if their original assessment, recommendations and conclusions have altered as a result of the revised design at the Great South Road intersection. Where the assessment has altered, a supplementary assessment (December 2016) is included with the relevant technical report in *Volume 3: Supporting Technical and Assessment Reports*[3]. Where the original assessment, recommendations and conclusions are not affected by the revised design, no supplementary assessment report has been prepared.

[3] Refer to Table 12-1 for a list of supplementary assessments.

1.7.2 Structure of the AEE

The structure of this AEE report is set out in Table 1-4.

Table 1-4: Structure of this AEE

Part	Sections	Name	Contents
A	1.0 – 3.0	Introduction and background to the Project	An outline of background to the Project, the Project area, the applicant and the Project objectives.
B	4.0 – 5.0	Statutory context	Identification of the legal framework that applies to the Applications.
C	6.0 – 7.0	Description of the Project	Description of the Project, including construction and operation.
D	8.0	Considerations of alternatives	The methodology by which alternative sites, routes and methods have been considered.
E	9.0	Engagement	Identification of affected persons and an outline of engagement that has occurred during preparation of the Applications and response to issues raised.
F	10.0 – 11.0	Description of the environment	Description of the existing and historic environment.
G	12.0	Assessment of effects on the environment	Outline of methodology and assessment of the actual and potential effects on the environment, including consideration of the measures proposed to avoid, remedy or mitigate the effects.
H	13.0	Management of effects on the environment	Proposed methods to manage the identified effects including proposed conditions for the designations and suggested conditions for the resource consents.
I	14.0 – 15.0	Statutory matters	An assessment of the Project against the matters set out in the RMA. An assessment of the Project against all relevant national, regional and local statutory and non-statutory documents.

The Project and assessments have been developed in an integrated manner. Whilst a single AEE report covers all aspects of the Project, some aspects of this report will only be relevant to:

- Specific geographical areas; or
- The NoRs and / or resource consent applications; or
- Specific components of the Project.

Forms 9 and 18 of the Resource Management (Forms, Fees, and Procedure) Regulations 2003 set out what information is relevant to resource consent applications and NoRs respectively[4]. The completed forms are contained in the *NoRs* and *Resource Consent Applications*.

[4] Regulations 9 and 11, Resource Management (Forms, Fees and Procedure) Regulations 2003.

2.0 Background

Overview

The Project area is a significant employment hub, second only to the Auckland Central Business District (CBD) for number of employees, and it generates a large proportion of Auckland's Gross Domestic Product (GDP). It has been, and remains, a strategically important location, being at the convergence of two main State highways and the main trunk railway.

While activity in the area has been slowly transforming over time, with the growth of business services and an increased specialisation in transport and logistics, there is evidence that transportation constraints (and in particular poor accessibility into and out of the area) already are, and will continue to limit the growth in economic activity in this area. Such constraints are considered to be adversely impacting on the spatial and economic growth of Auckland, as set out in the Auckland Plan, which identifies the need for Auckland to improve its overall economic performance and the importance of addressing issues, such as infrastructure constraints, to enable this.

As the population, business and jobs grow, appropriate transport infrastructure and good connectivity to the transport networks will be critical to the success of the area. The Project is recognised in the Auckland Plan as a key strategic project to support the ongoing growth and economic development of Auckland in a manner supporting Auckland's spatial plan.

2.1 Introduction

This section provides information on the economic context of the area and the reasons for developing new transport infrastructure. The following sections are structured to provide context to the existing and future problems or needs that the Project seeks to address. In summary, the section provides:

- A description of the Project location and the economic history of the area;
- A summary of the growth and economic development anticipated in Auckland;
- The implications of growth on transport demand in in the Project area; and
- The contribution of the Project in the context of strategic planning in Auckland.

2.2 Historic context of the Project

Geographically, the Project is located at the narrowest isthmus of New Zealand, and approximately in the centre of the Auckland urban area. It is bound on the west by the Manukau Harbour and the east by the Tāmaki River. The geography of the area has shaped land use, economic activity and the movement/transmission of goods and utilities through this area over time.

2.2.1 Historic context

The area has a long and significant economic history, both for Māori and since Pākehā colonisation. The Māori cultural landscape includes a rich history of settlement, trade and movement, described in more detail in *Section 12.6: Effects on values of importance to Mana Whenua*. A key element demonstrating this socio-economic landscape is defined, by the connections provided between the Manukau Harbour and the Waitematā via the portages (e.g. the Kāretu and Ōtāhuhu portages) which traverse this area[5].

While Auckland's CBD has always been the city's commercial centre, the Project area has also significantly contributed to economic activity in Auckland during the past 150 years.

From the early 19th century, industries such as timber milling and exporting flourished. Onehunga Port was a major timber trading point and dominated as the New Zealand shipping port between New Zealand and Great Britain and later between Auckland and Wellington[6].

At the same time, Ōtāhuhu was developing for industrial use and its location at such a narrow point meant it was ideally placed for road and rail connections to the north and south of Auckland[7].

Mt Wellington was established as a centre of heavy industry in the early 20th century. As transport, wholesaling and manufacturing grew between Mt Wellington and Onehunga, the greenfield space between them was rapidly taken over. The later reclamation of Māngere Inlet resulted in more capacity for industrial growth in Onehunga.

A detailed history is provided in *Section 10.0: History of the Area*.

2.2.2 Transport links supporting economic activity

As a result of the area's economic importance, transport into and out of the area has also been important. For example, the Onehunga Branch line was one of the earliest government-funded railways in New Zealand, connecting Auckland and Onehunga.

Core elements of the land transport network in the area were also established from the early 1900s. The rail lines (comprising the Onehunga Branch Line and the North Auckland Line) were established by 1925, and key local roads providing access between the Onehunga Wharf, and Penrose included Neilson Street (originally running along the foreshore) and Church Street. Great South Road provided access between these areas and the business areas to the north and south (e.g. Ōtāhuhu), while the 'Old Māngere Bridge' provided a connection between Onehunga and Māngere (in circa 1915).

As the city has grown, so too has the transport network to support it. In the early 1950s the first section of SH1 was constructed between Ellerslie and Wiri, and later, in the early 1980s, SH20 and the 'new' Manukau Harbour Bridge were built. Since this time, the State highway networks have been the 'backbone' of the regional economy, linking Auckland's main business district to the ports in Auckland City, Onehunga and the airport, as well as the port of Tauranga. Two full transport connections are provided on the State highway network from the north to the south of Auckland. The first of these is SH1 and the second the recently completed Western Ring Route (which will be finalised with the opening of the Waterview Connection project, in early 2017).

The need for transport connections between SH1 and SH20 to support economic activity in the area has also long been recognised. A connection to join the east of the city with the west was first proposed in the 1960s as part of the Auckland strategic road network. This part of the network was identified as being necessary by 1990 to accommodate the projected growth.

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[5] The function of the Kāretu portage in particular, mirrors the economic function sought to be provided by the Project

[6] NZ Herald 2010, Auckland: Soldiers of fortune

[7] The residential area of Ōtāhuhu further developed in the mid twentieth century.

2.3 Future growth and economic development in Auckland

Currently one of every three New Zealanders live in Auckland - it is home to about 1.4 million people. Auckland Council is forecasting that the proportion of New Zealanders living in Auckland will continue to increase, with the city reaching 42% of the national population by 2041[8]. Over the next 25 years, more than 60% of New Zealand's population growth is expected to occur in Auckland[9].

Auckland is also now the country's largest commercial centre. It accounts for 35% of New Zealand's GDP and is growing at 2.9% a year. The Auckland Plan identifies Auckland's economic performance as 'critical' to achieving the Auckland Plan vision and for the prosperity of New Zealand as a whole.

Auckland is also interdependent with the rest of New Zealand (being both the major domestic market for national producers) and the distribution hub for goods into and out of the northern North Island cities and regions. As a result of this and given the growth forecast, there is expected to be a 70% increase in freight demand within and between regions in the upper North Island (primarily between Auckland, Northland, Waikato and Bay of Plenty) by 2042[10].

The Auckland Plan cites the relatively poor economic performance of the city as a key issue and highlights strategies for the transformation of Auckland's economy (e.g. to achieve the goal for GDP growth to shift to 4% a year). Priority 1 of the economic development strategy of the Auckland Plan is to grow a business-friendly and well-functioning city. This priority specifically recognises the cost of traffic congestion, constraining the movement of goods and people at substantial cost to the productivity of businesses.

Roads cater for 86% of transport movements within Auckland, and the expected growth will place significant pressure on the existing road network, even with planned improvements to public transport. To meet the increasing demand, and to ensure people and freight can move around the city and the region quickly and efficiently, the Auckland Plan recognises that new capacity is needed (as set out in Chapter 6 and others of the Auckland Plan).

2.4 The economic context of the EWL area

The immediate 'Project area' includes the industrial and business areas of Onehunga, Southdown (Penrose), Mt Wellington (Sylvia Park) and Ōtāhuhu[11]. This area represents a major part of the city's employment 'picture', complementing the major commercial hub of the CBD (to the north) and other key employment areas such as East Tāmaki (which is accessed from SH1 just south of the Project area, at Highbrook Drive), Manukau (further south on SH1) and the emerging hub of the Auckland International Airport (to the south-west accessed by SH20).

2.4.1 Projected population and employment growth

Statistics New Zealand and Business and Economic Research Limited projections indicate strong population growth and some economic growth within and surrounding the Project area and surrounding suburbs, as illustrated in Figure 2-1 and Figure 2-2 below. These figures and projections are based on a fixed land use scenario 'without' the Project and as such, some figures of growth are likely to under-estimate the opportunity that may be provided through the Project. This is discussed further in *Section 2.5.1: Transport context* of this AEE.

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[8] Auckland Council, the Auckland Plan, Chapter 6.

[9] Ibid.

[10] Ministry of Transport, National Freight Demand Study (2014).

[11] In most cases, the Project traverses through industrial and business areas in these suburbs. In contrast, in Ōtāhuhu, (which is a mix of industrial/business and residential) the Project traverses a largely residential area.

Figure 2-1: Predicted employment growth 2011-2041

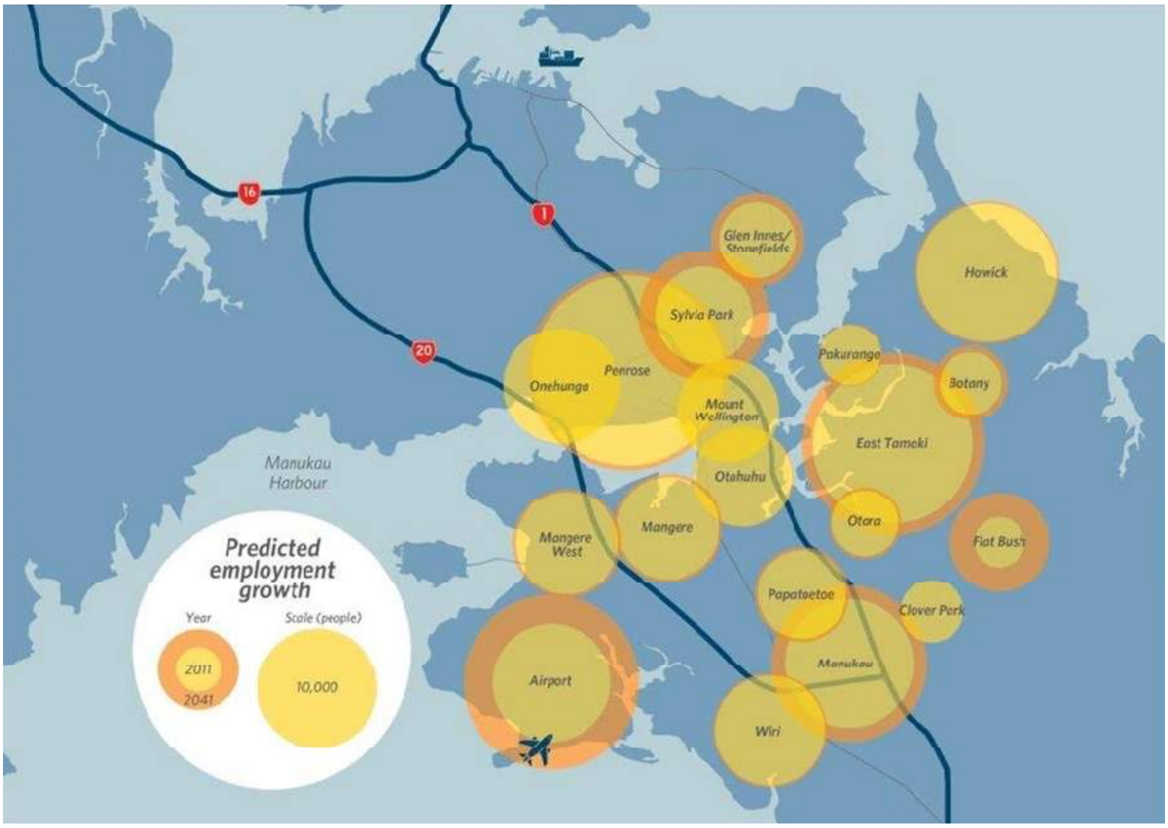
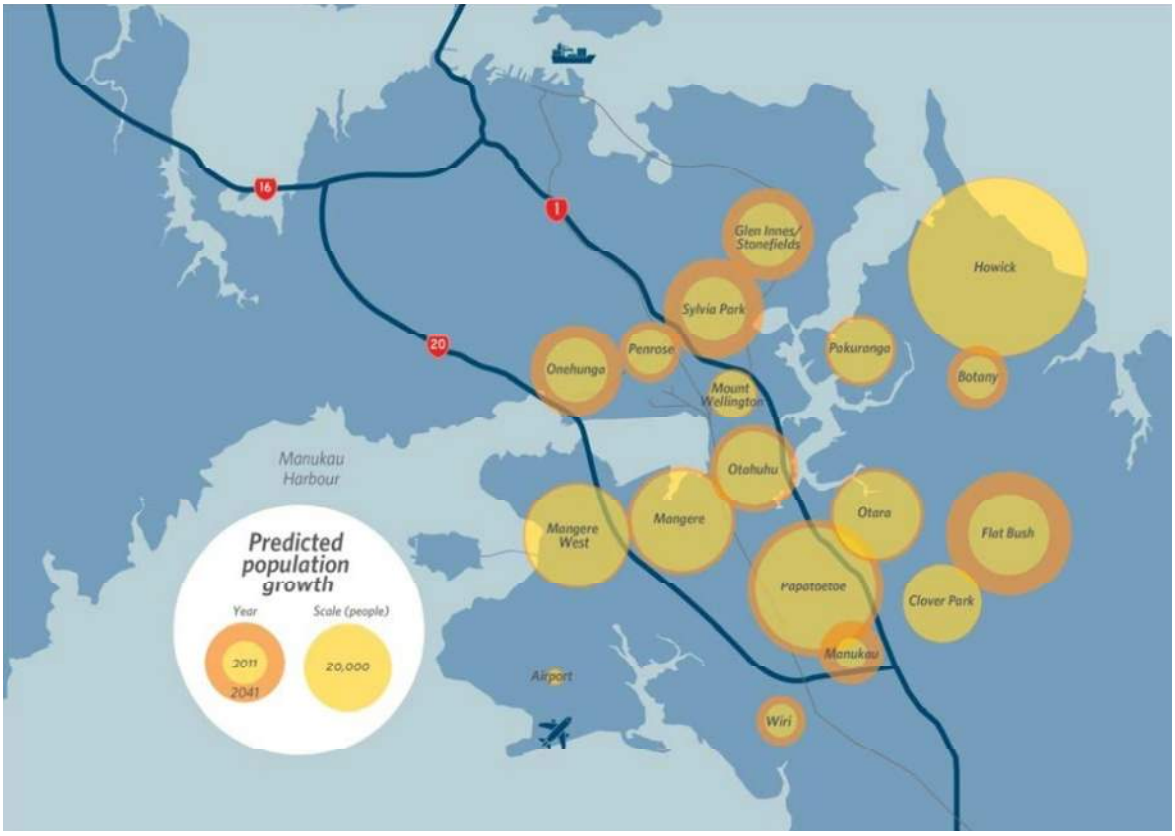


Figure 2-2: Predicted population growth 2011-2041



2.4.2 Economic Contribution of the Project Area

As set out above, the Project area has played and continues to play a unique and important role within the Auckland and upper North Island economy. It is a key industrial, transport and logistics hub for Auckland and the upper North Island. The GDP and jobs generated by the area are significant and in 2012, the direct Project area (Onehunga, Penrose, Mt Wellington and Ōtāhuhu) accounted for approximately $4.7 billion of output, or 7.5% of Auckland's total GDP[12]. As evident in Table 2-1, while this area has grown, it has not grown at the same rate as the whole Region, meaning a slight decline in the contribution this area makes to the region's activity. This is not unexpected given the rapid growth and extensive size of the wider area.

The area also represents a significant proportion of the city's employment and it is one of Auckland's principal manufacturing locations, accounting for 17.9% Auckland's, and 5.9% of New Zealand's manufacturing jobs. It also acts as a major hub for transport and logistics for Auckland and the upper North Island with 19.7% of Auckland's and 9.1% of New Zealand's employment in transport and wholesaling. Although not labour intensive industries, manufacturing, transport and logistics activities are transport intensive industries. Transport requirements of these businesses will increase with the growth of internet based commerce and population.

Table 2-1: EWL GDP (Output) by Sub Area ($ billions)

GDP (Output)	2001	2006	2012
Penrose Onehunga	2,219	2,421	2,298
Mt Wellington/Ōtāhuhu	1,976	2,110	2,392
Total East West Link Area	**4,195**	**4,530**	**4,690**
EWL % Auckland GDP	9.1%	8.0%	7.5%
Auckland	46,300	56,529	62,789

2.4.3 Economic trends in the Project area

While the Project area remains a stronghold of manufacturing and distribution activity, a change is gradually taking place as business services activity – such as construction, retail, professional services and healthcare – grows, while the dominance of transport, wholesaling and manufacturing has declined. The area's economy is becoming more service-oriented, which is reflected in the economic profile of the region in general. Business services has become a significant employment sector in the area; it now accounts for 17.5% of the area's jobs.

The area however, is retaining its distinctive character as an industrial and transport oriented stronghold, as the more transport intensive activities are growing too. Distribution activity is compensating for a decline in manufacturing, reflecting the area's function as a specialised regional distribution centre.

An increasing level of specialisation within the transport and logistics sector can be observed from the growing concentration of road and rail freight activities around Westfield and Southdown.

Logistics companies are investing in local facilities to take advantage of the unique attributes of a road/rail integration connecting to New Zealand's two major ports (Ports of Auckland and Port of Tauranga) in proximity to central Auckland.

[12] All data has been sourced from *Report 3: Economic Assessment* in *Volume 3*.

The economic function of the area is strongly influenced by the historically good level of accessibility offered by the transport system. This is particularly the case for transport and logistics activities, which benefit from the access to both rail and the strategic transport network.

The transport-intensive nature of logistics and distribution suggests that to meet growing customer needs, these movements will occur throughout the day, which for this sector may extend beyond 12 hours per day.

2.5 Transport and accessibility demands to support economic growth

2.5.1 Transport context

The Project area has a variety of roads ranging from two lane local streets to SH1 and SH20 which accommodate up to eight lanes of traffic. With the exception of SH1 and SH20, all roads have a posted speed limit of 50km/h. The majority of roads running through the residential and commercial areas are two-lane roads, however the key freight arterial routes are typically four lanes, including Great South Road, Mt Wellington Highway, and parts of Sylvia Park Road, Church Street and Neilson Street. These arterial roads are parts of the regional freight network and provide access to the adjacent and surrounding businesses. The high traffic flows mean there is often conflict between the turning movements associated with property access and the through traffic associated with their arterial function.

Given the land use is primarily industrial, it generates large volumes of traffic, including heavy vehicles. Specific sites generate much of this – e.g. MetroPort opened in 1999 and by 2012 generated 2,000 to 2,500 heavy vehicle trips per day. Currently, 19% of vehicle movements through the area are from trucks[13].

The existing roads carry significant volumes of traffic and this is anticipated to increase, as illustrated in Table 2-2 below.

Table 2-2: Existing and anticipated traffic volumes (vehicles per day)

Key Road	2013[14]	2026 Without Project	2036 Without Project
Church Street east of Neilson Street	43,300	48,400	51,200
Great South Road at Southdown Lane	31,900	32,900	33,000
Neilson Street east of Victoria Street	27,700	31,400	35,200
SH1 at Panama Road	123,600	137,900	145,900
SH20 Māngere Bridge	108,800	170,700	188,000

The local roads, particularly Neilson and Church Streets, are already heavily congested and do not provide reliable connections between businesses in the area or to SH1 and SH20. Getting on and off SH20 at Onehunga is particularly difficult due to the capacity constraint at the Neilson Street/Onehunga Mall intersection. The section of SH20 between Neilson Street and Queenstown Road is currently congested during peak periods. The current construction (due for completion in late 2016) of auxiliary lanes on this section of SH20 will help ease this congestion. It is anticipated that higher traffic flows will be on this section

[13] Whilst this figure was from a count taken on one day this is consistent with previous counts undertaken.

[14] The 2013 figures are modelled, rather than measured.

of SH20 after the Waterview connection opens in early 2017, including traffic wishing to access the Onehunga-Penrose area. The existing constraint on Onehunga Mall will therefore come under even greater pressure, with extended queuing likely to impact other movements on SH20.

A large proportion of roads within the area are classified as 'Strategic Freight Network', which links areas of generation (e.g. manufacturing or importing) with areas of attraction (e.g. the markets of urban Auckland and beyond). Within the immediate vicinity of the Project, the following roads are classified as strategic freight network:

- SH1 and SH20;
- Onehunga Mall;
- Captain Springs Road (north of Neilson Street only);
- Hugo Johnston Drive;
- South Eastern Arterial;
- Sylvia Park Road;
- Princes Street.
- Onehunga Harbour Road;
- Neilson Street;
- Church Street;
- Great South Road;
- Mt Wellington Highway;
- Panama Road;

A comparison of travel times shows variability as great as 12 minutes, and in some cases a maximum time four times the minimum time. This affects public transport and freight as well as other vehicles as illustrated in Table 2-3.

Table 2-3: 2016 Existing journey times accessing the Project area (all day)

From	To	Minimum (minutes)	Median (minutes)	95th Percentile (minutes)	Range (minutes)
SH20 south	Waikaraka Park	3.7	6.8	10.7	7
Waikaraka Park	SH20 south	2.9	5	9.6	6.7
SH1 south	MetroPort	6.1	9.8	18.1	12
MetroPort	SH1 south	7.1	11.8	17.5	10.4
Waikaraka Park	SH20 north	3.4	5.6	10.8	7.4
SH20 north	Waikaraka Park	2.5	4	5.6	3.13
SH1 north	MetroPort	4.5	6.7	9.7	5.2
MetroPort	SH1 north	2.7	6.1	10.8	8.1

Unreliable travel times affect all road users, including:

- **Public transport** - Unreliable journey times restrict the ability to use interconnecting services (e.g. transferring from buses to trains) and reduce the attractiveness of using public transport, especially relative to car use. For people using multiple forms of transport, lengthy travelling times can result from having to allow for the 'worst case scenario' journey. When trying to arrive at a place by a specified time, added time must be factored in to account for the potential variability in travel time. In addition, public transport timetabling is most accurate where travel times are consistent.
- **Freight** - Significant congestion including during the day at non-peak times affects the transportation of freight and other business activities. Delays to deliveries can reduce the number of journeys able to be completed by each truck in a day. In some cases, this can result in more vehicles and staff being required or longer working hours for affected staff. Shorter, regular journey times could enable more trips per vehicle per day and enable better planning for journeys.

The high level of predicted growth in the area and the wider upper North Island is expected to increase demand in the area. This is expected to exacerbate:

- Congestion on local roads surrounding the two State highways;
- Conflicts between the different transport users and traffic demands including pedestrians, cyclists, public transport, motorists and freight;
- High volumes of freight traffic and unreliable freight travel times;
- Demand for east to west travel between SH20 and SH1 and / or South Eastern Arterial;
- Poor resilience in the network between SH1 and SH20 leading to unreliable connections;
- Bus variability through sharing the roads and congestion with freight and general traffic;
- Vehicles increasingly using residential streets to avoid congestion on the strategic network; and
- Barriers to safe cycling and pedestrian access.

The priority issues for the Project area include:

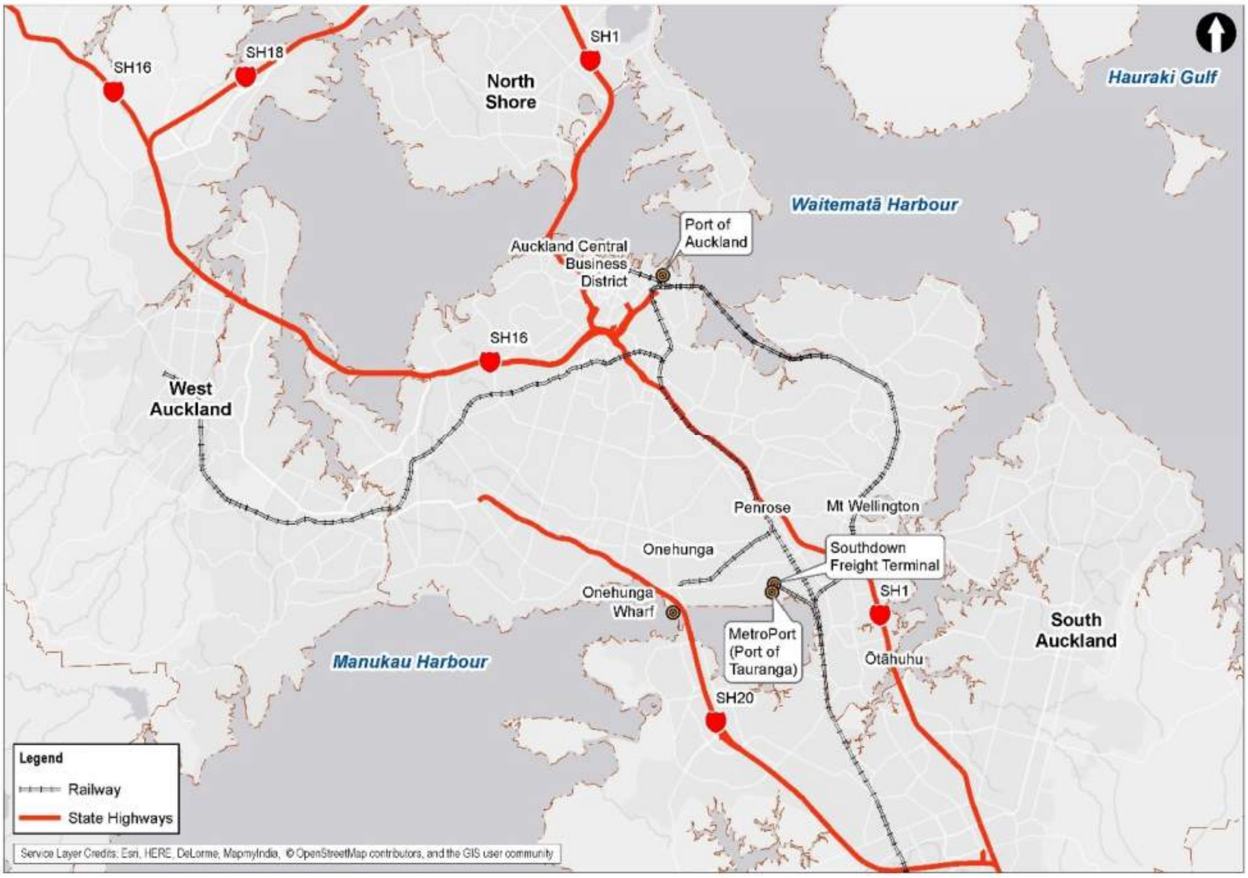
- Difficulty in accessing SH20 at Onehunga;
- High frequency of freight on Neilson Street and Church Street for the majority of the working day, conflicting with vehicles accessing properties and with through traffic;
- Indirect and congested southern connection on SH1;
- Poor cycle connections and conflict with high freight movements; and
- Unreliable public transport services accessing Onehunga due to congestion throughout much of the day, as well as congestion on other bus routes due to conflicts with general and freight traffic.

2.5.2 Strategic rail hub

The Project area provides the most important link between road and rail freight in Auckland. As illustrated in Figure 2-3, it contains:

- The MetroPort inland port serving the Port of Tauranga;
- The adjacent Westfield/Southdown KiwiRail and Toll freight terminals; and
- It is increasingly acting as a rail-served inland port for the Ports of Auckland.

Figure 2-3: Regional context



The area also accommodates a large number of other major distribution and logistics businesses serving Auckland and the upper North Island, taking advantage of proximity to key markets and suppliers and the access to not only rail but also the strategic road network – for transportation of goods by truck. The area also contains the Onehunga Wharf.

This rail and road link is vital as Northland, Auckland, Waikato and the Bay of Plenty together produce more than 50% of New Zealand's GDP. Increased economic interaction between these regions will continue to drive economic growth in the upper North Island and throughout the country.

The Westfield/Southdown road and rail freight terminal will therefore become increasingly important for future freight movements as the key link within these regional supply chains. Supporting these activities is critical to the economic prosperity of the region and the potential for future growth.

There is increasing conflict between freight and passenger movements on the rail network due to the high levels of growth in both activities. The local capacity is being increased by KiwiRail with the addition of a third rail line through Wiri and through other improvements set out in the Auckland Rail Development Plan[15] including the potential to separate the North Island Main Trunk (NIMT) and the North Auckland Line so that crossing points are at different elevations.

[15] KiwiRail and Auckland Transport (2016) Auckland Rail Development Plan. The Auckland Rail Development Plan is a programme of proposed works over the next 30 years as agreed between KiwiRail and Auckland Transport.

2.5.3 Transport Demands / Accessibility Demands to Support Economic Growth

In summary, the potential for economic growth within the Project area is strong, but the ability of the existing transport network to accommodate this growth is limited. Without further investment in the transport network, the following problems or issues are expected to perpetuate:

- Demand for freight and logistics services are expected continue to grow strongly as the region's strong population and economic growth is expected to increase demand for consumable goods, resulting in increased transport activity. This will more than offset any effects of a decline in manufacturing activity in the area;

- The expected increase in employment within and surrounding the Project area is projected to place increasing pressure on the transport system. This would be most evident at peak times with greater conflict between freight and commuter traffic. However, given the strategic setting of this area, and the extensive freight distribution and logistics industries, it is likely to result in much heavier congestion at all times of the day;

- Conflicting transport pressures within the Project area are likely to continue to increase, due to the broad economic expansion locally and the growth of population and economic activity regionally; and

- An increase in longer-distance freight rail services is expected as transport and logistics operations become more multi-modal (i.e. relying on more than one type of transport), however the benefits and growth of this kind of efficiency is likely to be constrained if the freight cannot be distributed on the receiving road network.

In addition these issues or 'lost opportunities' were identified through the early planning work for the Project as likely to arise, if the current transport network is maintained but not expanded:

- Lack of response to changes in industry's supply chain strategies leads to greater congestion, unpredictable travel times and increased costs;

- Quality of transport choices is inadequate and hinders development of liveable communities. The constraints and barriers to efficient public transport, walking and cycling will further increase car-based commuting, again exacerbating the vehicle conflicts with freight and business activities; and

- The strategic transport network does not have the capacity to keep pace with growth and deliver economic benefits for Auckland as planned and sought in the Auckland Plan.

2.6 Conclusion

Growth of business, employment and residential development in Auckland are creating increasing demand for transport investment. Auckland Council (in their spatial plan for the city) have identified the critical importance of transport projects such as the Auckland-Manukau Eastern Transport Initiative (AMETI) and the East West Link as important projects to address this demand and provide for freight and east-west traffic movements.

The strategic transport corridor provided by the Project establishes improved accessibility for existing and future businesses in the areas of Onehunga and Penrose (including rail freight hub at Southdown), through to Mt Wellington and Ōtāhuhu. It provides for improved connectivity for these areas to other economic hubs in the city, including the Auckland Port and CBD, major employment areas such as East Tāmaki, and to connect to inter-regional hubs south of the city.

The Auckland Plan identifies that the Project will support the strategic growth of Auckland by addressing the existing economic inefficiencies resulting from high traffic and freight movements on congested local roads, by providing for efficient freight movements between SH20 and SH1, and between industrial areas and the port and airport[16].

The existing constraints and conflicts will require a multi-modal response to gain the economic efficiencies desired, including providing improved options and accessibility for walking, cycling and public transport, as well as improved road capacity.

[16] See Directive 13.3 of the Auckland Plan, 2012.

3.0 Project Development

Overview

This chapter outlines the development process for the Project and the basis for the Project Objectives. The Project Objectives are particularly relevant for NoRs as an assessment is required to consider whether the "work and designation" is reasonably necessary to achieve the Project objectives (Section 171(1)(c)) of the RMA.

The objectives for the Project are:

1. *To improve travel times and travel time reliability between businesses in the Onehunga–Penrose industrial area and SH1 and SH20;*

2. *To improve safety and accessibility for cycling and walking between Māngere Bridge, Onehunga and Sylvia Park, and access into Ōtāhuhu East; and*

3. *To improve journey time reliability for buses between SH20 and Onehunga Town Centre.*

The final part of this section provides a summary of the key transport outcomes and the wider benefits of these outcomes identified through the process of determining the scope of the Project.

3.1 The strategic context

The Project has been developed in accordance with key legislation and government transport policy (including Auckland's spatial plan) which provides strategic direction and guidance[17]. The key relevant legislation and policies that have guided the development of objectives for the Project and the evaluation of the expected outcomes from it, include:

- The Local Government Act, which has informed regional spatial planning (the Auckland Plan) which in turn provides input to a number of other implementation Plans (including those set out below);
- The LTMA, which informs both the development of strategy (e.g. the Government Policy Statement and New Zealand Transport Strategy) was well as plans (e.g. the New Zealand and Regional Land Transport Plans and the Integrated Transport Plan); and
- The RMA. In particular, this Act is implemented through the National Policy Statements, AUP (OP) and Operative District and Regional Plans.

The Government Policy Statement on Land Transport 2015/16 – 2024/25 outlines the national priorities, outcomes and funding levels for the land transport sector until 2025. The three key priorities are economic growth and productivity, road safety and value-for-money. This Project specifically responds to the GPSLT identified priorities.

The 2015-2018 National Land Transport Programme (NLTP) developed under the Government Policy Statement on Land Transport focuses on economic growth and productivity, smart transport choices, making journeys safer and more effective and resilient networks. The NLTP contains all land transport

[17] It is noted that the initial phases of the Project were defined and developed with Auckland Transport. The Transport Agency has been responsible for the development and identification of the preferred alignment for the Project.

activities that the Transport Agency anticipates funding between 2015 and 2018. EWL[18] is identified within the NLTP as a key investment route to provide more efficient, predictable and safe freight journeys and also improved movement of freight between road and rail.

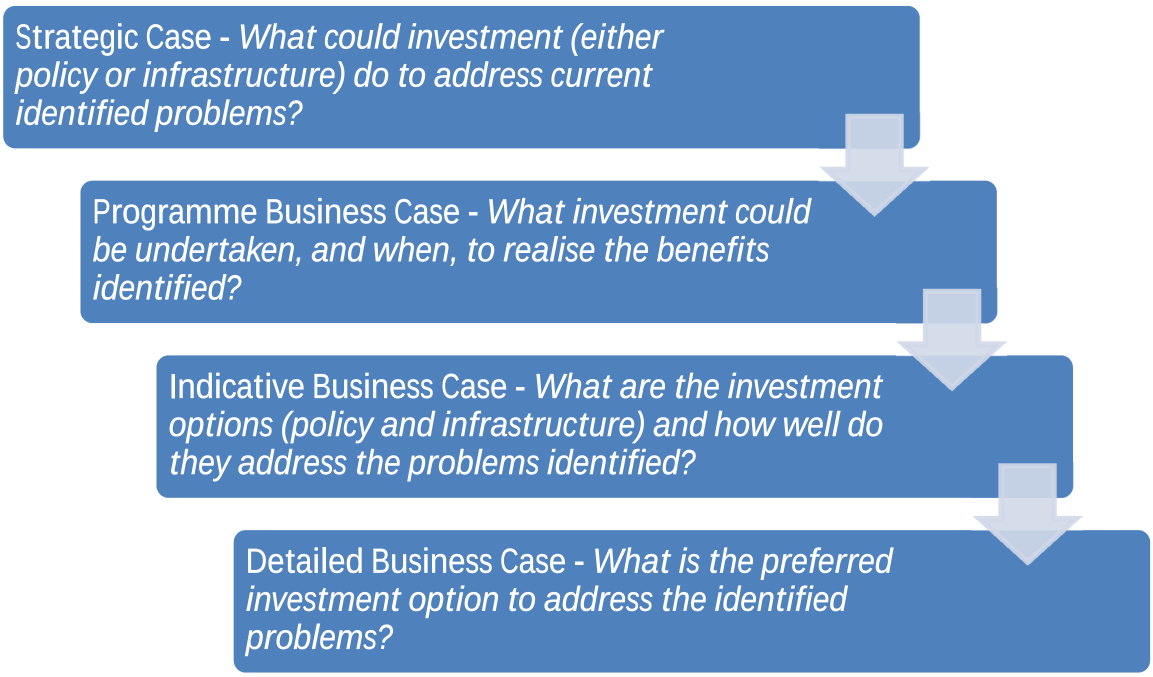
EWL was identified as a priority by the Government in June 2013[19] and reinforced in January 2016[20]. The Government recognised the importance of the economic contribution made by industrial and transport/logistics businesses within Onehunga, Mt Wellington to support the wider Auckland (e.g. East Tāmaki and CBD) and national economy (e.g. Hamilton and Tauranga).

The Auckland Regional Land Transport Plan 2015-2025 (ARLTP) outlines how transport priorities will be delivered for the next 10 years and implements the NLTP. The ARLTP identifies EWL[21] as an improvement project with inter-regional significance. EWL is an accelerated programme with funding provided in the capital programme from 2015-2018 for design, with construction scheduled primarily over the planning period 2019-2022.

3.2 Determining the need for transport investment

Figure 3-1 below provides an overview of the process undertaken to determine the need for the Project, following the business case approach.

Figure 3-1: Summary of process to determine the need for transport investment



[18] Referred to as East West Connections.

[19] Address to Auckland Chamber of Commerce by the Prime Minister, the Rt Honourable John Key, 28 June 2013.

[20] Address to Auckland Chamber of Commerce by the Prime Minister, the Rt Honourable John Key, 27 January 2016.

[21] Referred to as East West Connections.

3.2.1 Strategic Business Case

Following the directive in the Auckland Plan 2012 to undertake planning and implementation of an 'east-west' transport link, Auckland Transport, Auckland Council and the Transport Agency formed a team to develop a Strategic Case for the Project. This work commenced in late 2012.

The initial stage of this work focused on the high level transport problems within the wider 'east-west' area (being the areas of Onehunga, Penrose, Mt Wellington and East Tāmaki to Auckland International Airport). The outcome of the work was to classify the relative priority of transport and connectivity problems and the socio-economic benefits that could be accrued if these problems were addressed. This process was reported in the Multi Modal East West Solutions Strategic Case, which was completed in March 2013. This report confirmed that there was a case for progressing further investigations on specific priority 'problems'. This was supported by all parties.

3.2.2 Programme Business Case

Following the 'Strategic Case' above, Auckland Transport and the Transport Agency progressed to the development of a more detailed investigation of transport problems and potential 'interventions' (e.g. physical projects or policy changes to respond to the problems). The purpose of this phase was to investigate and clarify the problems identified during the Strategic Case (including input from wider stakeholders), and then outline a 30 year programme of works that would address these. From this work, the key outcomes relevant to the Project (reported in early 2014[22]) were:

- The confirmation that additional transport infrastructure would be required in the Project area (e.g. policy change would not be sufficient to address the problems identified); and
- That the priority for infrastructure connections to address transport problems in the area included:
  - A transport link in the Onehunga-Penrose area; and
  - A transport link between Māngere, Ōtāhuhu and Sylvia Park.

3.2.3 Indicative Business Case

During 2014, Auckland Transport and the Transport Agency continued to investigate specific options for the above priority infrastructure investments[23]. Investigation included:

- Evidence of the transport problems;
- Identification of investment options to address the problems (e.g. specific investment options of new infrastructure and corridors for infrastructure investment); and
- Quantification of potential benefits to be achieved from addressing these problems.

A recommended option for the two priority problems of the earlier Programme Business Case was outlined and a preliminary financial analysis undertaken. The outcome of this investigation was confirmation that new road capacity and access was needed to address the Onehunga-Penrose transport connection problem.

3.2.4 Detailed Business Case

The final step in the process to confirm the need for transport investment was the Detailed Business Case, which was completed in December 2015. The Detailed Business Case refined the scope of the

[22] The outcome of this investigation is reported in the Programme Business Case, 2014.

[23] This phase of work is reported in the Indicative East West Connections Business Case, December 2014.

preferred approach from the Indicative Business Case, identified potential strategies for staging and implementing the preferred approach and identified potential funding sources. The outcome was a preferred road alignment along the Māngere Inlet foreshore and an overview of the process to proceed with implementation.

Engagement with stakeholders (including Mana Whenua, other government agencies, road users, businesses and local communities) was undertaken during all phases of the above investigation, this included work to identify the scope of transport problems in the area and to identify and evaluate the investment options to address these problems. The outcomes of this consultation are summarised in *Section 9.0 Engagement* of this AEE.

3.3 The Project objectives for East West Link

The objectives for the Project reflect the transport problems that the Project is seeking to address (e.g. they reflect the benefits or outcomes that the business case process identified as being needed[24]). These are:

- To improve travel times and travel time reliability between businesses in the Onehunga-Penrose industrial area and SH1 and SH20;
- To improve safety and accessibility for cycling and walking between Māngere Bridge, Onehunga and Sylvia Park, and accessing Ōtāhuhu East; and
- To improve journey time reliability for buses between SH20 and Onehunga Town Centre.

3.4 The outcomes to be delivered by the Project

In delivering the Project and the above objectives, the following benefits are expected to be delivered by the Project:

- Improved and more reliable travel times;
- Accessibility that supports businesses for growth and economic prosperity;
- Improving safety and connected communities; and
- Enabling and providing environmental improvements and social/community opportunities to the local area.

The technical and planning assessments in the AEE illustrate how these benefits are being realised in more detail. The following provides a brief summary of the key positive outcomes delivered by the Project.

3.4.1 Improved and more reliable travel times

The Project will deliver reduced, more consistent and reliable travel times accessing the Onehunga-Penrose industrial area, as well as positive effects on the wider road network. For example:

- Trucks travelling from the Onehunga-Penrose industrial area to the State highways will be between four and 17 minutes faster;
- Journey times between MetroPort and East Tāmaki (Highbrook) will improve by up to 13 minutes; and

[24] In particular see the key benefits that the Project could deliver as identified in the Indicative Business Case, December 2014.

- Public transport benefits including buses will be five to six minutes quicker when travelling from Māngere Bridge to Onehunga Town Centre.

There will also be more resilience in the local road network, providing a connection and alternative to the existing Neilson Street corridor. In addition, providing a link between the two State highways in case of an emergency event or closure on either one, will also provide wider network resilience.

These benefits are important for the movement of road-based freight, commercial traffic, and for the general public who will experience improved and more reliable journey times as they go about their day. Local communities will benefit as a result of the overall reduced traffic volumes on local roads, particularly those in town centres (e.g. Neilson Street in Onehunga Town Centre).

For people wishing to commute via walking or cycling, the Project will deliver increased transport choice through the improved walking and cycleway infrastructure, and improved connectivity between Onehunga and Sylvia Park. This complements other transport deliverables such as the Auckland Region walking/cycling network, and the Sylvia Park bus way and multi-modal interchange being developed by Auckland Transport.

An assessment of the traffic and transport effects of the Project is provided in *Section 12.2: Traffic and Transport*.

3.4.2 Supporting businesses for growth and economic prosperity

As set out in *Section 2.0 Background*, the area is strategically important due to its proximity to the SH1 and SH20 strategic roads and to the rail network, which provides the opportunity to continue to service the area with rail freight, and to grow movement of freight by rail. The rail network and Southdown area are designated for rail purposes, and will continue to be critically important as increased economic interaction between the North Island regions (Northland, Auckland, Waikato and Bay of Plenty) will continue to drive economic growth in the upper North Island. The Project specifically supports the integration of road/rail, particularly with the Southdown/port link road connection to EWL and through the improved connections between the Onehunga–Penrose areas to both SH20 and southbound SH1.

The Project adds a new strategic road to the State highway network, which supports businesses in managing their anticipated growth. The quicker and more reliable travel times (as set out above) means more efficient distribution of freight by trucks using the strategic road network and therefore increased productivity, and the opportunity to continue to grow movement of freight by rail due to more efficient road connections.

In addition, it is anticipated that businesses will continue to consolidate in this one, well-served area to leverage the infrastructure provided by the Project, thus reducing demand for smaller distribution hubs elsewhere in Auckland or further afield, and lessening the risk of economic fragmentation.

Enhanced connectivity and facilities for public transport, walking and cycling will also support business growth by providing improved transport choices for employees. The design of the Project does not preclude the future development of mass transit[25] to the airport which will provide opportunities for additional transport choice and service for workers and visitors from the south.

An assessment of the economic effects of the Project is provided in *Section 12.3: Economic Effects* of this AEE.

[25] Moving large numbers of people on public transport.

3.4.3 Safer, more connected communities

Fewer cars and heavy vehicles using local roads such as the roads in the town centre (e.g. sections of Neilson Street and Onehunga Mall), Church Street and Mt Smart Road, which are commercial and/or residential (and an increased focus to residential in town centres), are considered to have a positive impact on the overall safety, amenity and liveability of Onehunga, to the benefit of the people who live there. The new access route will also significantly reduce the existing conflicts between through traffic and vehicles accessing properties on the key freight and arterial routes.

In addition, greater access to public transport (which will be more frequent and reliable, especially from Māngere to Onehunga) and access to new and improved walking and cycling networks will contribute to the connectivity of the community to each other and to community facilities such as schools, recreational centres and reserves. The Project will not preclude the development of a future mass transit link to the Manger and the airport employment area.

A direct, mostly protected cycle and pedestrian link from Māngere Bridge to Sylvia Park will also mean more recreational options are available, with the potential to enhance the overall health and wellbeing of the community.

Given the removal of freight vehicles from the roads and faster and easier public transport and walking/cycling options, it is anticipated that more people will visit and spend time in Onehunga Town Centre, contributing to a revitalisation of this key community meeting point and the local businesses within them.

The improved Princes Street Interchange and new and enhanced walking/cycling facilities will improve accessibility to the Ōtāhuhu community east of SH1. This will include new connectivity to the adjacent northern community at Panama Road, currently severed by both SH1 and the Ōtāhuhu Creek.

An assessment of the social impacts of the Project is provided in *Section 12.14: Social Effects* of this AEE.

3.4.4 Enabling and providing environment improvements and social/community opportunities to the local area

Central to the philosophy of this Project is integrating transport outcomes with environmental social/community benefits through restoring and rehabilitating the coast. This is identified as a component of the overall prosperity of Auckland (delivering to positive social, economic, environmental and cultural outcomes). This philosophy has influenced the overall design of the Project, particularly as it relates to the foreshore component. In particular:

- The Project provides for improved public access to the coast, including recreation and cycle/pedestrian through the provision of both shared paths and recreation walkways on the foreshore of the Māngere Inlet;
- The design includes restoration to a more natural coastal environment by referencing the historic coastal edge in the design of the reclamation;
- The design provides for improved stormwater and stormwater management from the wider Onehunga catchment. This will provide for improved water quality discharging into the Māngere Inlet from the urban and industrial areas of Onehunga (responding to the issue that historic development of this area has not required any, or has required only minimal[26], stormwater treatment for this catchment); and

[26] Some specific sites may have stormwater treatment.

- The construction design includes removal of parts of historic landfills along the Māngere Inlet foreshore and creation of a barrier between the remaining areas of landfill and the coastal environment. This will reduce the tidal/saltwater movement (and as a result leachate movement) from these areas to the coastal environment.

Collectively, it is anticipated that these works will refocus the attention of stakeholders and agencies operating in the Manukau Harbour on progressing improvements to this environment (e.g. assisting to restore the mauri of this environment to recognise and enhance its mana). These works refocus the community's attention on this currently neglected stretch of coast.

Mana Whenua particularly see these types of works drawing attention to the coast and engendering greater community ownership and interest in improving its health and vitality. This will provide the foundation for the long-term restoration of the mana of the Māngere Inlet.

Part G: Assessment of Effects on the Environment of this AEE provides further detail and assessment of these outcomes of the Project.

PART B

STATUTORY CONTEXT

4.0 The Resource Management Act 1991

Overview

This section sets out the key statutory matters under the RMA for the Project, namely:

- The Requiring Authority / applicant – the NZ Transport Agency;
- The purpose and principles of the RMA (Part 2);
- Duties and restrictions (Part 3);
- Proposals of national significance (Part 6AA);
- Applications for resource consent (Part 6); and
- Notices of requirement for designations, outline plans and alterations to designation (Part 8).

This section also provides commentary on the status of the AUP (OP) and the relevant statutory provisions.

A summary assessment of the Project against the statutory framework is provided in *Part I: Statutory Matters*. A more detailed context and the relevant provisions is provided in *Volume 3: Report 2-Statutory Context*.

4.1 Purpose and principles of the RMA

Consideration of the NoRs and of the applications for resource consent are subject to the purpose and principles under Part 2 of the RMA as set out in Table 4-1.

Table 4-1: Part 2 Matters of the RMA

Section	Contents
Section 5 (Purpose)	Sets out the purpose of the RMA being to promote the sustainable management of natural and physical resources, and sets out what sustainable management means.
Section 6 (Matters of national importance)	Describes the matters of national importance that all persons exercising functions and powers under the RMA shall recognise and provide for. Matters (a), (b), (c), (d), (e) and (f) are of relevance to this Project. In summary these matters relate to: (a) the coastal environment, wetlands, and lakes and rivers and their margins; (b) outstanding natural feature and landscapes; (c) significant indigenous vegetation and significant habitats; (d) public access to and along the Coastal Marine Area lakes, and rivers; (e) the relationship of Māori and their culture and traditions; and (f) historic heritage. Regarding 6(g) protected customary rights, it is acknowledged that there are still outstanding Treaty claims that relate to the Manukau Harbour.

Section	Contents
Section 7 (Other matters)	Sets out other matters to which particular regard shall be had. Of relevance to this Project are matters (a), (aa), (b), (ba), (c), (d), (f), (g) and (i). In summary matters relate to: (a) kaitiakitanga; (aa) the ethic of stewardship; (b) the efficient use and development of natural and physical resources; (ba) the efficiency of end use of energy; (c) the maintenance and enhancement of amenity values; (d) intrinsic values of ecosystems; (f) maintenance and enhancement of the quality of the environment; (g) any finite characteristics of natural and physical resources; and (i) the effects of climate change.
Section 8 (Treaty of Waitangi)	Requires all persons exercising functions and powers under the Act to take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi).

4.2 Duties and restrictions

Part 3 of the RMA sets out a number of restrictions on the use of resources (including land and the CMA), and on activities that impact on resources (such as the discharge of contaminants).

Section 9 of the RMA imposes restrictions on the use of land. Pursuant to this section, resource consents are sought to use land:

- In a manner that contravenes a national environmental standard (section 9(1));
- In a manner that contravenes a regional rule (section 9(2)); and
- In a manner contrary to a district rule (section 9(3)), including where the activities are to be undertaken on land that is proposed to be reclaimed (section 89(2)).

The Project will involve a number of land disturbance activities controlled under section 9 of the RMA. Many of the proposed activities that are contrary to district rules will be covered by the designations sought for the Project.

Section 12 of the RMA imposes restrictions on activities in, and uses of, the CMA, including in relation to any:

- Reclamation;
- Structures;
- Disturbance or deposit likely to have an adverse effect on the foreshore or seabed;
- Impact on the foreshore or seabed likely to have adverse effects on plants or animals or their habitat; and
- Impact on the foreshore or seabed likely to have adverse effects on historic heritage.

There are two areas of CMA impacted by the Project, being the Māngere Inlet which is part of the Manukau Harbour and the Ōtāhuhu Creek, a tidal upper reach of the Tāmaki River.

Section 13 of the RMA imposes restrictions on activities in, on, under and over the beds of lakes and rivers. There are some streams and channels in the Project area that will be modified including through permanent diversion.

Section 14 of the RMA relates to any take, use, damming or diversion of water, including coastal water. The Project will involve the diversion of groundwater associated with the construction of the road trench at Onehunga Harbour Road and diversion of both stormwater and coastal water during construction.

Section 15 of the RMA restricts discharges into or onto air, land or water. The Project will involve:

- Discharge of contaminants or water to water, including in stormwater;
- Discharge of contaminants onto or into land in circumstances which may result in that contaminant entering water, including contaminants from road surfaces; and
- Discharge of contaminants from an industrial or trade premises to air and to land, from concrete batching activities.

The resource consents triggered by these sections are set out in *Section 5.2*.

4.3 Proposals of national significance

Part 6AA (sections 140 – 150AA) of the RMA provides for the consideration of matters, including NoRs for designations and applications for resource consent, that are or are part of a proposal of national significance.

The Transport Agency has lodged the following matters for the construction and operation of the Project directly with the Environmental Protection Authority (EPA) in accordance with Section 145:

- Applications for resource consent (section 145(1)(a));
- A notice of requirement for a designation (section 145(3)); and
- An alteration to an existing designation (section 145(3)).

Section 147 of the RMA provides that, after receiving a recommendation from the EPA, the Minister for the Environment and Minister of Conservation may make one of three directions; being referral of the matters to a Board of Inquiry (BoI), the Environment Court, or the territorial authority. The Transport Agency considers that the matters should be directed to a BoI, which must then hear and consider the matters in accordance with sections 149J to 149S of the RMA.

4.4 Designations

The Transport Agency is a requiring authority and can give notice of its requirement to designate land for the State highway network in accordance with its statutory functions. This Project involves two NoRs – one new notice and a second to alter the existing State Highway 1 designation already held by the Transport Agency. In relation to NoR2 (to alter the existing designation for works along SH1), the assessment under section 171(1) is limited to the works proposed as part of the alteration. It does not include works or effects that are or could reasonably be generated by the existing designation.

The process for submitting a NoR for a designation and for an alteration to an existing designation is set out in Part 8 (sections 166 – 186) of the RMA and summarised below.

4.4.1 General provisions

Section 168(2), as modified by section 145(7) where a matter is lodged with the EPA, provides that:

> "*A requiring authority for the purposes approved under section 167 may at any time give notice in the prescribed form to [the EPA] of its requirement for a designation—*
>
> *(a) For a project or work; or*

(b) In respect of any land, water, subsoil, or airspace where a restriction is reasonably necessary for the safe or efficient functioning or operation of such a project or work."

In accordance with section 181(1) of the RMA the Transport Agency can give notice of its requirement to alter a designation at any time. Section 181(2) directs that sections 168 to 179 and 198AA to 198AD shall apply to a requirement to alter a designation as if it were a requirement for a new designation, with all necessary modifications.

The prescribed form for a NoR is set out in Form 18 of the Resource Management (Forms, Fees, and Procedure) Regulations 2003. The two NoRs for this Project have been prepared in accordance with these regulations.

If the application goes to a BoI, Section 149P(4) provides that the BoI may cancel the requirement, confirm the requirement, or confirm the requirement subject to such modifications or conditions as the BoI thinks fit.

4.5 Resource consents

Section 149P(2) of the RMA requires the BoI considering applications for resource consent to consider and determine the application as if it were a consent authority under sections 104 to 112 and 138A.

4.5.1 General provisions

Section 88(2) (as modified by section 145(5)) provides that an application to the EPA for a resource consent must:

(a) Be in the prescribed form and manner; and

(b) Include the information relating to the activity, including an assessment of the activity's effects on the environment, as required by Schedule 4.

The prescribed form for resource consents is set out in Form 9 of the Resource Management (Forms, Fees, and Procedure) Regulations 2003. The applications for resource consent for this Project have been prepared in accordance with these requirements.

For activities that will take place on reclaimed land, and which will require consent under district rules, consent is also sought pursuant to section 89(2) of the RMA. This section deems the area to be within the district of the territorial authority for the purposes of hearing and determining the applications for consent.

The activities that will be occurring on the new land created by the reclamation include:

- New State highway (arterial road and roads linking to local roads) and associated works including street furniture, signage and safety requirements;
- Walking and cycling paths; and
- Associated works including stormwater wetlands, landscape features and planting.

4.5.2 Matters for consideration

Section 149P(1) of the RMA requires the BoI considering applications for resource consent to have regard to:

- The Ministers' reasons for making a direction; and
- Any information provided to it by the EPA.

Section 104 of the RMA sets out that, when considering any application for resource consent, the consent authority is required, subject to Part 2 of the Act, to have regard to specified items in (1)(a) to (c).

The matters outlined in section 104 are assessed in this AEE as follows:

RMA requirement	AEE reference
104(1): Part 2 of the RMA	Part I: Statutory Matters and Volume 3: Report 2 - Statutory Context
104(1)(a): effects on the environment	AEE Part G: Assessment of effects on the environment
104(1)(b): policy statements and plans	Part I: Statutory Matters and Volume 3: Report 2 - Statutory Context
104(1)(c): other matters	Part I: Statutory Matters and Volume 3: Report 2 - Statutory Context

4.5.3 Additional matters for consideration

Section 105 of the RMA sets out further matters that must be considered in relation to the consents sought for:

- The discharge of water and contaminants (stormwater and sediment) during construction of the Project (including the construction of works within the CMA), and for the discharge of stormwater arising from the operation of the Project; and
- The proposed reclamation of the CMA.

The matters identified in section 105 are assessed in *Part G: Assessment of Effects on the Environment* of the AEE and Part I demonstrates how the requirements of section 105 are met.

Section 107 sets out restriction on grant of certain permits – of relevance to EWL are discharges of contaminants or water into water, and discharge of a contaminant onto or into land in circumstances which may result in that contaminant entering water.

4.5.4 Restrictions on the power to grant consent

Section 104D of the RMA restricts the ability to grant consent for non-complying activities to circumstances falling within either one of section 104D(1)(a) or (b) (the "gateway tests"), being where:

- The effects of the activity will be minor; or
- The application is not contrary to the objectives and policies of the regional and district plan.

The assessments in *Part G: Assessment of Effects on the Environment* of this AEE indicate that aspects of the Project will have more than minor adverse effects. Therefore, for consents to be granted, the BoI must be satisfied that the Project is not contrary to the relevant objectives and policies of a plan and proposed plan. The approach to section 104D(1)(b) involves a properly balanced and weighted consideration of the objectives and policies of the relevant plans, to determine whether or not the Project as a whole, is contrary to the relevant plans.

In addition, Section 107(1) restricts the power to grant resource consent to discharge a contaminant or water where that discharge is likely, after reasonable mixing, to give rise to any of a number of adverse effects. This restriction is subject to the exceptions listed at section 107(2), including where there are exceptional circumstances, or where the discharge is of a temporary nature.

A detailed consideration of sections 104D and 107(1) is contained in *Volume 3: Report 2-Statutory Context* and summarised in *Part I: Statutory Matters* of this AEE.

4.6 Status of the policy and planning documents

Sections 104(1)(b) and 171(1)(a) require the BoI to consider, among other things, any relevant provisions of an operative or proposed regional policy statement, regional plan or district plan. The relevant planning documents for Auckland are currently in a state of transition with the recent release of the decisions version of the AUP (OP) and receipt of appeals both on merit and points of law to the Environment Court and to the High Court. The period for lodging further appeals has passed and, accordingly, those parts of the AUP (OP) regional plan and district plan that are not subject to appeal must be treated as operative (and the provision of any previous plan as inoperative).[27] Accordingly, the relevant documents for assessment under sections 104(1)(b) and 171(1)(a) are, at the time of lodgement:

Planning document	Status for purpose of statutory assessment
Regional Policy Statement	There are a number of appeals on the AUP (OP) regional policy statement. These are relatively confined issues and are of limited relevance to the relevant provisions for EWL. Therefore, Operative Regional Policy Statement retains some limited relevance.
Regional Coastal Plan	The AUP (OP) regional coastal plan has not been submitted to the Minister for Conservation for approval, which means it cannot be treated as operative.[28] Therefore, the provisions of the Operative Regional Plan: Coastal still have effect.
Regional Plans	There are appeals on the air quality provisions of the AUP (OP). Therefore all provisions of the Operative Auckland Regional Plan: Air, Land and Water that relate to air remain in effect. There are no relevant appeals that would relate to the Auckland Regional Plan: Sediment Control and therefore it is not considered further. Other AUP (OP) regional plan provisions are considered to be operative.
District Plan	There are broad appeals on district plan residential zones, but not to the Industrial zones. Therefore AUP (OP) district plan provisions retain some relevance depending on the relevant part of the EWL alignment.

*[**Note**: Those parts of the AUP (OP) that are described above as deemed to be operative, became fully operative on and from Tuesday 15 November 2016 (following notice by Auckland Council pursuant to section 160 of the Local Government (Auckland Transitional Provisions) Act 2010 and clause 20 of Schedule 1 of the RMA, dated 8 November 2016). The Supporting Technical and Assessment Reports in Volume 3 and this AEE were prepared before the Council's notice of 8 November 2016, however, the change in status from deemed operative to operative is not considered to materially alter the scope or content of the provisions relevant to this Project.]*

[27] RMA section 86F.

[28] As required by RMA Schedule 1, Clause 19.

5.0 Designations and Consents

Overview

This section sets out the applications required for the construction, operation and maintenance of the Project. In summary there are:

- Two Notices of Requirement – one new NoR and one alteration to the existing State Highway 1 designation; and
- Various resource consent applications.

5.1 Notices of requirement

The Transport Agency is lodging two NoRs for the designation of land required for the construction, operation and maintenance of:

- A new arterial road from SH20 west of the Neilson Street Interchange to SH1 at Mt Wellington Highway and associated works (referred to as NoR 1); and
- SH1 from the Mt Wellington Interchange ramps to Princes Street for road widening and associated works (referred to as NoR 2).

These NoR are shown on Figure 1-2 (in *Section 1.0: Introduction* of this AEE).

5.1.1 Land subject to designations

A schedule of properties directly affected by the proposed designations is included with the NoRs. In summary, the proposed designations directly affect the following land:

Table 5-1: Summary of land directly affected by the designations

Owner type	NoR1	NOR2
Private	23.6ha	3.7ha
Crown	1.5ha	0.7ha
Council (non-road reserve)	30.3ha	0.1ha
Road	24.8ha	2.3ha
Other (unknown, railway, water)	3.7ha	0.4ha

In Anns Creek there is one parcel (Reference 136 on the NoR Schedule) that is identified as being partially within the CMA. However upon inspection, this portion of the coast appears to be land (being located above MHWS) and therefore the status of the land is currently uncertain. Until such time as a survey is completed, a precautionary approach has been taken to designate the entire area of the site which may be deemed as land and simultaneously seek coastal occupation consents for this parcel.

5.1.2 Future Designation – Coastal marine area

Once the reclamation is completed, and the new area of land created, it is envisaged that the Transport Agency would alter the designation area of NoR 1, which by that time will be a confirmed and operative designation. In any case, applications have been made under Section 89 of the RMA to authorise land use activities on the new land created from the CMA.

5.1.3 Outline Plan

Section 176A of the RMA requires that an outline plan must be submitted to a territorial authority before commencing construction of a project or work under a designation.

The Transport Agency intends to submit outline plan(s) for relevant aspects of the Project to Auckland Council prior to the commencement of works onsite. Further discussion is contained in *Section 13.0: Avoiding, Remedying and Mitigating Effects* of this AEE.

5.1.4 Land subject to existing designations

Some of the land to be designated for the Project is already subject to existing designations, as outlined in *Section 11.4.1: Land use* of this AEE and in *Volume 3: Report 2-Statutory Context*.

In order to undertake work in accordance with a designation on land where there is an existing designation in place, the written consent of the requiring authority for the earlier designation is required under section 177(1)(a). As such, approval under section 177(1)(a) will be required from:

- Auckland Council;
- Auckland Transport;
- New Zealand Railways Corporation (KiwiRail);
- Transpower New Zealand Limited;
- First Gas Limited; and
- Watercare Services Limited.

This written approval is required in order to be able to undertake works in accordance with the later designation. It is not required in order to designate the land for those later works. For this reason, written approval under section 177(1)(a) of the RMA has not yet been obtained. Consultation with all of those other requiring authorities has taken place and will continue as the Project is developed. Written approval from these requiring authorities will be obtained by the Transport Agency at a later date once the detailed design of the Project has been completed.

5.1.5 Existing resource consents

There are a number of parties (including the Transport Agency and Auckland Council) that hold existing resource consents to establish and operate activities on sites either within the proposed footprint of the Project, or adjacent to the Project. Directly affected parties have all been engaged with.

5.1.6 Project designations to be reviewed after construction

The proposed designations include land required for both temporary and permanent works. Once construction is complete, the designation area will be reviewed, and will be removed from those areas that are not required for the long term operation and maintenance of the State highway. The Transport Agency will review its designations and remove parts of those designations using the process set out in section 182 of the RMA.

5.2 Applications for resource consent

Applications by the Transport Agency for resource consents are being lodged under section 145(1)(a) and in accordance with section 88 (section 145(5)) of the RMA.

Consents are required under the following plans:

- Operative Auckland Regional Plan: Coastal (ARP: C);

- AUP (OP) in relation to:
  - The regional coastal provisions;
  - Works on land that is currently within the CMA, and works on land generally in some instances;
  - Divert and discharge ground and stormwater;
  - Discharge contaminants to air, land and water;
  - Land uses in relation to works on land that is currently within the CMA;
  - Other regional planning matters;
- Operative Auckland Council District Plan: Isthmus Section in relation to works on land that is currently within the CMA; and
- National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES (Soils)).

The consents being sought are set out in Table 5-2.

Table 5-2: Reasons for Consent

Construction

Consent No.	RMA/consent type	Activity	Geographic location and scope of application	Activity Status
Land Use Activities				
RC1	Land use (s9) - NES Soil	Disturbance of contaminated soils.	Project wide.	Discretionary
RC2	Land use (s9(2)) – land disturbance activities	Earthworks, vegetation alteration and removal.	Project wide.	Discretionary
RC3	Land use (s9(2)) – land disturbance activities	Vegetation alteration and removal.	Vegetation alteration and removal for restoration and rehabilitation works undertaken outside of the designation within Southdown Reserve, adjacent to Southdown Stream, Anns Creek Reserve, Gloucester Park and the Manukau Foreshore Walkway.	Discretionary
RC4	Land Use (s9(3))	Vegetation alteration and removal, tree trimming and works in the protected root zone of trees and establishment of access tracks.	Vegetation alteration, removal associated with the restoration works and the establishment of vehicle access and parking areas undertaken outside of the designation within Southdown Reserve, adjacent to Southdown Stream, Anns Creek Reserve, Gloucester Park and the Manukau Foreshore Walkway.	Discretionary
Coastal Activities				
RC5	Coastal Permit (s12,s14, s15) – construction activities in the CMA and temporary occupation and associated discharge of contaminants	Reclamation, depositing of material in the CMA, disposal of waste or other matter in the CMA including dredged material, CMA disturbance, dredging, vegetation alteration/removal (including mangroves), damming or impoundment of coastal water, taking, use or diversion of coastal water, parking on CMA structures, vehicle use of the foreshore and seabed, demolition or removal of any CMA structures, temporary CMA structures, temporary construction activities, planting of native vegetation, underwater impact and vibratory piling.	Construction activities within the CMA associated with: • the road embankment, stormwater treatment areas, landscape features and associated structures in the Māngere Inlet; • the Anns Creek viaduct in the Māngere Inlet; • works in Onehunga Bay associated with public access; and • erosion protection and environmental enhancement works at Ngarango Otainui Island.	Non-Complying

Consent No.	RMA/consent type	Activity	Geographic location and scope of application	Activity Status
RC6	Coastal Permit (s12, s14 and s15) – construction activities in the CMA and temporary occupation and associated discharge of contaminants	Declamation, depositing of material in the CMA, CMA disturbance, vegetation alteration/removal (including mangroves), damming or impoundment of coastal water, taking, use or diversion of coastal water, parking on CMA structures, vehicle use of the foreshore and seabed, demolition or removal of any CMA structures, temporary CMA structures construction activities.	Works associated with the removal of the existing culvert and replacement with a bridge and the construction of a new bridge at Ōtāhuhu Creek.	Non-Complying
Activities in on under of over water				
RC7	Water Permit (s13 and s14) - works in watercourses and associated diversion activities	Depositing of substances, mangrove removal, diversion of a river or stream to a new course and associated disturbance and sediment discharge, demolition or removal of existing structures, reclamation or drainage and associated diversion of water and incidental temporary damming.	Construction works in all fresh watercourses in the Project area including: • Hill Street Stream • Southdown Stream • Anns Creek (landward of MWHS) • Clemow Stream • Miami Stream	Non-complying
RC8	Water Permit (s14) - Drilling of holes	The drilling of holes or bores during construction which will destroy damage or modify any places scheduled in the historic heritage overlay.	Within any areas covered by a historic heritage overlay.	Restricted discretionary
RC9	Water Permit (s14) - groundwater diversion and take	Drainage of groundwater.	Drainage of groundwater from the Pikes Point Landfill to enable construction.	Discretionary (innominate)
Discharges				
RC10	Discharge Permit (s15) - Discharge of contaminants into air or into or onto land or water	Discharges of contaminants from construction activities.	Full extent of proposed works in all land areas and within the coastal marine area.	Controlled
RC11	Discharge Permit (s15) - Discharge of contaminants into air or into or onto land or water	Discharges of contaminants from disturbing contaminated land or potentially contaminated land.	Project wide.	Discretionary

Consent No.	RMA/consent type	Activity	Geographic location and scope of application	Activity Status
RC12	Discharge Permit (s15) - Air Discharges	Storage of cement and manufacture of concrete.	Concrete batching facility within the construction yard proposed in Waikaraka Park.	Discretionary

Permanent works and operation

Consent No.	RMA/consent type	Activity	Geographic location and scope of application	Activity Status
Land Use Activities				
RC13	Activities on new land to be created (s9 and s89)	Use of land for a road, pedestrian and cycleway facilities, stormwater treatment, amenity areas and associated infrastructure and activities.	New land area to be created between existing MHWS and future MHWS, includes road embankment, stormwater treatment and amenity areas, and bund.	Discretionary (innominate)
Coastal Activities				
RC14	Coastal Permit (s12) – occupation and associated use	Occupation and associated use by permanent structures in and below the surface of the CMA including extension or alteration of existing CMA structures, bridge structures in Anns Creek, stormwater outfalls, retaining walls and seawalls, hard protection structures, observation areas, viewing platforms and boardwalks and any other public amenities.	Occupation and use of the Māngere Inlet and at Onehunga Bay including of the: • Anns Creek Viaducts, boardwalk and stormwater outfalls in the Māngere Inlet; and • Structures providing public access in Onehunga Bay.	Non-complying activity
RC15	Coastal Permit (s12) – occupation and associated use	Occupation and associated use by permanent structures in the CMA including extension or alteration of existing CMA structures, stormwater outfalls, retaining walls and seawalls, hard protection structures and any other public amenities.	Occupation and use of the replacement bridge and new bridge at Ōtāhuhu Creek.	Discretionary
Activities in on under or over water				
RC16	Water Permit (s13 and s14) - works in watercourses and associated diversion activities	Structures (including temporary structures), bridges or pipe bridges, new cables or lines crossing over a river or stream, culverts, erosion protection structure, stormwater outfalls.	The construction and operation of new structures in all fresh watercourses in the Project area including: • Hill Street Stream • Southdown Stream • Anns Creek (landward of MWHS)	Non-complying

Consent No.	RMA/consent type	Activity	Geographic location and scope of application	Activity Status
			• Clemow Stream • Miami Stream	
RC17	Water Permit (s14) - groundwater diversion and take	Groundwater diversion caused by excavation and associated dewatering or groundwater level control.	Permanent diversion of groundwater from the trench at Onehunga Harbour Road.	Restricted discretionary Activity
RC18	Water Permit (s14) - Permanent damming of surface water	Dams.	Extent of the stormwater treatment wetlands and Miami Stream in Sector 2.	Discretionary
Discharges				
RC19	Discharge Permit (s15) - Discharge of contaminants into or onto land or water	Discharge of contaminated water from leachate interception drain to water (proposed stormwater treatment wetlands)	Discharge into the Māngere Inlet via the stormwater treatment wetlands.	Controlled
Stormwater diversion and discharge				
RC20	Discharge permit (s15) – Discharge of stormwater	Diversion and discharges of stormwater from new permanent impervious surfaces and existing state highways impervious surfaces to land, freshwater and coastal water from SH1 between the Mt Wellington Highway and the Princes Street Interchange, the EWL, walking and cycling facilities and new and altered existing local roads.	Full extent of proposed works in all areas; discharges to both Waitemata and Manukau Harbour catchments and receiving environments, from existing SH1 between Mt Wellington Highway and the Princes Street Interchange and new State highway, local road connections, pedestrian and cycle facilities and other impervious surfaces to be constructed as part of the East West Link project from the vicinity of the SH20 Neilson St interchange to the existing SH1 at Mount Wellington.	Discretionary
RC21	Land Use (s9(2)) – impervious surfaces	New impervious surfaces for high use roads.	All new impervious surfaces within the extent of works.	Controlled

Miami Stream

The following apply specifically to the works outside of the designation footprint at Miami Stream. Note the construction related regional consents for the Miami Stream works have been grouped with Project wide resource consents in the above tables.

Consent No.	RMA/Consent Type	Activity	Geographic location and scope of application	Activity Status
M-RC1	Land use (s9(3)) – land disturbance, and associated discharges	Earthworks and vegetation removal.	Miami Stream	Restricted discretionary
M-RC2	Land use (s9(3)) – stormwater	Stormwater detention and retention.	Miami Stream	Controlled

5.2.1 Permitted activities

The permitted activities that are relevant to the Project are identified within Appendix B to *Report 2: Statutory Analysis Report*. This table identifies a number of typical construction activities and discharges that are permitted. Small-scale vegetation alteration and removal on land and in the CMA, is also permitted. The scale and nature of the Project, however, means that the majority of the major components require resource consent, including reclamation, discharges into the CMA, structures in the CMA and vegetation alteration and removal within SEA.

5.2.2 Bundling of Activities

Where there are a group of activities where the effects overlap or where the activities are intrinsically linked (such that one activity could not occur without the others), it is appropriate for them to be considered holistically as a single bundle according to the most stringent activity status. The Decisions Version of the AUP (OP) also contains guidance that activities should be bundled if the effects overlap.

Given the linear nature of the Project and the large distance between some of the Sectors the effects of some activities will not overlap with others. On this basis it would be possible to unbundle some activities and consider them on an individual or sector basis. However, this would be an unnecessarily complex task as all parts of the Project are necessary for the operation of the Project. Therefore, the resource consents have been bundled together and have been considered as a whole. The most restrictive activity status applies and the Project is considered as a non-complying activity.

5.2.3 Lapse periods – designations and resource consents

Section 184 of the RMA provides that a designation lapses, unless given effect to, on the expiry of 5 years after the date on which it is included in the district plan unless the designation specified a different period. Pursuant to section 184(1)(c), the Transport Agency proposes a lapse period of 15 years for each designation.

Section 125 of the RMA provides that a resource consent lapses, unless given effect to, five years after the date of commencement of the consent unless a date is specified in the consent. Pursuant to section 125(1), the Transport Agency proposes a lapse period of 10 years for each of the resource consents.

The reasons for seeking these longer lapse periods include:

- The national significance of the Project, its broad geographic extent, and its complexity in terms of the range and scale of the works involved;
- The need for adequate time to complete construction procurement and tendering processes;
- The need for adequate time to undertake property acquisition negotiations and processes, including access negotiations;
- The need for adequate time to complete further site investigations and design (preliminary, detailed and construction) of all aspects of the Project;
- The need to protect the alignment for this strategic transport project, so that there is certainty that it can be constructed and operated; and
- The need to provide sufficient time to construct the Project, which it is estimated could take well in excess of five years.

The lapse date for each designation and consent will be detailed in the proposed designation conditions and suggested consent conditions.

5.2.4 Duration

The Transport Agency is seeking resource consents for the following durations:

- Unlimited duration in respect of the coastal permits for reclamation; and
- 35 years from the date of commencement, in respect of all other consents required for the long term operation of the Project.

The expiry date for each consent will be detailed in the suggested consent conditions.

5.3 Additional Considerations under other Legislation

In addition to the matters requiring consideration under the RMA, there are some further statutory considerations that are relevant to the Project. Some of the matters also have relevance in terms of section 104(1)(c) or section 171(1)(d) of the RMA and this is covered in detail in the statutory assessment contained in *Part I: Statutory Matters* of this AEE and in Volume 3: *Report 2 - Statutory Context*.

The additional considerations are summarised in Table 5-3.

Table 5-3: Additional considerations under other legislation

Legislation	Relevance
Public Works Act 1981	The acquisition of land required for the Project
Heritage New Zealand Pouhere Taonga Act 2014	Archaeological sites affected by the Project
Reserves Act 1977	Reserves affected by the Project
Wildlife Act 1953	The relocation of protected species
Freshwater Fisheries Regulations 1983	The provision of fish passage in waterways affected by the Project
Marine and Coastal Area (Takutai Moana) Act 2011	Ownership of reclaimed land. There are no protected customary rights or customary marine titles (or applications for the same) that are relevant to this Project.[29]
Te Kawerau ā Maki Claims Settlement Act 2015	Parts of the Project are within the coastal area shown on OTS-106-14[30]. Te Kawerau ā Maki have a statutory acknowledgement in relation to this area and have been involved in the development of the Project as described in *Chapter 6: Description of the Project* of this AEE.

Any authorisations required under other legislation are not applied for as part of the current application package and the requirement for additional authorisations is stated for completeness. The additional authorisations will be applied for at the appropriate phase of the Project.

[29] As at 27 October 2016, according to the Ministry of Justice record of applications under the Marine and Coastal Area (Takutai Moana) Act 2011, found at <www.justice.govt.nz/maori-land-treaty/marine-and-coastal-area/applications>.

[30] Office of Treaty Settlement plan reference.

PART C

DESCRIPTION OF THE PROJECT

6.0 Description of the Project

Overview

This section includes the Project Description which provides the basis for the assessment of effects on the environment in *Part G: Assessment of Effects on the Environment* of this AEE. It includes a description of design and form of the Project and how the Project will be operated once construction is complete.

6.1 Introduction

This Project description provides the basis for the assessment of effects on the environment. It includes a description of the key physical elements of the Project and how different aspects of the Project will be operated once construction is complete.

Given the integrated nature of the Project, the description provides a brief overview of the transport elements of the Project and the wider open space, water and environmental elements. This is followed by a description of the Project's physical works within each of the six sectors.

The transport elements of the Project are described in terms of the following aspects:

- The State highway environment and local roads, other transport modes;
- A summary of the key features including: major structures, interchanges, acoustic barriers;
- Traffic function; and
- Design approach.

In addition, the wider integrated elements of the Project are described in terms of the social, environmental and cultural outcomes they deliver. In particular, these relate to the:

- Open space and recreation outcomes (public access);
- Water quality outcomes (the receiving environment including the CMA); and
- Wider environmental / cultural restoration / rehabilitation outcomes.

The second part of this section provides a description of design elements specific to each of the six sectors described in *Section 6.6: Physical description – Project sectors* of this AEE. The section also highlights how this Project integrates with other transport network-related projects in the wider area in *Section 6.7* of this AEE.

The information provided in this section is indicative and is intended to provide sufficient detail on the Project to assess the actual and potential effects and to identify any necessary measures to avoid, remedy, or mitigate any adverse effects, where appropriate.

The design will be further refined, through subsequent phases of the Project. This will be undertaken within the scope of the final designation and consent conditions which will have been put in place to manage the effects on the environment. The detailed design of the Project will be reflected in the Outline Plan(s) and other documentation submitted to Auckland Council prior to construction. Further discussion on the Outline Plan process is provided in *Section 13.1.2* of this AEE.

6.2 Overview of key features

At its core, the Project seeks to provide transport outcomes to meet the Transport Agency's objectives for the Project as set out in *Section 3.3* of this AEE. In delivering these outcomes, the Project has also sought to integrate with wider social, environmental and cultural outcomes and aspirations for the area. This integrated approach is core to the Project, but also means that some components of the Project are beyond the defined transport outcomes. As a summary, for each of the design features described, reference is made to whether these are contributing to transport, public access, water quality and/or wider environmental/cultural outcomes.

The principal design features are addressed in the sections below.

6.3 Transport environment

6.3.1 New State highway

The Project involves the establishment of a new section of State highway generally between existing SH20 and SH1. The new State highway will comprise all parts of the alignment where the primary function is State highway and will likely be gazetted as State highway on completion. This will include:

- All ramps onto and off the Neilson Street Interchange and the alignment where it passes to the north of the Onehunga Wharf;
- The Main Alignment adjacent to the Māngere Inlet foreshore;
- Viaducts over Anns Creek and the intersection with Great South Road;
- Connections from the Main Alignment to Great South Road and Sylvia Park Road and the alignment;
- Sylvia Park Road; and
- New SH1 on and off-ramps at Mt Wellington.

Where the alignment ties into local roads, these will be designated for State highway purposes as far as physical works are required. In due course the designation will be uplifted to cover the gazetted State highway, with the balance of any works becoming part of the local road network. This is described further in *Section 6.3.4* of this AEE.

The new State highway will operate as an arterial road environment, enabling local road connections, walking and cycling paths, and crossings at some intersections. The majority of the State highway will comprise two lanes in each direction with shoulders, raised median, and separated walking and cycling paths on either side.

6.3.2 SH1 alignment and capacity improvement

The Project will increase capacity on SH1 between the Mt Wellington Interchange and just south of the Princes Street Interchange by adding one additional lane in each direction on the existing motorway. The additional lanes will have adjacent shoulders and vertical retaining walls on the outer edges. The additional lanes merge from new south-facing ramps providing access between the Main Alignment and the SH1 corridor. Where the new State highway joins SH1, the southbound on-ramp will comprise two lanes that enable ramp metering, merging into a single lane prior to joining into the new auxiliary lane on SH1. The northbound off-ramp from SH1 includes an improved Mt Wellington Highway off-ramp, with the Project connection coming off this ramp. The new EWL/Great South Road/ Sylvia Park Road intersection will provide long term benefits by providing grade separating the east west connections improving reliability and future resilience for this intersection.

6.3.3 SH20 alignment

Capacity improvements on SH20 are being undertaken in 2016 as part of a wider programme of improvements along the SH20 corridor. These are described in *Section 6.7.1* of this AEE. In addition, the Project will include the following changes to the existing SH20, which are illustrated in *Plan Set 3: Road Alignment* in *Volume 2: Drawing Set*.

- A bus priority lane leading into a reconfigured off-ramp which directs bus access to a reconfigured Galway Street/Onehunga Harbour Road;
- New on-ramp from the Main Alignment comprising a bridge over SH20 and on-ramp west of the existing access from Neilson Street which remains in its current location with lanes merging between the two ramps; and
- Extended bus only on-ramp to SH20.

6.3.4 Local roads

Local roads will be altered and constructed as part of the Project. These are administered by Auckland Transport. These works are required as part of the Project to provide connectivity to the Project and to provide improved local road function. The Transport Agency designation for the Project will provide for these works to occur. The designation will be uplifted from local road areas on completion and local roads will be transferred to Auckland Transport to operate and maintain. The local roads are described in Section 6.6 of this AEE.

6.3.5 Walkways, cycleways and shared paths

The Project includes both commuter and recreational cycle paths provided along the Project alignment, and also in a north-south direction to enhance connectivity to communities in the Onehunga-Penrose area to the north of the Project. There is no provision for walking and cycling paths on the existing motorways (SH1 and SH20). There is an existing pedestrian path under the SH20 Manukau Harbour Bridge which will be retained.

New paths will connect to existing cycle and walking networks, improving connectivity to the wider Auckland region facilities. Key linkages provided by the Project are illustrated on *Plan Set 3: Road Alignment* in Volume 2, and include:

- Improved linkages in and around the Neilson Street Interchange linking with the New Old Māngere Bridge, the new pathways in Taumanu Reserve (Onehunga Foreshore), clearer access into Gloucester Park North Reserve and improved facilities on Onehunga Harbour Road and Onehunga Mall[31];
- A new Māngere Inlet foreshore with recreational and commuter paths along the alignment;
- North-south shared path linkages to/from Alfred Street, Captain Springs Road, Waikaraka Park and Hugo Johnston Drive, improving access to businesses and the residential communities to the north;
- Linking the existing Waikaraka shared path through to Sylvia Park Town Centre thereby improving the functionality of the existing path which currently ends in an industrial environment in Hugo Johnston Drive;
- A shared pedestrian and cycle path over the Great South Road intersection will provide improved east west connections;
- Wider pedestrian and cycle paths on the replacement bridges across SH1 at Panama Road and at Princes Street, improving sight lines and crossing points, and connectivity to residential communities; and

[31] This connection will maintain and enhance connections from the southern side of the Māngere Inlet, including to and from the Māngere Bridge township, across the Old Māngere Bridge (and its future replacement structure), and into the Onehunga Town Centre.

- A new pedestrian/cycle crossing at Ōtāhuhu Creek parallel to SH1, connecting Mataroa Road (north) with Deas Place (south), improving local connectivity between the residential communities east of SH1 (Panama Road and Princes Street East).

The Project has been designed to avoid the need for on-road cycling where practicable, with separated cycling facilities provided beside the Project Main Alignment between SH20 and SH1, and access to the separated recreational cycle and walkway on the Māngere Inlet coastal edge. Cycle paths will be designed to the following approximate design specifications (to be confirmed in detailed design):

- Off-road exclusive cycle paths will be generally be 3m wide;
- Shared paths will have a minimum width of 3m; and
- Separated foot/cycle paths will have widths as specified in *Auckland Transport Code of Practice (ATCOP)*[32].

The detail of the type of walking and cycling infrastructure, will be developed in the detailed design process, including both the form and connections. Pedestrian footpaths will generally be provided on either side of the Project, on all local roads and at signalised intersections (except motorways). Pedestrian facilities will generally be designed in accordance with the Transport Agency's *Pedestrian Planning and Design Guide*[33]*,* the design principles from the Transport Agency's *Urban Design Guideline – Bridging the Gap*[34] and the *Auckland Transport Code of Practice*.

6.3.6 Bus

The Project has been designed to enhance bus connectivity and travel time reliability for buses travelling from Māngere Town Centre to Onehunga Town Centre via SH20 by removing through traffic from the local network (Onehunga Mall) onto the EWL. The bus network will also benefit from a reduction of traffic on Church Street and Neilson Street, resulting from volumes of through traffic moving to the EWL, and the increased resilience in the network arising from more route options. The reduction of freight traffic accessing Onehunga Town Centre (including buses) and the traffic accessing the industrial areas to its east will occur as a result of industrial and freight traffic being encouraged to use the EWL. Key measures for buses include:

- Northbound buses: A realigned SH20 Neilson Street off-ramp and new link to Galway Street via the new EWL exit. Buses will no longer use Onehunga Harbour Road to access the town centre;
- Northbound buses: A new link road connecting Galway Street to Onehunga Mall via a roundabout and signalised intersection which will be used by buses to access the town centre; and
- Southbound buses: Existing southbound on-ramps will be realigned. The existing T2 lane (a lane for vehicles carrying two or more passengers) at Gloucester Park Road and the SH20 on-ramp will be converted to a bus-only lane and will connect directly into the existing bus lanes on SH20.

Galway Street will be primarily used by those travelling west, with Onehunga Mall used by those with northern destinations, this is self-defining. Onehunga Mall is designed to remain as a 2-lane facility, with Galway Street as 4-lanes. This will discourage 'rat-running' on Onehunga Mall. The role of Onehunga Mall as a route for pedestrians and cyclists will be via the facilities provided.

During engagement, Auckland Transport advised their preference that buses utilise the existing local network rather than the new State highway. Therefore no bus priority lanes are proposed on EWL.

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[32] Auckland Transport, *Auckland Transport Code of Practice*, March 2014.

[33] Transport Agency, *Pedestrian Planning and Design Guide,* October 2009.

[34] Transport Agency, *Bridging the gap: NZTA urban design guidelines,* October 2013.

6.3.7 Rail

A key feature of the Project is the strategic location in the vicinity of the rail network including Southdown rail line accessing the KiwiRail land and inland ports. The NIMT rail line is used for freight around the upper North Island, including from the Port of Tauranga. The Project has been designed to accommodate existing rail operations and to not preclude the future aspirations of KiwiRail for development of rail facilities, particularly in the vicinity of the inland ports and Great South Road intersection. Integration of the EWL with other transport projects (including Auckland Transport multi-modal and mass transit proposals) are discussed in *Section 6.7* of this AEE.

The Project:

- Where crossing the KiwiRail rail corridor, provides for structures with appropriate clearances over the rail network to accommodate ongoing use, electrification and operational constraints;
- Avoids requirement for land within the designated rail corridor, where there are future aspirations for development of rail infrastructure; and
- Seeks to integrate future rail development with the construction and operation of the Project.

6.4 Design approach

6.4.1 Design Standards and guidelines

The design, including geometric layout, safety features, stormwater, structures, noise barriers and lighting, has been developed using guidelines that include:

- The Transport Agency design standards and guidelines; (transport, urban design, pedestrian and cycling etc.);
- The Association of Australian and New Zealand road transport and traffic authorities (AUSTROADS) standards;
- Auckland Council and Auckland Transport standards and guidelines;
- New Zealand Standards; and
- Utilities standards.

Safety in Design will be an integral part of the detailed design process. This is a process to ensure that the right choices about the design are made as early as possible to enhance the safety of the Project, for those who will construct, operate or maintain it. For example, these choices may relate to methods of construction, on-going maintenance provisions, or materials used.

6.4.2 Urban and Landscape Design Framework

The Urban and Landscape Design Framework (ULDF) provides guidance on landscape and urban design principles for the area. The Transport Agency has worked with Mana Whenua, Auckland Council and a range of other stakeholders to develop an ULDF. The ULDF for the Project is contained in *Volume 4: ULDF.*

The overall purpose of the ULDF is to:

- Demonstrate how the design of the Project supports the Agency's strategic commitment to high quality urban design outcomes;
- Bring together the delivery of built and natural environment aspirations and outcomes; and
- Demonstrate alignment between the Transport Agency and other agencies in their planning, transport and urban design initiatives for the area. In this regard, the ULDF reflects a wider strategic direction

and has a longer term urban and landscape design vision than just what the Project will deliver on its own.

CPTED and accessibility principles are fundamental to the development of the ULDF (see for example *Sections 4.1* and *4.1.1-4.1.2* of the *ULDF* in *Volume 4*) and will be incorporated into the detailed design.

6.4.3 Travel Times and Travel Time Reliability

A core Project objective is to improve travel times and travel time reliability between the businesses in the Onehunga-Penrose industrial area. The Project has been designed to improve travel time and reliability accessing the Onehunga-Penrose area, as well as to have positive travel time/reliability effects on the wider local road and motorway network.

The Project has been designed to achieve significant improvements in the consistency and reliability of travel times for trips accessing the strategic network (e.g. SH1 and SH20) from the Onehunga-Penrose area. With the Project in place, the access times become much more consistent and reliable across the day, which will in turn allow improved and more flexible journey and logistics planning for businesses in the area, and result in increased freight efficiency.

The general pattern of changes in daily flow suggests that traffic moves from the adjacent corridor to the Project, with large reductions in flow and therefore reduced congestion seen on Neilson Street and Church Street. There is a decrease in flows on other routes, particularly in residential areas.

More than half of the truck movements are expected to be removed from the Neilson Street/Onehunga Mall and Great South Road/Sylvia Park Road intersections. This reduction allows improved pedestrian and cycling facilities and amenity, and reduced traffic severance between Onehunga and the Māngere Inlet, new Taumanu Reserve foreshore and access to the New Old Māngere Bridge[35].

The reductions of flows and congestion, particularly on Neilson Street and Great South Road, will improve accessibility for local businesses onto those arterial roads.

The Project is expected to improve journey times over a much wider area than just Onehunga-Penrose, including:

- Between SH20 and Highbrook;
- Between Onehunga and the Airport;
- Between Royal Oak and the Airport;
- Between SH1 and the Airport;
- Between the inland port and Highbrook; and
- Between Pakuranga and Onehunga.

The Project has been designed to be complementary to the traffic flows on SH1 and SH20 such that the extra EWL ramp flows can be accommodated without a detrimental impact on travel along SH1 and SH20.

[35] The New Old Māngere Bridge is a proposed replacement bridge for the existing Old Māngere Bridge. Details of the New Old Māngere Bridge are included in Section 6.7.6.4.

6.4.4 Interchanges and local road connections

The Project has been designed to provide connectivity to the local network at regular intervals along the alignment. It is designed to function as an arterial route (not a motorway) which allows for local connectivity on and off the Main Alignment.

There are two main State highway interchanges – at Neilson Street, Onehunga and at Princes Street, Ōtāhuhu. The Project also crosses over the existing Mt Wellington Highway, merging into new SH1 lanes south of the Mt Wellington Interchange.

Direct access to and from the Main Alignment will be provided via controlled intersections accessing onto and off roads designed to local road standard, extending Galway Street and Captain Springs Road southwards, a new cul-de-sac accessing the inland ports land, at Hugh Johnston Drive and at Great South Road.

The intersections will generally be signalised, depending on the design requirements and space constraints. The EWL/Great South Road/Sylvia Park Road intersection will be maintained with traffic able to pass under the new viaduct. Access for all properties with existing access onto Great South Road will be maintained. However, some entrance/exits will be changed to accommodate improved safe ingress and egress onto the Great South Road intersection. The Sylvia Park Road and Pacific Rise intersection will be maintained with traffic able to pass under the new elevated south facing ramps onto SH1. Access will be maintained for all properties on the northern side of Sylvia Park Road, however some rationalisation of existing accessways and accommodation works will be required as not all movements will be provided for. The changes will limit the number of right turns in and out of properties along Sylvia Park Road.

6.4.5 Design speed/posted speed

The design speed across the Project varies depending on the function of the roads. Whilst State highways are often associated with motorway or open road speed, there are other State highways with lower design speeds (generally the design speed is 10km/h higher than the posted speed). The general philosophy of design speeds are as follows:

- SH1 and SH20 are designed at higher speed to match the speed limits within the existing State highway network with a normal posted speed of 100km/h;
- The Neilson Street Interchange is designed with a lower speed to accommodate curved ramp connections and connectivity from local roads;
- East of the ports link road through to where the ramps tie into SH1, the Main Alignment has a design speed of 80km/h. A shared path is located on the southern side of the Main Alignment between the ports link road and Great South Road;
- The Main Alignment along the Māngere Inlet foreshore will be an arterial catering for heavy vehicles turning in and out of signalised intersections (with a design speed of 70km/h). There will be a shoulders and pedestrian and cycle paths on each side of the carriageway. It will be designed to have an urban arterial appearance;
- The ramp connections to and from SH1 will be designed for a speed in between local road and motorway, accommodating the change in environment between motorway and urban arterial; and
- Local roads, Galway Street, Captain Springs Road, the port link road, Great South Road and Hugo Johnston Drive have a design speed of 50/60km/h depending on new and existing constraints.

6.4.6 Traffic Services

Traffic services includes features such as:

- permanent road signs and gantries, including variable message signs;

- lighting; and
- required safety features including barriers.

The traffic services that are to be in place when the Project initially opens to traffic will be considered and finalised during the detailed design phase and will be designed in accordance with the relevant standards at the time the Project is constructed. Throughout the life of the Project, it is anticipated that traffic services will be renewed and upgraded as required, to ensure the continued safe and efficient operation of the State highway. This would be done as part of the normal operation and maintenance.

The services will include:

Signage	Design of all road signs and markings will be in accordance with the appropriate versions at the time of the *Manual of Traffic Signs and Markings* (MOTSAM), and the *Land Transport Rule: Traffic Control Devices*. Signage, including overhead gantries, will be required to be installed at locations along the route to meet these standards.
Lighting	Provision has been made for lighting along the full alignment. In some areas, lighting may be minimised to reduce the impact on ecologically sensitive areas. All operational lighting for the Project will be designed to comply with *AS/NZS 1158:2005 Lighting for Roads and Public Spaces* (Standards New Zealand and Standards Australia, 2005). Specific requirements: • all SH1 and SH20 ramp lighting will have lighting levels appropriate for roads with no property accesses and carrying large volumes of traffic. • sections of the road which do not receive direct natural light due an obstruction will be lit 24 hours per day (e.g. under bridges). • sections of the road which do not receive direct illumination from the pole mounted road lighting, will be lit via alternative methods (e.g. mounted on a structure), as is provided for in the trench section of the new State highway at Onehunga wharf. • shared paths, where separated from roads by a significant distance, will be lit using ground mounted lights unless there is adequate light spill from the adjacent roadway lighting.
Safety features	Safety features will be appropriate to the motorway or arterial road environment in which they are located and will include medians, shoulders and barriers.

6.4.7 Network Utilities

The location of the Project at the narrowest point of the North Island means there are numerous infrastructure networks converging in the area, making for a complex built environment. The Project will require the relocation and works in the vicinity of major utilities – including regionally and nationally significant infrastructure. Major infrastructure that will require relocation and/or protection as part of the Project is discussed in detail in *Section 12.5: Network Utilities* of this AEE. In summary major infrastructure includes:

- Transpower: relocation of towers and lines in some locations (both 110 and 220kV lines);
- First Gas: relocation of a high pressure gas main; and
- Watercare: crossing over the Hunua No. 4 Watermain and other major water and wastewater infrastructure.

With the exception of the Transpower relocations (which are covered by specific legislative provisions), works required for network utility relocations are within the scope of the proposed works for which consents are being sought.

6.4.8 Structures approach

Structures comprise part of the two major interchanges, as well as bridging over areas that include elements of the existing built environment such as the rail corridor, and the natural environment, ecological and geological features.

The bridge structures required as part of the Project are summarised in Table 6-1 below and the location of the major structures are indicated in Figure 6-1. Further detail on the location and form of the bridges is contained within the drawings in *Volume 2: Drawing Set*.

Figure 6-1: Structures along the alignment

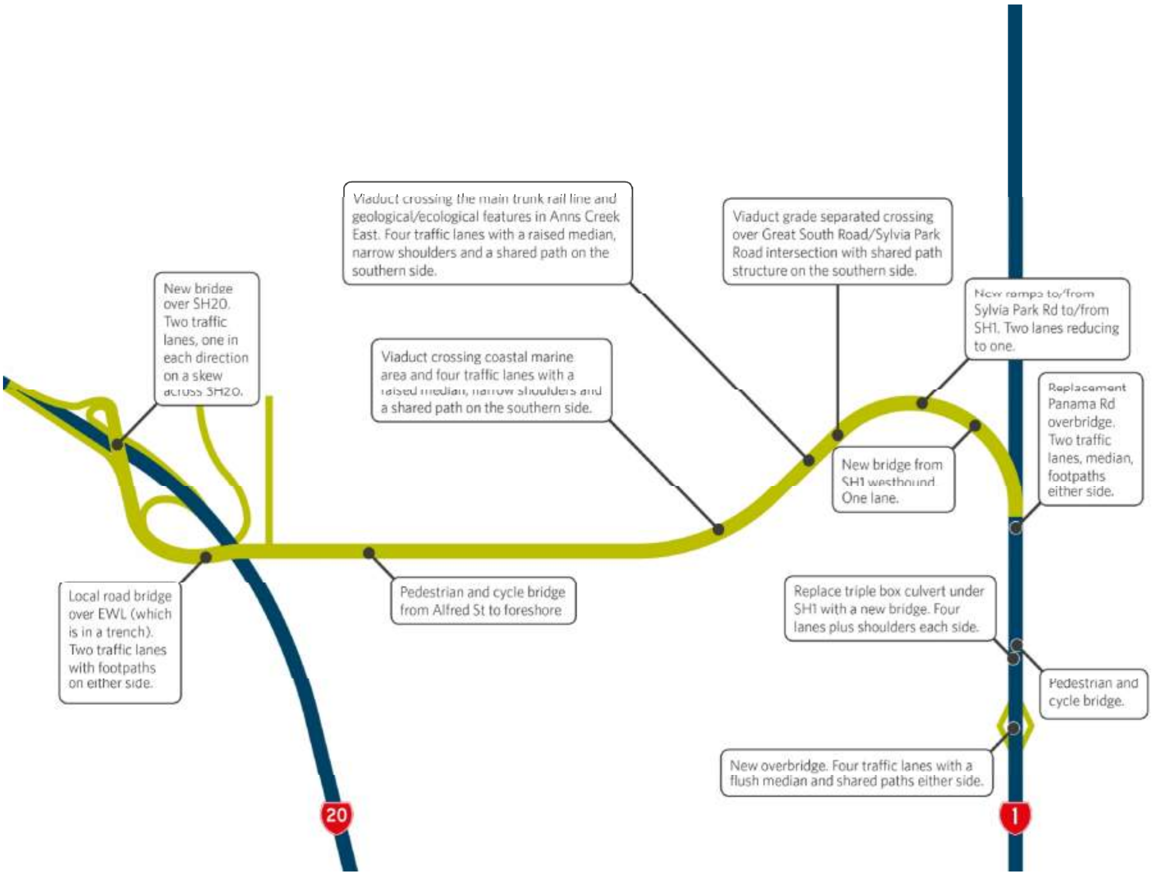


Table 6-1: Bridge structures

Chainage	Location and Purpose	Description
200	As part of the new Neilson Street Interchange design, a new bridge over the existing SH20 alignment is required. Its purpose is: • to provide access onto EWL for traffic coming off SH20 at the Neilson Street southbound off-ramp; and • for traffic coming from EWL and Onehunga getting onto SH20 heading southbound.	Two traffic lanes – one each way, on a skew across SH20. No pedestrian or cycle access will be provided.

Chainage	Location and Purpose	Description
720	Local road bridge, pedestrian and cycle access over the EWL from Onehunga Harbour Road providing access to the Onehunga Wharf (25m width). This bridge spans over the new EWL alignment which is constructed below current ground level in a trench in order to improve accessibility and connectivity to the port. The structure provides for the future bridging of up to 50m over the State highway in this section (if appropriate to enable integration with the future development of the Onehunga wharf).	Two traffic lanes with footpaths either side.
850	As part of the construction of a new configuration of Onehunga Harbour Road and extension of Galway Street, a new replacement pedestrian bridge, crossing over Onehunga Harbour Road and the Project is required, providing access to the foreshore walkway and Māngere Bridge.	Replacement structures for pedestrians and cyclists.
850-3350	A bridged boardwalk is proposed along the Māngere Inlet foreshore as part of the new recreational shared path. This will tie into paths constructed as part of the new foreshore landscaped edge.	Pedestrian / shared paths.
3620 - 4420	New viaduct crossing the CMA and the Southdown rail spur, between the Māngere Inlet foreshore and landing on new embankment at the end of Hugo Johnston Drive. Viaduct has been designed to cross over marine ecological areas and geological features. “Pier exclusion” areas are specified based on these sensitive environmental features.	Four traffic lanes with a raised median, narrow shoulders, and a shared path (pedestrian and cycle) on the southern side.
4470-4980	New viaduct crossing the main trunk rail line, geological and ecological areas in Anns Creek, to tie in with the new intersection at Great South Road.	Four traffic lanes with a raised median, narrow shoulders, and a shared path (pedestrian and cycle) on the southern side.
4980-5700	Viaduct continuing from Anns Creek, tying in with the new grade separated Great South Road intersection to maintain existing connections and provide for east west movements.	Grade separated two traffic lanes – one each way over Great South Road and connections from EWL to Great South and Sylvia Park Roads. Separate pedestrian and facilities provided as a shared path over Great South Road.
5730-6500	New bridge from Sylvia Park Road linking onto SH1 southbound, merging into an additional (new) lane on the eastern side of SH1.	Two lanes reducing to one at SH1.
5730-6280	New bridge from Mt Wellington Highway SH1 northbound providing an off-ramp to Sylvia Park Road and EWL.	One lane.
7150	Replacing the existing Panama Road overbridge over SH1 with a new, longer bridge to accommodate additional lanes on SH1 (one lane either side of SH1). The new bridge will also accommodate wider footpaths and provide for safer cycle access.	Two traffic lanes, flush median, shared paths either side.
8000	The existing triple box culvert carrying SH1 over Ōtāhuhu Creek will be replaced with a new bridge. The new bridge will accommodate additional lanes (on either side of the existing SH1).	New SH1 bridge – eight lanes plus shoulders in each direction.

Chainage	Location and Purpose	Description
8000	To carry out the culvert replacement on SH1 a new additional bridge structure will be constructed to divert traffic onto. This will be constructed on the eastern side of the existing SH1 alignment. This bridge will remain in place permanently and will enable local pedestrian and cycle connectivity across Ōtāhuhu Creek.	Local access bridge.
8600	In order to widen SH1 on either side, the Princes Street Interchange overbridge will be replaced with a longer structure, and a complete reconfiguration of the Princes Street Interchange is proposed. This includes a new on-ramp for southbound traffic (from Frank Grey Place) which will pass underneath the new overbridge. The new bridge will accommodate additional lanes, better providing for local through traffic separated from motorway traffic, and more clearly defined walking and cycling routes.	Four traffic lanes with a flush median, shared paths on either side of the new overbridge.

6.5 Other works

6.5.1 Open Space / Recreation

The Project involves the creation of new public open space on the coastal edge. This will comprise open areas and walkways, pebble banks and headlands. This is shown in the *Volume 2: Drawing Set*.

In addition to the pedestrian and cycle connections, the following recreation linkages are incorporated within or enabled by the Project:

- Provision of a 4.0m recreation path on the southern side of the new State highway, between Old Māngere Bridge (or its planned replacement) and its connection to the existing Manukau Foreshore Walkway (also known as the Waikaraka Walkway) at the inland Port, with separation between the walkway and the new arterial road; and
- Opportunity for provision of connection between the Project shared path and recreation walkway and the future ‘greenways’ link to the eastern edge of the Māngere Inlet (parallel to rail).

6.5.2 Coastal works

The Project requires works on the coastal edge and within the CMA in the Māngere Inlet and in Ōtāhuhu Creek. Table 6-2 describes the approximate areas of coastal works in the Māngere Inlet and Table 6-3 describes the approximate areas of coastal works in Ōtāhuhu Creek.

Table 6-2: Approximate Areas of Reclamation, Permanent and Temporary Occupation (Sector 2)

	Reclamation (rounded)	Permanent Occupation (rounded)	Temporary Occupation (for construction)
Road Embankment	5.6 ha	0.9 ha	11.1 ha
Landscape features and wetlands	12.7 ha	4.4 ha	
Boardwalk	-	0.7 ha	
Anns Creek bridges	-	0.8 ha	1.1 ha
Anns Creek bridge piles	-	0.01 ha	0.02 ha
Total	**18.4 ha**	**6.68 ha**	**12.85 ha**

The proposed construction methodology also includes the potential excavation of marine sediments to use in construction of the proposed road embankment and foreshore bund. This is described in *Section 7.0: Construction of the Project* of this AEE.

Table 6-3: Approximate Areas of Reclamation, Permanent and Temporary Occupation (Sector 5)

	Declamation	Permanent Occupation	Temporary Occupation (for construction)
Ōtāhuhu Bridge	**0.5 ha**	**0.12 ha**	**0.16 ha**

6.5.3 Acoustic barriers

The Project passes through a variety of different noise environments some which have low ambient noise levels and others which have reasonably high ambient noise levels. Different levels of noise mitigation are required throughout the Project area.

The guiding approach for the acoustic design is to address the adverse effects of road-traffic noise on people through adopting the best practicable noise mitigation options to keep noise at a reasonable level at sensitive receivers. The design solutions to address the increased noise levels can be, but are not limited to:

- New noise barrier construction at the boundary of the State highway corridor or adjacent to traffic lanes;
- Design and incorporation of low noise roadway surfacing;
- Increased heights of roadside barriers; and
- Modifying of existing buildings at sensitive locations to mitigate noise issues.

All noise attenuation design will be carried out in accordance with NZS 6806:2010 – *Acoustics – Road Traffic Noise – New and Altered Roads*.

Where required, acoustic barrier height varies depending on the modelled requirements and topography. Barriers will be constructed from a material that performs to meet the appropriate acoustic performance requirements. Options that can meet the required standard include a range of concrete or timber products, which will also need to meet the Transport Agency's durability considerations from a maintenance and whole of life cost perspective. The recommended options for traffic noise mitigation are set out in further detail in *Section 12.11: Noise and Vibration* of this AEE.

6.5.4 Stormwater

In developing the stormwater treatment concept for the Project, the opportunity to incorporate treatment of a wider urban catchment (other than just the road surfaces) was identified. The integrated design development incorporates treatment for over 600ha additional to the requirements for the road in Sector 2 of the Project.

The approach for stormwater design has been to use guiding principles, identified below, and to develop the solution for the whole alignment from those principles. The approach has been to seek opportunities for "natural" treatment of stormwater as a preference where there is space available, and to use proprietary devices as an alternative where less space is available.

For the treatment of stormwater from the road alignment (both the new road and sections of existing SH20 and SH1), the design concept is to use "best practicable option" that aligns with Auckland Council guidance documents (including the AUP (OP) and Auckland Council Technical Publications) with respect to discharges in relation to flow rates, volumes and quality.

The stormwater concept – for both quality and quantity – has been developed to a preliminary level, and will be further developed at subsequent design stages in consultation with Auckland Council. These designs will be *aligned* with the outcomes described in this AEE.

6.5.4.1 Stormwater – quantity

The performance of stormwater systems is a key design objective for safe operation and use of the road network both on local roads and the State highway network. Specifications include managing stormwater flows on main carriageways to disperse quickly away from traffic lanes. This includes designed overland flow paths that cater for a 1% annual exceedance probability[36] rainfall event, or where no overland flow path is available, the capacity of the primary system is designed to cater for the 1% annual exceedance probability rainfall event.

6.5.4.2 Stormwater – quality

The approach for stormwater quality has been to take a "best practicable[37] option" approach having regard to:

- Mana Whenua's views of appropriate outcomes, including a preference for natural methods that involve water passing through or over land;
- Guidance set out in Auckland Council TP10 (Stormwater Management Devices) and testing against other guides;
- Wetlands preferred and constructed devices (such as cartridges or storm filters) secondary;
- Ease of maintenance and whole of life considerations including safety for access;

[36] Annual Exceedance Probability (AEP) event indicates the significance of the potential storm event and percentage chance of it occurring in any given year. It is used as a design criteria to inform sizing (such as pipework, ponds and treatment devices) for stormwater infrastructure.

[37] From RMA Section 2 "***Best practicable option****, in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to – (a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; (b) the financial implications, and the effects on the environment, of that option when compared to other option; and (c) the current state of technical knowledge and the likelihood that the option can be successfully applied."*

- Use of innovation to reduce treatment area footprint having regard to the constrained urban environment and limited corridor space;
- Opportunity to incorporate stormwater treatment within a constructed coastal edge reclamation; and
- Where practicable, the use of temporary (construction) ponds to be converted into permanent wetlands.

Practical design considerations and outcomes need to take into account:

- The existing stormwater collection and disposal network that includes older pipework discharging to natural watercourses and the CMA at a low level, meaning discharge is often below the level of the tide;
- Climate change and sea level change effects;
- Ability to accommodate a 10% annual exceedance probability rainfall event (that is, a one in 10 year event), with pipework designed to achieve self-cleaning velocities, minimising build-up of debris in pipes;
- Potential for water to back up in the pipes during rainfall events, due to the low level of discharge and the flat gradient of pipe work;
- Permanent erosion protection measures to protect against localised scour at outfall locations, including new structures within the CMA and existing outfall structures; and
- Placing stormwater manholes outside live traffic lanes and sealed areas to accommodate a safe environment for maintenance activities.

The following provides a summary of the approach:

Overall concept	The stormwater treatment wetland areas consist of two key components; freshwater wetland areas and biofiltration areas (raingardens). The use of biofiltration areas in addition to wetlands, enables the treatment of stormwater in a greater number of rainfall events in a smaller surface area.
Wetlands	Wetlands will be shallow (water depths 100-300mm), extensively vegetated water bodies that use enhanced sedimentation, fine filtration and pollutant processes to remove pollutants from stormwater. Stormwater will be discharged from the collection network into a forebay where coarse sediment will settle out. Flows will then enter the main shallow heavily vegetated area to remove fine particulates and soluble pollutants. Wetlands will treat base flows and small storm events and discharge treated flows through outfalls in, for the most part, the CMA.
Bio-filtration/ rain gardens	A concept for using biofiltration systems (an alternative filtration system using natural plants) has been developed for EWL because they are less space-hungry than wetlands, and emulate natural treatment systems. Space is an important consideration in a constrained urban environment. These systems are vegetated soil biofiltration systems that provide efficient sediment and nutrient removal from stormwater. The biofiltration system remains dry under normal conditions and minor storm events and will treat stormwater flows during moderate rainfall events.
Proprietary devices	In some instances, proprietary devices will be used. This will be where there is limited space so an underground solution (that limits land requirements) is preferred.
Outfalls	Treated water will be discharged from either the wetland and biofiltration systems, or the proprietary devices (whichever is used), to constructed outfall structures in the CMA – some with tidal control included, natural watercourses or the piped network. These are designed to function effectively with predicted sea level changes as discussed in *Volume 3: Technical Report 12 - Stormwater Assessment*.

6.5.4.3 Stormwater treatment wetland

Stormwater from the local road network, and the wider Onehunga-Penrose urban catchment is currently untreated and discharges directly to Miami Stream, and via the stormwater network to the CMA through eleven discharge locations along the foreshore. Working in collaboration with Auckland Council, the Transport Agency has undertaken to achieve stormwater quality treatment for both the new road carriageway and part of the wider urban catchment within a new constructed coastal edge.

This involves the construction of new wetlands and biofiltration areas to capture and treat stormwater from both the road alignment and inland Onehunga-Penrose catchment. The wetlands will contain a range of vegetation types suitable for these environments and intended to visually appear similar to estuarine marshland, blending in with the landscape treatment. The current concept includes new outfalls with flap gates (to prevent tidal inundation) occupying the CMA which will require access for periodic maintenance.

As the majority of the Onehunga-Penrose urban catchment is outside of the future State highway corridor, it is intended that Auckland Council will become the future asset owner of a large component of the stormwater system. The final details of the catchment areas to be treated and the treatment standards to be achieved, will be developed in the detailed design phase in close consultation with Auckland Council as future asset owner. The final arrangements will also be subject in some areas to the ability to secure private land outside of the proposed designation area (e.g. at Miami Stream).

6.5.4.4 Drainage and stormwater treatment

The Project will involve new stormwater quality treatment with extended detention and flood attenuation for all the new surfaces and modified existing surfaces. The stormwater treatment includes:

- A new wetland on the north-western side of the interchange adjacent to the end of Hill Street within the proposed new loop on-ramp to SH20 from the Main Alignment and an enlarged wetland on the south-western side of the interchange adjacent to the off-ramp from SH20 onto the Main Alignment;
- Upgrading the existing wetland within Gloucester Reserve South;
- A number of existing outfalls will be retained, along with the existing stormwater management area in the Anns Creek area bounded by the western extent of the rail corridor, and which overlaps with existing ecological areas. The viaducts over the Great South Road intersection will discharge treated stormwater to Anns Creek;
- One new stormwater treatment wetland is located at the end of Hugo Johnston Drive capturing and treating stormwater from the new viaduct west of Great South Road and discharging to existing pipework on the edge of Southdown Reserve;
- Surface water treatment from all road surfaces in proprietary devices where wetlands are not an option, including on the new viaduct structures;
- Installation of new treatment for all existing and modified SH1 surfaces – a significant improvement to the current situation where sections of SH1 are currently untreated. This involves a complex network of underground infrastructure and the use of proprietary devices to provide treatment; and
- Proprietary devices will be installed on SH1 which will treat all stormwater from the Transport Agency's existing and new road surfaces. An existing stormwater wetland at Princes Street Interchange will be expanded.

All outfalls and discharge points for stormwater are shown in indicative locations in *Plan Set 9: Stormwater* in *Volume 2*.

6.5.5 Climate change

For coastal infrastructure, sea level rise is required to be considered over a 100 year period. The Ministry for the Environment publication *"Preparing for coastal change: A guide for local government in New Zealand*" (dated 2009) and the AUP (OP) recommend a sea level rise of 1.0m for infrastructure projects be provided for over a 100 year period. The Transport Agency's *Coastal Effects Assessment Guide* has also been considered for the Project. The Māngere Inlet alignment has been designed to accommodate 1.0m sea level rise and includes a "wave run-up allowance" suitable for the low energy environment (of

0.50m). This means the combined effect is to establish the outer edge of the road alignment at a minimum of 4.5m RL.

6.5.6 Contaminated land and geotechnical consideration

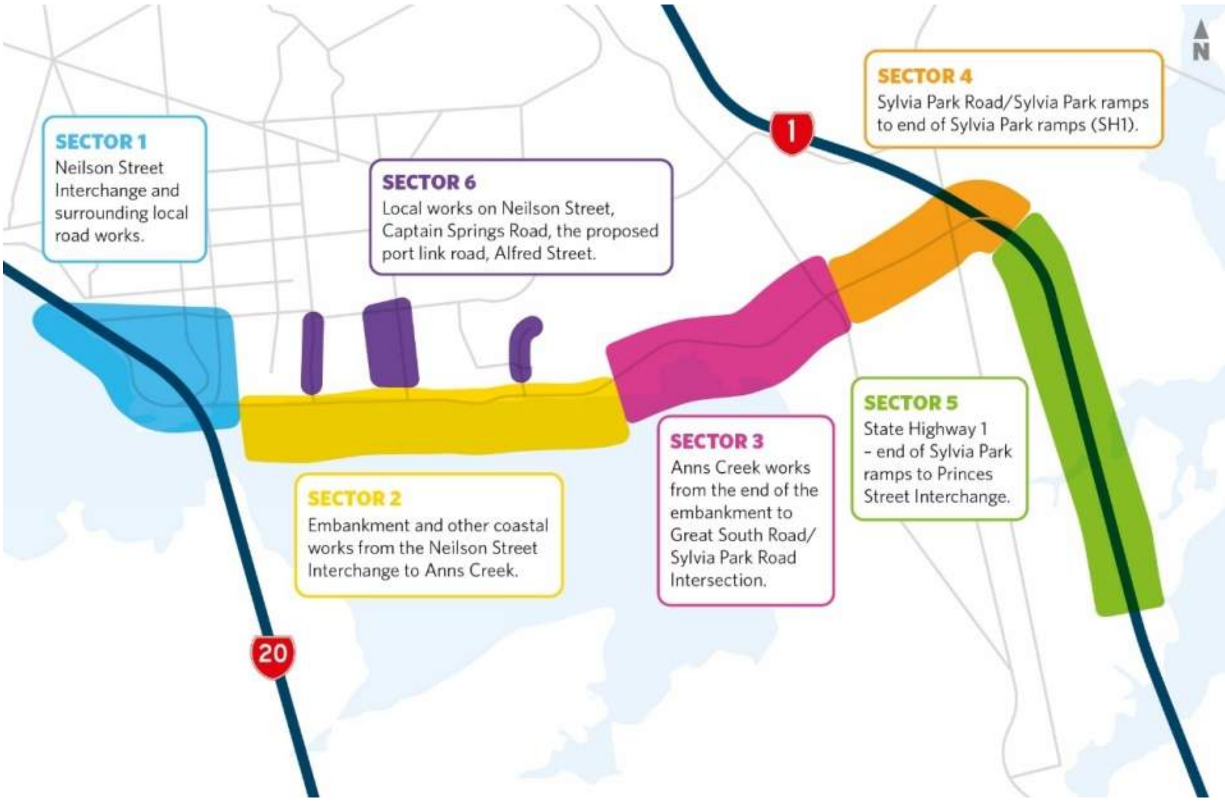
The Main Alignment along the Māngere foreshore and some of the local roads will be constructed over historic landfills. In these areas specific design is proposed in order to limit post construction settlement of the road alignment. This will involve specific design on a case-by-case basis to achieve a firm foundation to build from, and to minimise post-construction settlement. In some locations there are specific design requirements to accommodate the presence of contaminated materials and these are discussed in the sector descriptions below.

Key construction considerations for works in contaminated land are discussed in *Section 7.0*: *Construction of the Project* of this AEE. Key design considerations include the use of piled and reinforced road alignment, even where constructed at current ground level to minimise settlement and potential impact on drainage piped networks.

6.6 Physical description – Project sectors

To assist with an understanding of the proposed works and the potential effects of these works, the alignment has been divided into six sectors as shown on Figure 6-2.

Figure 6-2: Project sectors



Note: *In this section, Sector 6 is described in conjunction with Sector 2 – as it relates to the local roads that provide connectivity to EWL in this location.*

Further detail is contained in *Plan Set 1: General Drawings* in *Volume 2: Drawing Set*. The Project will be in general accordance with these plans. Table 6-2 lists the sectors described in the remainder of this section along with their drawing page references from *Plan Set 1: General Drawings* in *Volume 2: Drawing Set*.

Table 6-4: General Arrangement design drawings for each Sector

Sector	Drawing in Plan Set 1
Sector 1 – Neilson Street Interchange	G-101
Sector 2 – Māngere Inlet	G-102 to 103
Sector 3 – Anns Creek	G-103 to 104
Sector 4 – Sylvia Park Road and Mt Wellington ramps	G-104 to 105 Rev 1
Sector 5 – SH1 widening and Princes Street	G-106
Sector 6 – Local connections	G102 to 103

6.6.1 Sector 1 – Neilson Street Interchange

6.6.1.1 General Description

The Neilson Street Interchange has been designed with a main alignment route around the southern part of the interchange connecting to SH20 to and from EWL and the new Galway Street extension to connect local traffic into the local community and to and from SH20. The interchange provides for the following:

- Additional capacity at the SH20 interchange.
- Separation of local (Onehunga) and industrial/business traffic through this interchange; this includes reducing traffic (especially trucks) in the area between Onehunga Town Centre and the foreshore/New Old Māngere Bridge and Galway Street because the traffic accessing EWL and SH20 will predominantly use the new Galway Street extension instead of the existing Onehunga Harbour Road.
- Reduction of the significant current traffic congestion for buses accessing Onehunga Town Centre via SH20 – the frequent bus service from Māngere to Onehunga will be able to use the Galway Street/Onehunga Harbour Road connection.
- A significant reduction in traffic on Onehunga Harbour Road/Onehunga Mall enabling enhanced pedestrian and cycle facilities to be provided between the Onehunga Wharf and Town Centre.
- Free-flowing connections between EWL and SH20 with a T2 lane giving priority to buses, heavy vehicles and high occupancy vehicles.

Figure 6-3: Sector 1 diagram

6.6.1.2 Local roads

The Project will involve modification to local roads:

- Closing Gloucester Park Road north access onto Neilson Street to allow for the new SH20 access configuration;
- Improving local connectivity from Gloucester Park Road south to Neilson Street with a reconfigured connection;
- The existing Onehunga Harbour Road will be reconfigured with the wharf access local road crossing over the EWL Main Alignment to connect to Orpheus Drive;
- Parking outside The Landing and apartments on Onehunga Harbour Road will be reconfigured and alternative parking provided in areas on Onehunga Harbour Road for the equivalent number of car parks. Other areas currently used for parking for recreation activities (e.g. the informal parking under Manukau Harbour Crossing on Onehunga Harbour Road) will be removed and alternative locations for on-street parking for the recreation will be provided (e.g. at Hugo Johnston Drive);
- Onehunga Harbour Road/Orpheus Drive will include a new shared path to link to the existing pedestrian/cycle way on Orpheus Drive (to Taumanu Reserve); and
- Galway Street will be extended south with a four-lane configuration providing at grade signalised intersection onto the Main Alignment for local connectivity and with cross-connection to Onehunga Harbour Road and Onehunga Mall.

6.6.1.3 Onehunga Wharf connectivity

A new land-bridge will provide access along Onehunga Harbour Road and between Onehunga Harbour Road and the Onehunga Wharf. This has been developed in consultation with Panuku Development Auckland (an Auckland Council Controlled Organisation (CCO) hereafter referred to as Panuku) to integrate with the “Transform Onehunga” strategy for the future of the Port and wider surrounding area.

While the Project provides for construction of a 20m wide bridge (with local road and shared paths), there is provision for the bridge structure of the trench to be up to 50m (approximate) wide/long. The current design provides for local connection along Onehunga Harbour Road to/from Orpheus Drive, while the extended bridging provides an opportunity for future land use integration between 2-6 Onehunga Harbour Road and the Onehunga Wharf development site.

6.6.1.4 Pedestrian, cycleway and shared path

The Project includes new and modified pedestrian and cycle connections at Neilson Street as follows:

- Shared path from the New Old Māngere Bridge connecting with the existing walking and cycling facilities at the Taumanu-Onehunga Foreshore via Onehunga Harbour Road, the Wharf and Orpheus Drive;
- Shared path between the Onehunga Wharf land-bridge and the intersection of Onehunga Mall and Neilson Street. The shared path will pass underneath SH20 and along the western side of Onehunga Harbour Road and Onehunga Mall;
- Footpath on the northern side of the new Galway Link and both sides of Galway Street (between Neilson Street and Galway Link);
- The existing Onehunga Harbour Road pedestrian overbridge will be replaced to go over the EWL and the existing underpass under the SH20 bridge to the cul-de-sac at Onehunga Mall will remain; and
- Commuter cycle path, footpath, and recreation connections on the southern side of the Main Alignment, providing contained public access to and along the CMA through this area.

6.6.1.5 Key bridges and structures

In Sector 1, the Project includes these major bridges and structures:

- A new bridge over the existing SH20 alignment to provide access onto EWL for traffic coming off SH20 at the Neilson Street southbound off-ramp, and for traffic coming from the Main Alignment and Onehunga getting onto SH20 heading southbound;
- The new bridge over SH20 involves construction of retaining wall abutments of some 8-10m in height facing onto Onehunga Harbour Road / Orpheus Drive;
- Local road crossing over the new Main Alignment (with the EWL constructed in a trench) to improve accessibility and connectivity to Onehunga Wharf (described further above); and
- A new replacement pedestrian bridge, crossing over Onehunga Harbour Road and the Main Alignment providing access to the foreshore walkway and the New and Old Māngere Bridges. The foreshore walkway is on structure in part.

6.6.1.6 Acoustic barrier

The Project involves the construction of new noise barriers on one side of SH20 adjacent to residential terrace housing located on Onehunga Harbour Road. The location of the acoustic barriers are shown on the drawings in *Plan Set 3: Road Alignment* in *Volume 2: Drawing Set.*

6.6.1.7 Closed landfills

There are areas of fill that the Project will affect in Sector 1 at Gloucester Park Reserve and Galway Street. The former municipal landfills such as Galway Street and the others described in Sector 2 below are recognised as distinct from the areas of "uncontrolled fill" such as the reclamation within Gloucester Reserve.

There are limited works required that will disturb soils in the filled parts of Gloucester Reserve. These include:

- Widening of SH20 southbound; and
- Realignment of the SH20 northbound off-ramp.

At the Galway Street landfill (partly located in Sector 1), the Main Alignment is located on existing reclamation, and the local road connection will encroach into the landfill footprint. The description for works on this landfill is described below under Sector 2.

6.6.2 Sector 2 – Māngere Inlet and Sector 6 - Local Road Connections

6.6.2.1 Sector 2 – General description

The Māngere Inlet foreshore alignment includes:

- Four lane arterial road constructed on 'land' (partly on existing landfill and partly on an earth and mudcrete embankment) with shoulders and a mixture of commuter cycling path on the south side and shared path along the length;
- The alignment straddles the CMA edge and land to varying degrees along the northern shore of the Māngere Inlet;
- Removal of the existing Auckland Council foreshore amenity strip and Manukau Foreshore Walkway in part;
- A new landscaped foreshore and recreational space comprising three reclaimed headlands, pebble banks, recreational paths and bridged coastal walkways, and incorporating stormwater and leachate treatment wetlands;

- A new cycleway path and overbridge on Alfred Street; and
- Local connections at Captain Springs Road and a new link to Southdown (inland ports and Miami Parade area).

Figure 6-4: Sector 2 diagram

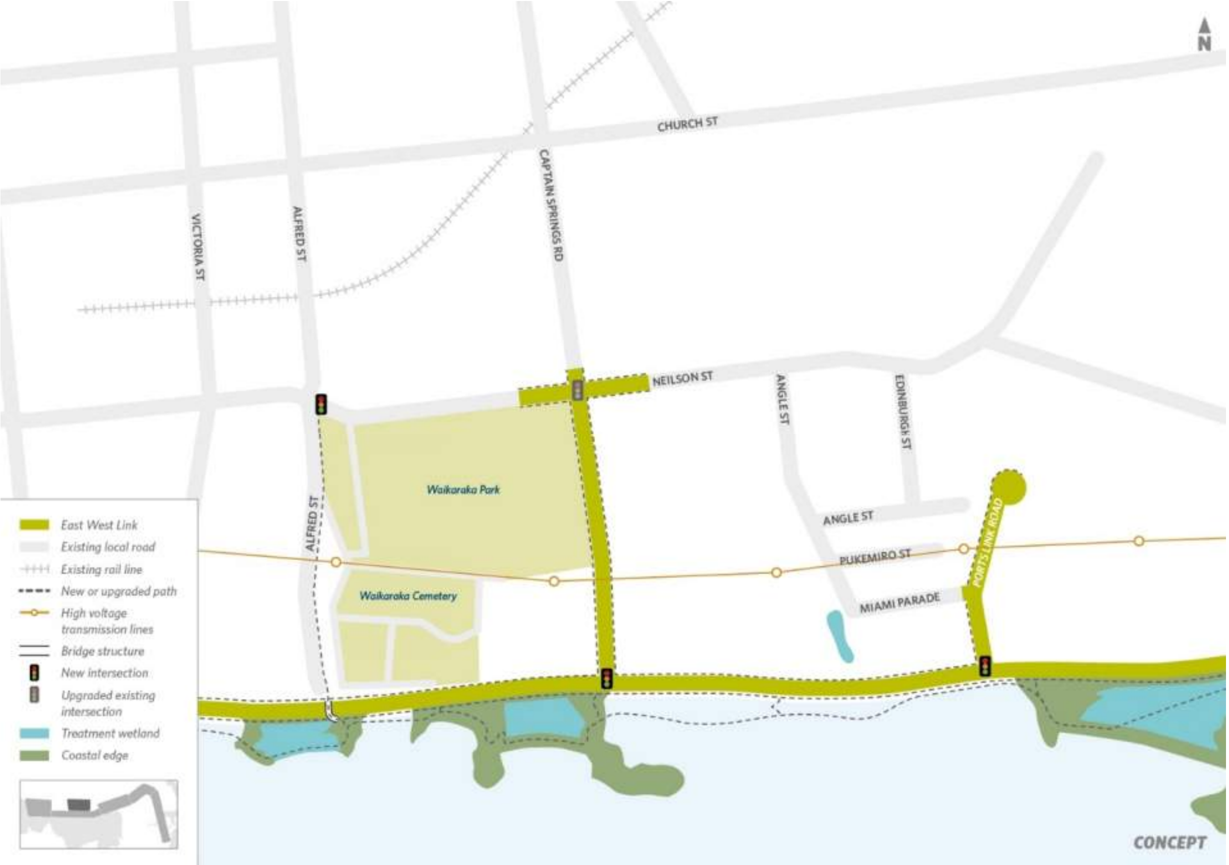
Note: *In this section, Sector 6 is described in conjunction with Sector 2 – as it relates to the local roads that provide connectivity to the Main Alignment in this location.*

6.6.2.2 Sector 6 – General description

The local road connections to the Project alignment on the Māngere Inlet foreshore include:

- An extension to the existing carriageway of Captain Springs Road. Captain Springs Road is currently a two lane local road ending in a cul-de-sac and will be widened to four lanes along its full length south of Neilson Street. This will necessitate the removal of some parking and the implementation of a clearway in morning and evening peak times only;
- Widening the existing intersection of Captain Springs Road and Neilson Street to provide for turning movements for large freight vehicles;
- New shared path on the western side of Captain Springs Road to the entrance of Waikaraka Park. This shared path will connect with the new shared path on the northern side of EWL. A footpath will be provided on the eastern side of Captain Springs Road;
- A new shared path along Alfred Street connecting via an overbridge from EWL to Neilson Street. A signalised crossing will be established on Neilson Street to provide for safe crossing; and
- A new cul-de-sac referred to as port link road connecting from EWL northwards improving access into the inland ports and connecting to Miami Parade.

Figure 6-5: Sector 6 diagram



6.6.2.3 Pedestrian, cycleway and shared path

The Sector 2 and Sector 6 works will provide the following pedestrian, cycleways and shared paths:

- 3m commuter cycle path and 1.8m pedestrian path on southern side of road;
- 3m shared path from Alfred Street to Captain Springs and a 1.8m path from Captain Springs Road to the port link road;
- Recreational shared path along the foreshore comprising a combination of paths and bridged walkways;
- Cycle and walking connectivity into Alfred Street, Captain Springs Road, Waikaraka Park and Cemetery; and
- Signalised pedestrian facilities at Captain Springs Road and the port link road.

6.6.2.4 Landscaping, stormwater treatment, wetlands and amenity areas

The northern shore of Māngere Inlet formerly comprised lava flows and tidal mudflats creating an indented, irregular shoreline. However, the inlets were filled and the northern shoreline is now an artificially straight line bordered by a rip-rap seawall. This infilling comprised a range of fill types, including general municipal waste, which is described further below. The Project alignment is to be constructed on embankment that straddles this shoreline, partly on land and partly in the CMA. It will be approximately 4.5m higher than the adjacent mudflats of the Inlet, designed to accommodate predicted sea level rise.

It is proposed to naturalise the shoreline on the seaward side of the alignment by creating three new headlands, pebble banks and paths to improve the natural character of, and public access to, the Māngere Inlet.

The landscape works will comprise three major landforms to echo the original shoreline, and to be in scale with Māngere Inlet as a whole. The landforms will comprise three main components:

1. Headlands faced in basalt rock designed to replicate “fingers” of lava. These will be built up to a height of approximately RL 6.0m at high points, and will contain a range of coastal vegetation;

2. Pebble and shell banks; and

3. Marshland contained behind the pebble banks and headlands which will able to be used to capture and treat stormwater runoff from the road and inland catchments.

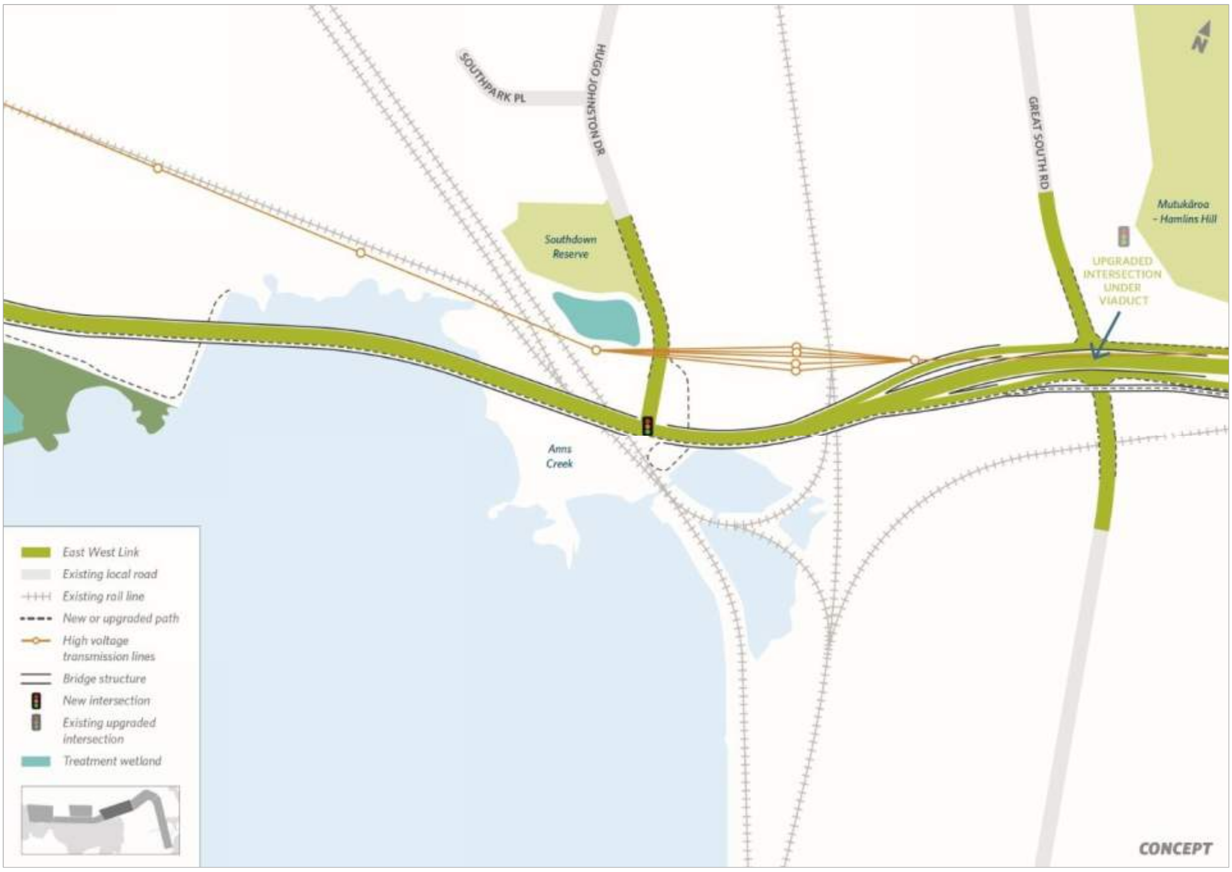
6.6.3 Sector 3 – Anns Creek and Great South Road Intersection

6.6.3.1 General description

In this location the Project comprises:

- Four lane arterial with shoulders and walk/cycle shared path on the south side only;
- Major crossings of the KiwiRail corridor and live commuter and freight rail lines;
- Major crossings of the CMA and Anns Creek on structures;
- Extension of Hugo Johnston Drive to provide a new connection with EWL at the southern end – westbound free flow traffic with signalised right turn (signalised “seagull” intersection);
- Hugo Johnston Drive will remain two lanes, however due to narrow widths at the northern end this will necessitate the removal of some parking at pinch points and the implementation of a clearway in morning and evening peak times only;
- New western approach (seven lanes eastbound, two lanes westbound) connecting EWL into the existing signalised Great South Road / Sylvia Park Road intersection;
- Upgrade of Sylvia Park Road from two lanes to four lanes necessitating the removal of parking on both sides of the road;
- Access to some properties on Sylvia Park Road may require access movements to be via a longer route;
- A grade separated intersection of EWL/Great South Road/Sylvia Park Road, including two lanes for east west traffic with east and west bound connections to Great South Road and Sylvia Park Road;
- Widening on Great South Road to accommodate an upgraded intersection with Sylvia Park Road and EWL;
- All movements on and off the Main Alignment will be provided for with the exception of west bound (right hand turns) from Hugo Johnston Drive onto the EWL;
- Access to Mutukāroa-Hamlins Hill is unchanged; and
- Access to the TR Group Ltd site on Great South Road will accommodate all movements (currently left in left out).

Figure 6-6: Sector 3 diagram



6.6.3.2 Pedestrian, cycleway and shared path

The Project includes:

- Shared path on one side of the Main Alignment linking in to Sylvia Park Road;
- Existing foreshore cycle and walkway remains unchanged, with a short length of shared path on the eastern side of Hugo Johnston Drive. This shared path will connect with the new shared path on the southern side of the EWL;
- A grade separated shared path is provided for the east west movements on the southern side of the Great South Road intersection;
- Shared path on the western side of Great South Road over the extent of works; and
- Commencement of shared path on southern side of Sylvia Park Road.

6.6.3.3 Key structures

- The viaducts over Anns Creek East tie into Great South Road intersection with two west facing connections, providing access onto and off the EWL west of Great South Road;
- Grade separated pedestrian and cycle shared path;
- Embankment at end of Hugo Johnston Drive providing for access onto the Main Alignment;
- The viaduct over Anns Creek East which balances severance of the remnant Anns Creek environment, and encroachment into mapped geological and ecological features;

- A specific pier exclusion area and an area where construction works are excluded. These areas are dictated by:
  - Location of pahoehoe (folded) lava flows and areas of particular ecological significance;
  - Mapped and ground-truthed significant ecological areas – both land and marine;
  - Outstanding natural features – pahoehoe lava flows remnant in and around the Anns Creek area; and
  - Specific rare plant habitat coincident with the lava flows, saline and freshwater sequences and presence of a variety of plant species.

6.6.4 Sector 4 – Sylvia Park Road and Mt Wellington ramps

6.6.4.1 General description

The proposed works at Sylvia Park Road and Mt Wellington Ramps include:

- Upgrading Sylvia Park Road carriageway to two lanes each way;
- One east bound lane accessing the SH1 ramp structure and the other eastbound ramp continuing at grade to Mt Wellington Highway;
- One westbound lane joining Sylvia Park Road from the SH1 northbound off ramp and the other west bound lane allowing traffic from Mt Wellington Highway and Pacific Rise to continue at grade to Great South Road;
- Raised median along Sylvia Park Road means some limitations to private property accesses – a “U” turn facility will be provided at the Pacific Rise / Sylvia Park Road intersection;
- A widened intersection for entering and existing Pacific Rise from Sylvia Park Road westbound;
- New south-facing ramps onto and off SH1 south of the existing Mt Wellington Interchange, providing access for traffic travelling north on SH1 to get onto the Main Alignment, and for traffic travelling east to south on the Main Alignment to get onto SH1 to travel south; and
- Pedestrian and cycle access from EWL into Sylvia Park Town Centre.

Figure 6-7: Sector 4 diagram

6.6.4.2 Pedestrian, cycleway and shared path

Pedestrian and cycle paths continue along the Main Alignment to the Sylvia Park Town Centre.

6.6.4.3 Key structures

The Project requires major ramp structures from the Main Alignment linking to SH1:

- New off-ramp for traffic travelling north on SH1 onto the EWL; and
- New on-ramp for traffic travelling from the EWL onto SH1 to go south.

6.6.4.4 Utilities

The Project will require the relocation of Transpower assets (towers and lines) for the construction and operation of the new ramps in this location. The design of these are under discussion with Transpower (see further discussion in *Section 12.5: Network utilities* in this AEE).

6.6.5 Sector 5 – SH1 widening and Princes Street Interchange

6.6.5.1 General description

Sector 5 of the Project is from the end of the ramps linking from the EWL onto and off SH1 to south of the Princes Street Interchange and involves:

- Adding one lane each side of SH1 from the new on/off ramps in the north to just south of Princes Street Interchange in the south – resulting in a total of four lanes in each direction with shoulders;

- Complete replacement of the Panama Road overbridge to accommodate additional SH1 lanes including a wider bridge to accommodate a shared path on both sides;
- Complete replacement of the existing triple box culverts over Ōtāhuhu Creek with a new wider bridge structure to accommodate additional lanes, plus separate bridge structure with a new pedestrian and cycle connection;
- Complete replacement and reconfiguration of the Princes Street Interchange, including a new wider overbridge accommodating four lanes of traffic and shared paths; and
- Noise barriers for adjacent residential properties along both sides of SH1.

6.6.5.2 Transport function

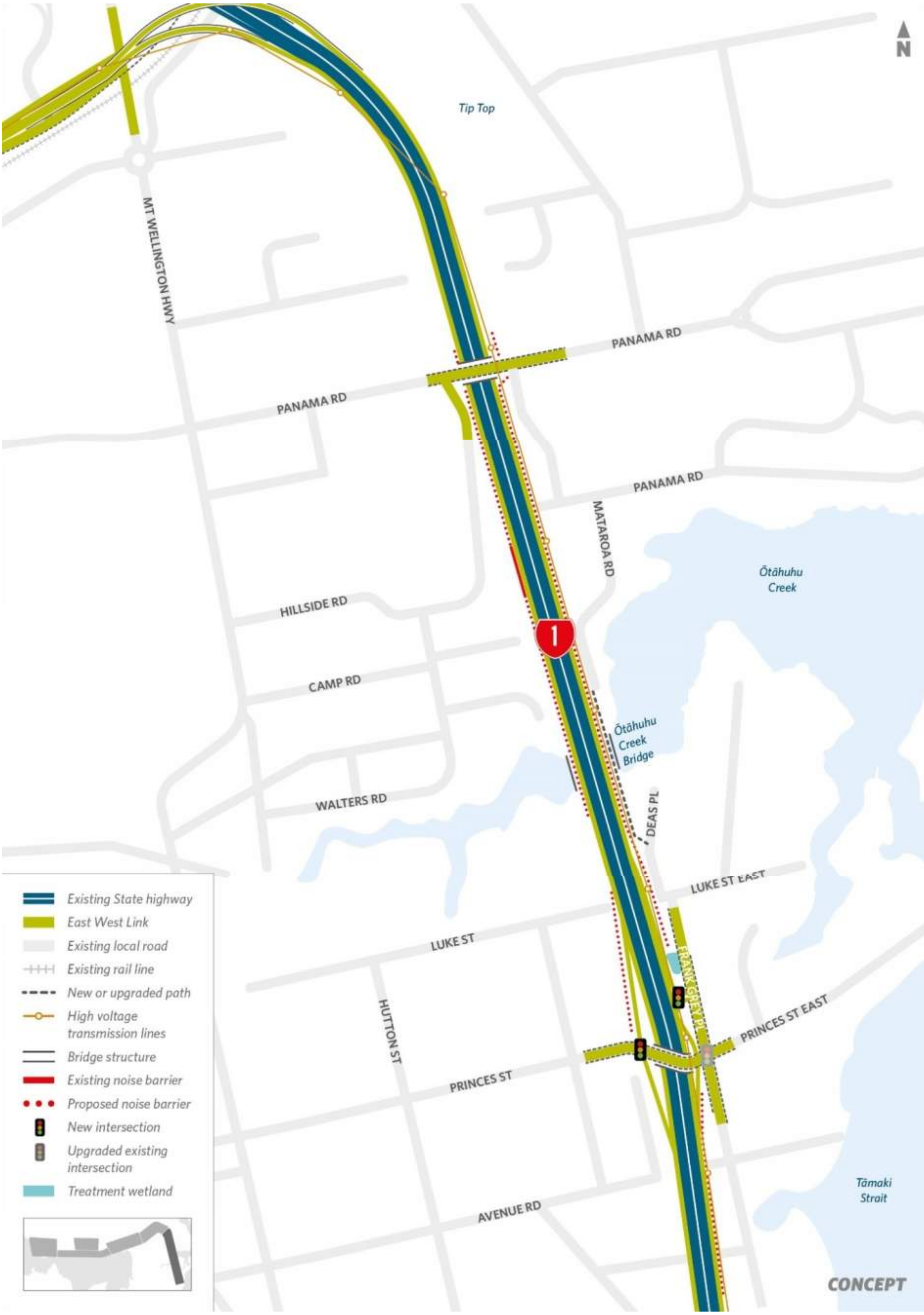
- Additional capacity is included on SH1 between the Mt Wellington Ramps and Princes Street to both accommodate the extra flows and provide consistent four lanes for the section between the Mt Wellington and Highbrook Interchanges;
- Widening Panama Road bridge and improving the vertical geometry provides an opportunity to improve turning movements out of Hillside Road which are currently restricted to turning left out only (onto Panama Road). The new configuration will allow for a new movement for vehicles to turn right into Panama Road, improving vehicle connectivity between communities on the west and east of SH1;
- Upgrade of the Princes Street Interchange includes:
  - Extra capacity and lane arrangement to reduce the effects of existing motorway ramp queuing on the local road network;
  - A reconfigured interchange providing controlled crossing points across SH1 Princes Street off-ramps;
  - Provision of a large refuge for waiting pedestrians across the SH1 Princes Street on-ramps;
  - A more direct and shorter pedestrian route between the two communities on the east and west of SH1; and
  - A shared path on both sides of Princes Street Bridge, certain lengths of Princes Street, Princes Street East and Frank Grey Place.

6.6.5.3 Pedestrian, cycleway and shared path

The Project involves the following:

- Widening the Panama Road overbridge improving pedestrian and cycling access across;
- Construction of an additional bridge over Ōtāhuhu Creek to allow for diversion of motorway traffic whilst constructing the new bridge. Constructing this bridge on the eastern side of SH1 offers the opportunity to retain the structure and use it for permanent pedestrian and cycle access north-south across the Ōtāhuhu Creek linking in to local road carriageways of Deas Place and Mataroa Road;
- Significant improvements for movements through the Princes Street Interchange, including a shared path on both sides of Princes Street Bridge, certain lengths of Princes Street, Princes Street East and Frank Grey Place; and
- A footpath will be along both sides of Frank Grey Place tying into the existing footpath.

Figure 6-8: Sector 5 diagram



6.6.5.4 Key structures

Widening of SH1 by adding more capacity in two additional lanes requires the replacement of the existing overbridges. The key structures (for which a design is provided in *Plan Set 8: Structural* in Volume 2) in Sector 5 include:

- Complete replacement of the existing Panama Road overbridge over SH1 with a new wider structure;
- Replacement of an existing triple box culvert underneath SH1 at Ōtāhuhu Creek. The existing box culvert will be removed and replaced with a new bridge, which will require slight raising of the height of the motorway carriageway either side of the alignment and construction of a traffic diversion during construction, also on a new bridge;
- Retaining the additional bridge used for temporary traffic diversion at Ōtāhuhu Creek and using it for permanent pedestrian and cycle access north-south across the Ōtāhuhu Creek linking in to local road carriageways of Deas Place and Mataroa Road;
- Replacement of the Princes Street Interchange will involve reconfiguration of the interchange:
  - Bringing the southbound on-ramp to the northern side of the interchange requiring local road widening and reconfiguration works on Frank Grey Place;
  - Moving the southbound off-ramp further to the north along Frank Grey Place;
  - Widening the Princes Street overbridge to accommodate four lanes (from the current two), with two each way, with one lane straight through for local traffic travelling east improving accessibility for local traffic. Widened pedestrian and cycleways on both sides of the bridge improves community connectivity for east-west movements across this bridge, linking these communities with schools, shops, sports fields and other amenities; and
  - The new layout is expected to notably improve safety, particularly for pedestrians and cyclists that includes children walking to school who will have a more legible environment that does not require as many unsignalised road crossings and has more clearly marked footpaths.

6.6.5.5 Acoustic barriers

The Project involves the construction of new noise barriers on both sides of SH1 adjacent to residential properties and as determined in *Technical Report 7 - Traffic Noise Assessment* in *Volume 3* using New Zealand Standard 6806:2010 *Acoustics – Road traffic noise – New and altered roads*. Noise barrier height varies depending on the modelled requirements and topography. The recommended barrier heights are shown on the plans contained in the Traffic Noise Assessment and range from 1.1-3.0m. Barriers will be constructed from a material that performs to meet the appropriate acoustic performance requirements. Options that can meet the required standard include a range of concrete or timber products, which will also need to meet durability considerations. The visual appearance of the barriers will also require treatment to meet principles set out in the ULDF and Transport Agency guidelines and provide general visual consistency with other parts of the Transport Agency's network.

6.6.6 Sector 6 – Local roads

Refer Section 6.6.2 above – described with Sector 2.

6.7 Integration with other transport projects

As discussed in *Section 2.0: Background* of this AEE, the Onehunga-Penrose area plays an important role in the growth and spatial planning of Auckland. As a consequence, and given the unique geographic characteristics of the area (being the narrowest part of the city isthmus between the Manukau and Waitematā Harbours), there are a number of other transport projects progressing that either complement or are supported by the Project. These projects are not part of this Project and are not assessed in this AEE. However, they are described below, and illustrated on Figure 6-10, to show how land use and transport integration is being progressed in the area and the contribution that the Project makes to this.

6.7.1 Local improvements – Neilson Street

Auckland Transport and the Transport Agency have jointly progressed local improvement works within the vicinity of the Project. Local road upgrades to meet increasing demands, maintain safety and improve access along Neilson Street are underway including the removal of the road bridge over the existing (disused) rail corridor to reduce the gradient of Neilson Street, and four-laning within the existing carriageway from the rail over bridge through to the Captain Springs Road intersection.

6.7.2 Auckland Manukau Eastern Transport Initiative, Sylvia Park Bus Interchange

AMETI is a multi-modal transport project in the Sylvia Park, Panmure, Pakuranga and Botany area being delivered by Auckland Transport to address existing public transport and vehicle transport capacity constraints on the network. Parts of AMETI have already been completed, such as the new Panmure bus-train interchange.

AMETI provides additional capacity for passenger transport, walking, cycling and private vehicles in order to support expected population growth within the eastern suburbs. AMETI interfaces with the Project at Sylvia Park where a new bus station is proposed adjacent to the Sylvia Park rail station.

A shared path will tie in with the AMETI bus lane works under SH1 and continue to the key destination of Sylvia Park Town Centre. A shared path is proposed on the southern side of the AMETI bus connection before swapping to the northern side to link into the proposed roundabout. It is likely a crossing facility will be provided to allow pedestrians and cyclists to cross the bus connection safely. It is noted that bus volumes along this connection road will not be that frequent and pedestrians and cyclists will be able to cross the road independently. Coordination with Auckland Transport should continue on design and programme details.

The full benefits of the enhanced connectivity to Sylvia Park Mall Shopping Centre are dependent on the AMETI link. A condition is recommended which will ensure the shared path through this area is delivered in conjunction with Auckland Transport and AMETI and the designation extends through to the Sylvia Park Mall Shopping Centre boundary.

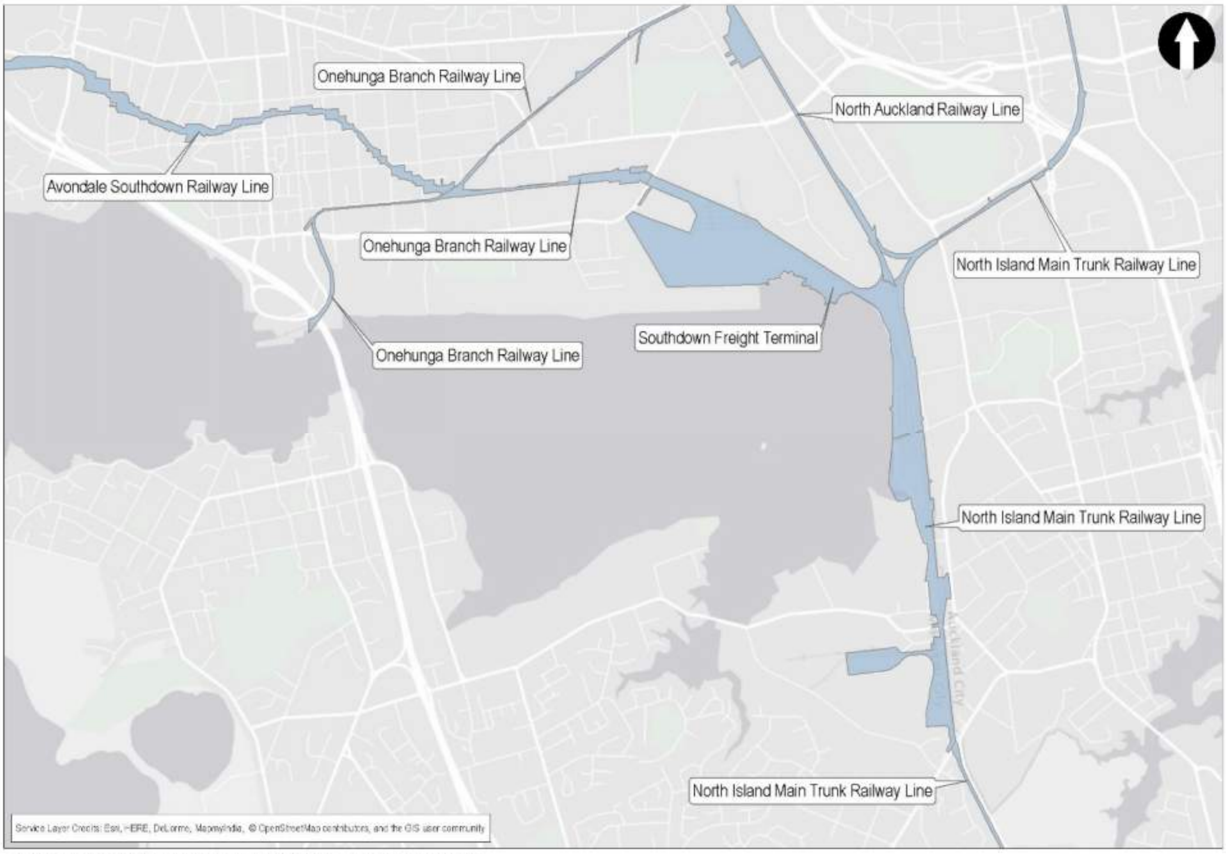
6.7.3 Bus Frequent Network 32

Frequent Network 32 is an Auckland Transport project which seeks to improve bus public transport connection between Māngere Town Centre, Ōtāhuhu and Sylvia Park. It includes walking, cycling and public transport improvements and an upgrade to the Māngere Bus Interchange. It is an important part of the wider programme of transport projects in the area, improving the capacity of the network for pedestrian and public transport modes. In particular, it supports the planned population growth in the area and supports economic activity (focusing on providing access to people between living and working areas of the southern part of the city). The Project integrates with this work, in particular in the design of the cycle and pedestrian connection to Sylvia Park Town Centre and for the local road and bus connections at Mt Wellington.

6.7.4 Future rail development at and around Southdown

As shown on Figure 6-9 designations for rail purposes are held for the rail sidings at Southdown and for the NIMT, and Auckland Eastern Line. In addition, the Onehunga Branch Line connects further to the north of Southdown. Much of the Southdown designation is occupied by the MetroPort operation, part of the Port of Tauranga's Auckland inland port. Ports of Auckland owns land immediately to the south, which may also have the potential to be served by rail in future.

Figure 6-9: Existing KiwiRail designations (shown in blue)



As explained in *Part A: Introduction and Background* of this AEE, the Southdown area is of strategic importance for the rail network, being at a convergence between both freight and commuter rail networks. KiwiRail Holdings Limited as the requiring authority (KiwiRail), continues to hold existing designations in this area. KiwiRail has indicated as part of Project discussions that it intends to carry out a range of future upgrades to the rail network in this area, generally within the scope of these existing designations. These upgrades include:

- Increasing capacity to run both commuter and freight services on the rail network. These services are not always complementary, because commuter services run quicker but stop frequently, whilst freight generally runs continuously and stops infrequently. Establishment of a third rail line in future as well as improving the linkage between the NIMT and eastern lines through grade separation is part of current rail planning; and
- Adding additional capacity to the Southdown rail sidings is also planned in future as part of accommodating the longer trains that are required as a result of the increasing number of larger tankers coming into the Port of Tauranga.

Land use and transport integration, including the integration of transport modes, are key to the EWL Project. As such, the Project has been designed in consultation with KiwiRail to make sure rail overbridges are able to accommodate the planned future rail development in the Southdown area. The location of the designations has also been a key influence in the options assessment process, given the constraints imposed by the presence of the existing designations and future planned development, which have limited inland alignments available. This is discussed further in the in *Part D: Consideration of Alternatives* in this AEE and in *Report 1: Assessment of Alternatives Report* in *Volume 3*.

6.7.5 Mass transit to Auckland Airport

Auckland Transport has been developing a business case considering options for mass transit to Māngere and the airport employment area. Various options and alignments for this connection have been developed by Auckland Transport.

The design of the EWL has provided for Auckland Transport's current preferred alignment and design for future mass transit to the airport. These future plans are indicatively shown on the design drawings for the Project contained in *Volume 2: Drawing Set*. The proposed EWL design for public transport (bus) connection between Galway Street and Onehunga Harbour Road supports a future integrated bus-rail connection at the Onehunga Station (both for the existing Onehunga Branch Line and potentially for any future connection to the airport).

6.7.6 Other State highway projects

6.7.6.1 The Western Ring Route

The Western Ring Route, including the Waterview Connection tunnel project and the SH16 causeway widening, is due to be completed in early 2017. The Waterview Connection project delivers a new connection through Mt Roskill and Mt Albert connecting SH16 to SH20. It provides an alternative south-western route between the south and north of the isthmus (e.g. a route connecting from Manukau in the south to Albany in the north). This route provides improved resilience for transport in the city (e.g. an alternative to SH1 and the Auckland Harbour Bridge) and will both enable greater transport capacity and provide more reliable travel times. With the completion of the Waterview Connection, the Western Ring Route (the route linking Albany and Manukau – SH18, SH16, and SH20) will have increased capacity and as a result there will be increasing traffic volumes on SH20 in the Project area (e.g. between the SH20 Manukau Harbour Crossing and Queenstown Road).

6.7.6.2 EWL SH20 Capacity Improvements: Neilson Street to Queenstown Road

As an early work for the Project, auxiliary lanes are being constructed along SH20 between Queenstown Road and Neilson Street in Onehunga. These works are due for completion in early 2017. The purpose of this work is to:

- Improve traffic flows on SH20 and provide improved capacity to support the completion of the Western Ring Route; and
- To improve network efficiency once the Neilson Street Interchange is delivered as part of the Project.

This work supports the planned opening of the Waterview Connection in early 2017 and is within existing designation. Therefore it has been delivered in advance of the main EWL Project works.

6.7.6.3 SH1 - Southern Corridor

Growth within southern Auckland and surrounding the Auckland International Airport has created a need to increase capacity and upgrade interchanges along SH1. The current Southern Corridor Improvements Project includes work on SH1 from the SH20/SH1 connection at Manukau to Papakura in the south. The Southern Corridor Project includes additional lanes in both directions, an upgraded Takanini Interchange and a 4.5km shared use pedestrian/cycle path from Takanini to Papakura. Construction works for this project commenced in 2016 and are due to be completed by the end of 2018.

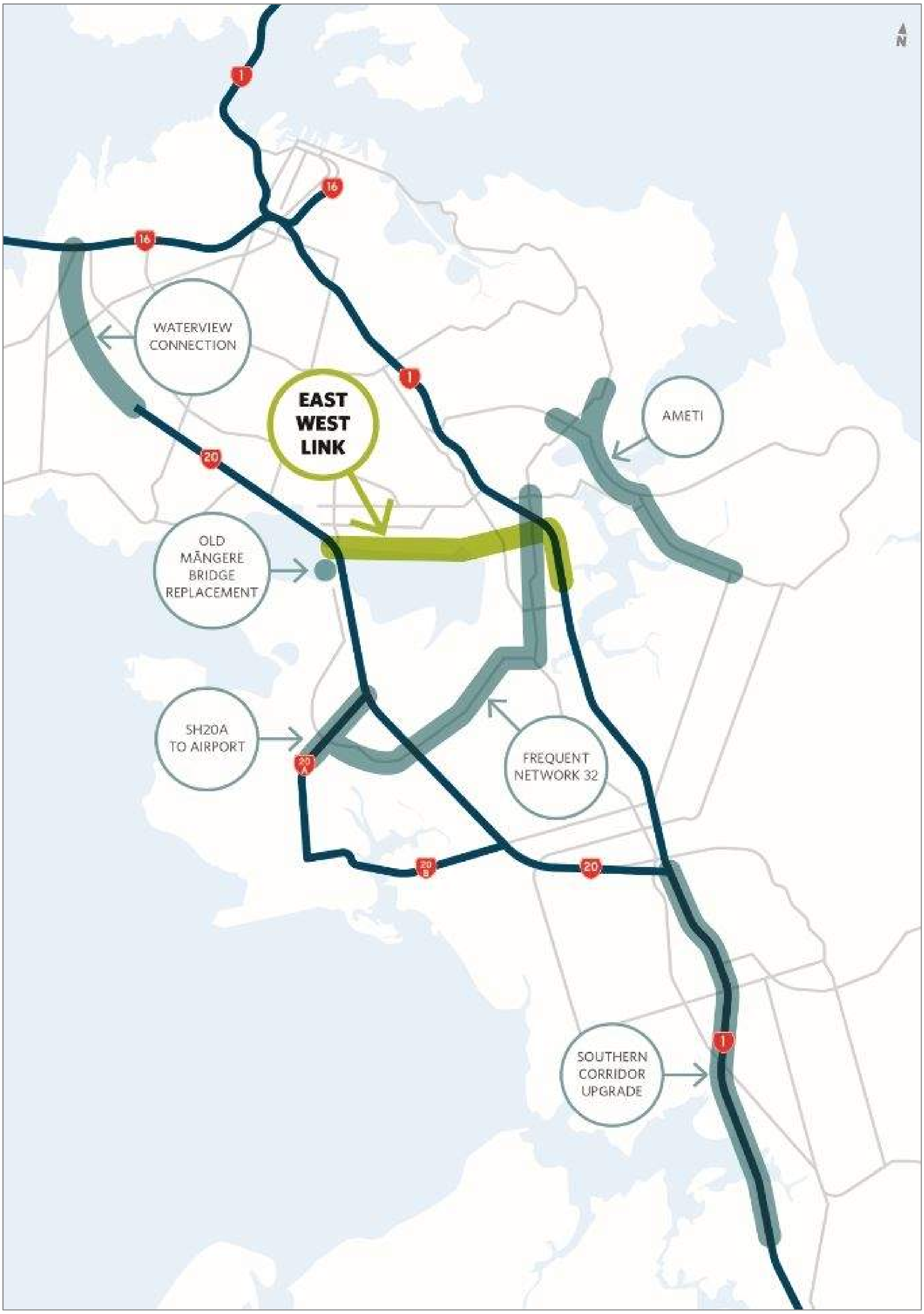
The network capacity improvements (e.g. removal of bottlenecks on SH1), safety improvements (e.g. Takanini Interchange) and provision for pedestrians and cyclists will increase capacity for road users and for pedestrians and cyclists. This project complements the work on the EWL Project, providing for both existing demand and supporting the planned growth in the southern Auckland area.

6.7.6.4 The Old Māngere Bridge replacement

The Transport Agency is planning to replace the Old Māngere Bridge, now used for pedestrian and cycle access. The replacement Old Māngere Bridge will provide continued walking and cycling access between Māngere Bridge Township and Onehunga. It is required to be replaced as the existing structure is aging and in poor condition. The Transport Agency has been granted resource consents for the complete replacement of the bridge with a new structure for recreational use. It is an important component of walking and cycling access between Māngere Bridge township and Onehunga Town Centre.

The Project design is integrated with the proposed New Old Māngere Bridge. The Project will enhance connectivity in and around the Neilson Street Interchange and onto the new network of paths on the northern foreshore of the Māngere Inlet. During construction of the Project, pedestrian and cycle access between Māngere Bridge and Onehunga will be maintained at all times.

Figure 6-10: Interaction of EWL with other transport projects



6.8 Future Ownership, Operations and Maintenance

This section describes the intended ownership of new land to be created by reclamation in CMA, and the intended ownership, operations, and maintenance responsibilities for other assets, including:

- Local roads, pedestrian and cycle facilities;
- Park land and reserves;
- Stormwater assets;
- Dams; and
- Structures in the CMA.

The proposed works will be constructed by the Transport Agency, and the majority of the completed infrastructure and associated assets will be owned, operated and maintained by the Transport Agency. Aspects of the completed works which may be owned, operated or maintained by other parties are summarised below.

The final details of future land and asset ownership, operations and maintenance will be developed in consultation with the relevant parties, and agreements established between the Transport Agency and those other parties.

6.8.1 Reclaimed land

6.8.1.1 Future ownership of new land to be created by reclamation

The ownership of land created by reclamation in the CMA is set out in the Marine and Coastal Area (Takutai Moana) Act 2011 (MACA Act). Ownership of the proposed reclamation will initially vest in the Crown once Auckland Council has approved a plan of survey under section 245 of the RMA[38]. Other provisions of the MACA Act provide for the granting of interests in the reclaimed land, including provision for network utility operators to obtain an interest in reclaimed land.

Future ownership and legal interests in the new land will be determined through the process set out in the MACA Act. This process will include discussions between the Transport Agency and the Crown, Mana Whenua, Auckland Council, Auckland Transport and network utility operators to determine future interests in, and management of, the new land.

6.8.1.2 Future activities, operations and maintenance of assets on proposed new land

The proposed activities to be undertaken on the new land to be created by reclamation in the CMA are described in the early parts of this section. The new “land” includes the proposed stormwater treatment wetlands within the new coastal foreshore area.

The final layout of the proposed reclamation and activities on the new land will be developed in the detailed design phase, and in consultation with Auckland Council, Auckland Transport, Mana Whenua and other key stakeholders.

At this stage, the management responsibilities envisaged are:

- The Transport Agency to own, operate and maintain assets directly associated with the safe and efficient operation of the new State highway;

[38] Section 30 MACA Act.

- Auckland Council to own, operate and maintain assets not primarily associated with the ongoing operation of the State highway – e.g. the stormwater treatment wetlands along the Māngere Inlet foreshore, and other recreation and amenity areas; and
- Auckland Council or Auckland Transport to own, operate and maintain recreational pedestrian and cycle facilities not abutting the State highway.

6.8.2 Connections to local roads, pedestrian and cycle facilities

New road connections are proposed between existing local roads and the new State highway at the southern end of Onehunga Mall, Captain Springs Road, and Hugo Johnston Drive.

The land required for these connections is currently owned by Auckland Council, the Crown, or private landowners. The future ownership of the land will depend on the location, the physical nature of the proposed road (e.g. on land or on bridge structure), and on statutory requirements of the Public Works Act 1981 and Local Government Act 2002.

The Transport Agency will be responsible for the ongoing management, operation and maintenance of the State highway. At this stage, it is envisaged that Auckland Transport will be responsible for the ongoing management, operations and maintenance of the local road connections, and the proposed pedestrian and cycle paths or shared pedestrian and cycle paths associated with and abutting the local road network.

6.8.3 Stormwater asset ownership, operations and maintenance

The proposed stormwater infrastructure to be constructed as part of the Project is described in *Section 6.5.4: Stormwater* of this AEE. In summary, the proposed stormwater infrastructure includes:

- New or upgraded stormwater infrastructure directly associated with the existing and proposed works to SH1 and SH20;
- New stormwater infrastructure directly associated with the EWL main alignment and its connections to SH1 and SH20;
- New stormwater infrastructure associated with the proposed new local road connections and pedestrian and cycle paths; and
- New stormwater infrastructure associated with run-off from existing and future impervious surfaces in the wider Onehunga-Penrose catchment.

At this stage, the management responsibilities envisaged are:

- Transport Agency to own, operate and maintain stormwater assets directly associated with the safe and efficient operation of SH20, SH1 and the EWL main alignment;
- Auckland Council to own, operate and maintain:
    - Stormwater assets not directly associated with the State highways – e.g. stormwater collection and conveyance infrastructure associated with local road connections and the shared pedestrian and cycleway;
    - Stormwater detention and treatment areas and associated structures provided for in the new coastal foreshore area;
    - Stormwater detention and treatment wetland area at Miami Stream; and
    - Stormwater outfalls in the CMA;

The stormwater collection and conveyance infrastructure includes but is not limited to swales, pipes, chambers, risers and outfalls to the CMA.

6.8.4 Structures within the CMA

Permanent structures to be located within the CMA are described earlier in this section and are shown on the drawings in *Plan Set 5: Coastal Occupation* in *Volume 2: Drawing Set*. Permanent structures will include the seawalls of the new road embankment and coastal foreshore, bridge structures, boardwalks and stormwater outfalls.

At this stage, the management responsibilities envisaged are:

- Transport Agency to own, operate and maintain permanent structures in the CMA which are directly associated with the safe and efficient operation and maintenance of the new State highway; and
- Auckland Council to own, operate and maintain assets not directly associated with the State highway.

6.8.5 Potential future transfer of consents in whole or in part

The permanent structures and long term activities described above will be authorised if the consents sought for the Project are granted. As part of the agreements to be developed with other parties regarding asset ownership, operations and maintenance, all or part of some consents may be transferred at a future date from the Transport Agency to another party. In particular, consents authorising land use activities on the new land area, long term stormwater discharges, dams, and structures in the CMA may be transferred in part to Auckland Council for activities intended to be under its control.

Any future consent transfer would be undertaken in accordance with sections 134 – 137 of the RMA. If, and until any transfer occurs, the Transport Agency will be responsible for operations and maintenance of the assets, and for compliance with all consent conditions.

7.0 Construction of the Project

Overview

Indicative information about key construction activities is provided in this section as a basis for the assessment of effects in *Part G: Assessment of Effects on the Environment* of this AEE. It provides a description of the likely scale, duration and type of construction activities that are anticipated, to enable potential effects to be identified and any necessary mitigation measures developed.

The design and construction methods proposed for the Project have incorporated measures to avoid and mitigate effects. These therefore form an inherent part of the Project.

7.1 Introduction

This section provides an outline of the proposed construction of the Project to provide a basis for the assessment of the effects in *Part G: Assessment of Effects on the Environment* of this AEE. It provides a broad overview of the construction methodology across the Project in Section 7.5, and then provides further details of main construction elements that will be undertaken within each of the Sectors. An indicative construction programme for the Project is set out in Section 7.4.

Throughout this section there are cross references to drawings where further information describing construction of the Project is available. In particular the drawings contained in *Volume 2, Plan Set 11: Construction Activities* show the construction footprint, proposed construction yards and other key construction features of the Project.

The information provided in this section is indicative only and is intended to provide sufficient detail of the proposed construction activities to assess their potential effects on the environment and to identify any necessary measures to avoid, remedy or mitigate those effects, where appropriate.

Construction of the Project will be influenced by a number of factors, including:

- The detailed design of the Project which will occur once the designations have been confirmed and resource consents have been granted;
- The construction duration and target completion date;
- The procurement method adopted; and
- Technological advances in construction methods.

Where appropriate, the Transport Agency seeks a degree of flexibility in construction methods to accommodate these factors. Once the contract(s) for the Project have been awarded and a contractor (or contractors) are in place, the construction methodology will be further refined and developed. This will be undertaken within the management plan framework (as set out in Section 7.13) and conditions of the designations and consents which will be in place to manage the effects of the construction activities. Should a contractor wish to undertake construction activities in a manner which is not within the scope of the designations or consents held, appropriate assessment and additional authorisations would need to be obtained at that time.

Management plans form an integral part of the construction methodology for the Project setting out how specific matters will be managed. A suite of management plans is proposed for the Project. These are discussed in *Section 13.1.5: Management plans* of this AEE.

The management plans, Outline Plan(s) required for the designations, and other pre-construction documentation will be submitted to Auckland Council prior to the commencement of construction. The anticipated process for this is discussed further in *Part H: Management of effects on the environment* of this AEE.

7.2 Development of construction methodology

The construction methodology and activities outlined in this section were developed through an iterative process that involved several rounds of multidisciplinary reviews and workshops. The intention was to balance the cost, programme implications and likely adverse effects of various construction options to achieve a methodology that, as far as practical, avoids or where avoidance is not possible, minimises adverse effects. This included consideration of the following:

- The location and extent of construction compounds, laydown areas and construction access tracks. The intent was to minimise disturbance and vegetation clearance in sensitive environmental areas and as far as practicable avoid locating construction activities in or in close proximity to sensitive land uses;
- Various methodologies for coastal works including reclamation, temporary occupation, mudcrete and dredging;
- Construction programme and timing of particular activities to take advantage of seasonal weather conditions or ecological breeding patterns; and
- Transport Agency construction guidelines and standards relevant to the avoidance and minimisation of adverse effects on the environment.

While aiming to avoid adverse effects and taking into consideration social, environmental and cultural constraints, the construction methodology also aims to maximise flexibility in the methodology for any future construction contractor(s). The construction methodology will be further refined and developed during the detailed design phase of the Project and once a contractor is appointed. This will be undertaken with consideration of the designation and resource consents conditions, and balancing cost and programme, environmental and social outcomes.

7.3 Detailed design and construction procurement

The Transport Agency's Highway and *Network Operations Environmental and Social Responsibility Manual* sets a framework for integrating environmental and social commitments into all phases of Transport Agency infrastructure projects. This includes development of detailed design and procurement of construction contractors.

Procurement of the construction contractor will integrate environmental and social commitments into the procurement process. Any Request for Proposal documentation for the Project will capture designation and consent requirements to ensure detailed design meets conditions and commitments are carried from the approvals process, through detailed design and into construction management documentation.

During detailed design, refinement of the construction methodology will further consider the actual and potential impacts to determine if they are consistent with the assessment of effects documented in *Part G: Assessment of Effects on the Environment* of this AEE. The process of finalising the construction methodology will be undertaken in consultation with key parties (e.g. network utility operators for the relocation of their assets). This process is discussed further in *Section 14.2: Introduction to the statutory framework* of this AEE.

The specialist technical investigations that informed this AEE will be utilised to understand the environmental and social constraints and ensure that the final design and construction methodology meets the Transport Agency's legal requirements, environmental commitments and conditions of designations and resource consents.

7.4 Anticipated construction programme

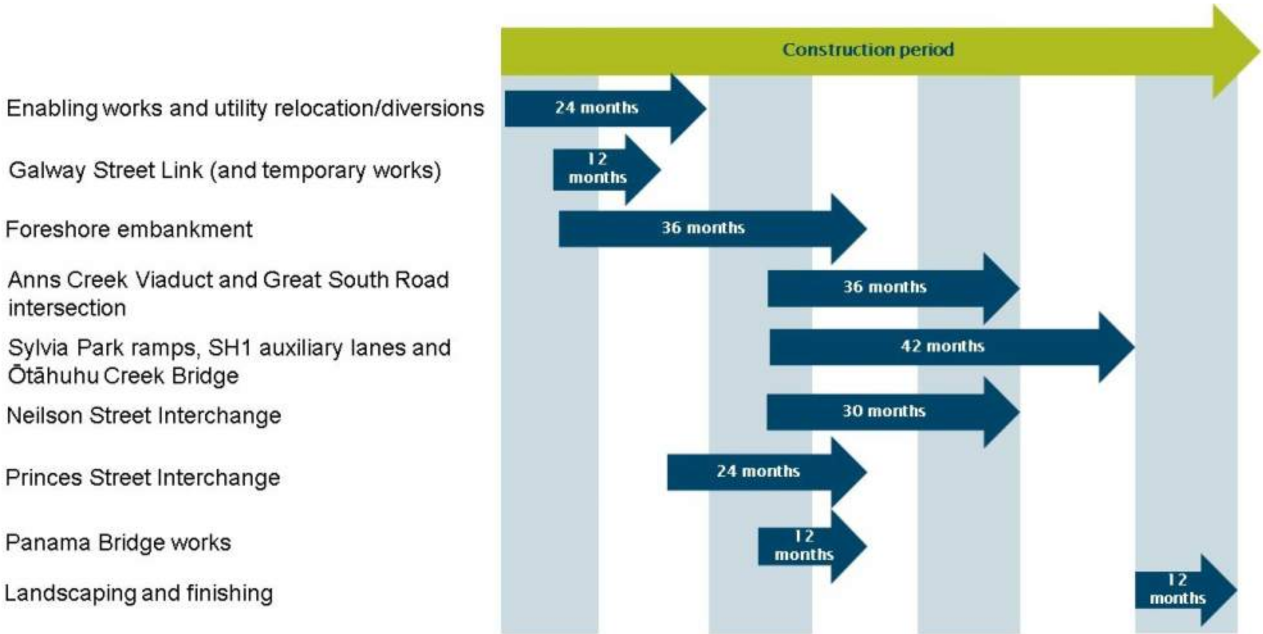
Construction of the Project is expected to be completed by 2025. This date is dependent on funding processes and property acquisition. Many elements of the Project may be undertaken concurrently during the construction period.

The main construction elements for the Project are expected to be:

- Neilson Street Interchange including the Galway Street link (Sector 1);
- Foreshore (road embankment, headlands and stormwater treatment areas)(Sector 2) including Captain Springs Road and the port link road (Sector 6);
- Anns Creek viaducts, Great South Road intersection and Hugo Johnston Drive extension (Sector 3);
- Sylvia Park Road and SH1 ramps (Sector 4);
- SH1 Auxiliary Lanes and Ōtāhuhu Creek Bridge (Sector 5); and
- Panama Road Bridge and Princes Street Interchange (Sector 5).

Figure 7-1 shows the approximate timing of the proposed works and how the different elements may progress within the 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, the availability of contractors and availability of other resources (such as materials and construction equipment). As outlined further in Section 7.5, this timeframe assumes occasional night time works depending on activities required.

Figure 7-1: Indicative construction timing (subject to change with contractor methodology)



7.5 General construction aspects

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

- Enabling works;
- Night time works;
- Protection and/or relocation of existing network utilities;
- Temporary traffic management;
- Construction yards and site compounds;
- Earthworks and vegetation clearance;
- Managing contaminated material; and
- Works in watercourses.

7.5.1 Enabling works

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

- Site investigations including geotechnical, contaminated land and groundwater investigations, and investigations to confirm the location of existing services;
- Building and structure demolition and removal;
- Site establishment activities including site access points, construction yards, fencing etc.; and
- Protection and/or relocation of existing network utilities (as discussed in Section 7.5.3).

7.5.2 Night time works

In order to minimise disruption to traffic, tie in with tidal cycles and network outages, some works will be undertaken on SH20, SH1 and in other locations at night. This may include (amongst others) the following major construction activities:

- Neilson Street overbridge construction (Sector 1);
- Neilson Street Interchange on/off-ramps (localised sections only, where offline works need to tie in with the existing SH20) (Sector 1);
- Placement of bridge beams at the Great South Road intersection;
- Erection of structures at Sylvia Park Road over the live motorway (Sector 4);
- Some aspects of the widening works on SH1 between the Sylvia Park Road ramps and Princes Street Interchange adjacent to the live motorway (Sectors 4 and 5);
- Sylvia Park Road ramps tie in with the existing SH1 (Sector 5);
- Demolition and removal of the Panama Road overbridge (Sector 5);
- Installation of bridge beams over the SH1 at Panama Road, (Sector 5);
- Demolition and removal of the Princes Street overbridge (Sector 5);
- Installation of bridge beams over the SH1 at Princes Street (Sector 5);
- Princes Street Interchange on/off-ramps to tie in with the existing SH1) (Sector 5); and
- General traffic management set up and changes and removal throughout the life of the contract (all sectors).

7.5.3 Protection and/or relocation of existing network utilities

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

The key services within the Project area include:

- High voltage transmission lines (Section 7.5.3.1);
- High pressure gas transmission pipelines (Section 7.5.3.2);
- Bulk water supply and wastewater infrastructure (Section 7.5.3.3);
- Fibre optic communication cables and telephone lines (Section 7.5.3.4); and
- Electricity and gas distribution (Section 7.5.3.5).

Discussions have been undertaken with network utility operators and agreements are being developed with each operator regarding their assets. Services will be 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. *Section 12.5: Network Utilities* of this AEE sets out the assessment of effects of the Project on these network utilities.

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.

The Project also crosses a number of operational rail lines. Preliminary discussions have been held with KiwiRail regarding the construction activities that have the potential to affect rail operations. Some construction activities will be timed to occur during periods of scheduled line closure. All construction activities on or over the rail corridors will be co-ordinated with KiwiRail.

7.5.3.1 High voltage transmission lines (including towers)

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

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 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 either relocate existing towers or increase the clearance under lines by raising the height of the transmission towers. Details of the anticipated works to specific towers are provided in *Section 12.5: Network Utilities* of this AEE.

The Transport Agency is in discussion with Transpower regarding the specific design and proposed construction timing for relocation/modification of transmission assets.

7.5.3.2 High pressure gas pipelines

The Westfield-Hillsborough high pressure gas pipeline is located within the Project area, between the Neilson Street Interchange in the west, along the edge of the Māngere Inlet and Anns Creek and the northern side of Sylvia Park Road. The proposed road embankment (Sectors 1 and 2) and viaducts (Sector 3) conflict with the pipeline in some locations and as a result, a new pipeline will need to be constructed at various locations. Along the foreshore, the pipeline will be constructed to lie immediately to the north of the embankment within a services trench and through other areas it will be constructed clear of the alignment. Where the new pipeline relocation is located clear of the road alignment, this can be undertaken prior to main construction works on the Project.

Along the foreshore section, the new pipeline can be constructed concurrently with the construction of the road embankment. It is estimated that the pipeline construction will be undertaken in three to four stages to enable construction of the new pipeline within the embankment whilst maintaining operation of the existing pipeline during this time. This will be managed to meet the requirements for permanent and temporary construction loading required by First Gas under an operational asset. The proposed alignment for the replacement gas pipeline is shown on the design drawings in *Plan Set 12: Utilities Relocation*.

The Transport Agency is in discussion with First Gas regarding the specific design and construction methodology for the gas pipeline relocation.

7.5.3.3 Water Infrastructure

The Hunua 4 bulk watermain crosses the Project in Sector 1. Due to the depth of the pipeline, no impact is anticipated on this asset. Therefore, no specific works are required to protect or divert the watermain during construction of the Project.

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 Transport Agency is in discussions with Watercare regarding the relocation of water and wastewater assets.

7.5.3.4 Fibre optic communication cables

The Project conflicts with a number of below ground telecommunication cables and these will require relocation during construction. 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.

The Transport Agency is in discussion with Chorus, Vodafone, Vector Communications and FX Networks regarding the specific design and relocation of assets.

7.5.3.5 Electricity and gas distribution

Most of the local reticulation network in the Project area is underground with the exception of overhead infrastructure near Onehunga Harbour Road. Relocation of existing lines may be required to avoid or manage conflict. Where required, the lines will be undergrounded into a common services trench out of the direct earthworks/carriageway construction zones.

There are a number of low to medium pressure gas mains 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.

The Transport Agency is in discussion with First Gas regarding the specific design and relocation of assets.

7.5.3.6 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 a number of existing Auckland Council stormwater outfalls along the edge of the Māngere Inlet which will be retained, diverted or upgraded as part of the Project.

The Transport Agency is in discussion with Auckland Council regarding the design of proposed new stormwater assets, including assets to service parts of the Onehunga-Penrose Catchment and the impact of the Project works on the existing stormwater drainage assets. Auckland Council will be involved in the detailed design of these assets.

7.5.4 Temporary traffic management

Construction of the Project will require temporary traffic management. This may include:

- Footpath closures / detours;
- Pedestrian crossing closures;
- Cycle lane closures / path closures/ detours;
- Property access closures;
- Shoulder and lane closures;
- Road closures / detours;
- Site access arrangements; and
- Temporary speed limits.

The proposed temporary traffic management measures are discussed in *Section 12.13: Construction traffic* and detailed in *Technical Report 10: Construction Traffic Impact Assessment* in *Volume 3*.

7.5.5 Construction yards and site compounds

Fourteen areas within the Project footprint have been identified as construction yards/laydown areas for construction of the Project. These areas are shown on *Plan Set 11: Construction Activities*. The construction yards/laydown areas have been selected because of their proximity to key construction elements (as set out in Sections 7.6 to 7.12 below).

A description of the construction yards/laydown areas is set out in Table 7-1 below.

Seven main construction yards are proposed with seven supporting laydown areas. The final construction yard locations and activities may change depending on the final construction methodology and will be confirmed once a contractor(s) has been confirmed.

The construction yards/laydown areas may contain the following (or similar) activities commonly associated with construction:

- Temporary site buildings;
- Material laydown areas including stockpiling of material;
- Workers' office and workshop;
- Plant and equipment maintenance facilities;
- Fuel storage and refuelling facilities;
- Wheel washing and cleaning facilities;
- Lighting;
- Vehicle parking; and
- Plant and equipment storage areas.

The seven main yards will include the activities set out above as well as yard specific activities (e.g. the mudcrete operation and concrete batching at Yard 4 – Waikaraka Park). In addition to these specific yards and laydown areas, typical construction activities (such as stockpile, laydown and assembly areas, plant and equipment storage) will occur throughout the construction footprint.

As night time works are required on occasions across all the Sectors, the yards/laydown areas will operate both during the day and at some times during the night depending on activities required (e.g. night time motorway lane closures for bridge beam lifts).

Site establishment activities for the construction yards/laydown 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 yards will be disestablished.

The main construction yards 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 on completion of construction.

The final location of construction yards and the activities undertaken within each yard will be confirmed as part of the preparation of the Construction Environmental Management Plan (CEMP). Further discussion of the CEMP is contained in *Section 13.1.5:* Management plans and other information.

Table 7-1: Construction yards/laydown areas

Yard	Location	Yard specific activities	Approx. commencement date	Approx. duration of use	Plan Set 11 ref
Yard 1	Neilson Street	Laydown area for the construction of Neilson St Interchange.	Mid 2021	18 months	CA-101
Yard 2	Onehunga Wharf	The **main yard** for construction activities associated with the Neilson Street Interchange. Access will be from Onehunga Harbour Road. Supported with an additional construction laydown area at Neilson Street.	Mid 2021	18 months	CA-102
Yard 3	Waikaraka Reserve (South)	The **main yard** for construction activities associated with the new road embankment. Will contain the activities associated with the mudcrete operation including a pugmill, cement storage and mudcrete transport (including conveyors or similar).	Late 2018	42 months	CA-104
Yard 4	141 Hugo Johnston Drive	The **main yard** for construction of the Anns Creek viaducts. Access from Hugo Johnston Drive.	Late 2020	42 months	CA-107
Yard 5	Great South Road	Supporting laydown area for the construction of the Anns Creek viaducts and Great South Road intersection.	Late 2020	30 months	CA-108 Rev 1
Yard 6	Sylvia Park Road	The **main yard** for the construction activities to the east of Hugo Johnston Drive. Access provided from Sylvia Park Road.	Mid 2021	30 months	CA-109 Rev 1
Yard 7	430 Mt Wellington Highway	The **main yard** for the construction activities for the on/off-ramp construction and motorway widening. Access provided from Mt Wellington Highway.	Mid 2021	42 months	CA-109
Yard 8	103 Carbine Road	Laydown area and access for the construction of the SH1 ramps. Provides access to the eastern side of the works.	Mid 2021	42 months	CA-110
Yard 9	Hillside Road	Laydown area for the construction of the Panama Road bridges.	Mid 2021	18 months	CA-111
Yard 10	61 Mataroa Road	Laydown area for the construction of the Ōtāhuhu Creek bridges.	Mid 2021	24 months	CA-112
Yard 11	12 and 14 Deas Place	Laydown area for the construction of the Ōtāhuhu Creek bridges.	Mid 2021	24 months	CA-113
Yard 12	89 Luke Street	The **main yard** for the construction activities for the on/off-ramp construction and motorway widening.	Mid 2020	24 months	CA-113
Yard 13	Todd Place	A supporting laydown area for construction of the Princes Street Interchange.	Mid 2020	24 months	CA-113

Yard	Location	Yard specific activities	Approx. commencement date	Approx. duration of use	Plan Set 11 ref
Yard 14	Frank Grey Place	The **main yard** for the construction of the Princes Street Interchange. This yard will be used in conjunction with Yard 15 depending on the staging of the works.	Mid 2020	24 months	CA-114

7.5.6 Earthworks and vegetation clearance

Construction of the Project will involve vegetation (both terrestrial and marine) removal and earthworks within the construction footprint. The Project construction footprint consists of approximately:

- 15.5ha of land based works; and
- 25ha of coastal works

For the purposes of this assessment, it has been assumed that any existing vegetation located within the Project footprint will be removed where required to facilitate construction. The exceptions are where there are amenity trees that can be retained (see Section 12.9), and the pier and construction exclusion areas within the Anns Creek Estuary and Anns Creek East (see Section 12.20).

Table 7-2 sets out the approximate total cut and fill quantities anticipated for the Project.

Table 7-2: Total cut and fill quantities for the Project

Cut and fill	Quantity (approx.)
Imported fill	850,000 m^3
Reused marine sediments from within embankment footprint	450,000 m^3
Dredged marine sediment for use as mudcrete	300,000 m^3
Cut to waste	200,000 m^3

The use of marine sediment to produce mudcrete is detailed in Section 7.7.1.

Fill material required for the Project will be sourced from quarries with suitable material. Concrete and steel 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 culverts, bridge beams etc), surfacing materials (including bitumen) and street furniture.

Erosion and sediment control measures will be implemented for the Project. The Erosion and Sediment Control measures are discussed in further detail in *Section 12.15: Erosion and Sediment Control* of this AEE 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; and
- Sediment control devices including sediment retention ponds, decanting earth bunds (where there is insufficient space to use ponds), sediment fences and silt socks.

The drawings contained in *Plan Set 10: Erosion and Sediment Control* show how erosion and sediment control could be delivered for the Project.

7.5.7 Managing contaminated material

There are numerous 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 *Section 12.18: Contaminated land* of this AEE. These are likely to include specific measures to cover:

- 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;
- Exposure of construction worker and the public to landfill gas;
- Potential human health risks for the construction work force; and
- Discharge of leachate from the Pikes Point Landfill leachate interception system and potentially contaminated groundwater elsewhere along the alignment.

Where excavations are to be undertaken in contaminated material, containment measures will be put in place which will include diversion of surface water and groundwater from excavation and pumping of contaminated water to the trade waste system. Contaminated material will be removed from site to approved disposal sites.

7.5.8 Works in watercourses (including associated diversions)

The Project will involve the placement of culverts and permanent diversions of streams as follows:

- A tidal section of Hill Stream will be realigned for construction of the Neilson Street Interchange and new stormwater treatment wetland;
- Miami Stream will be realigned at the lower end to allow the construction of a wetland and biofiltration area before it enters the Māngere Inlet;
- A section of Southdown Stream will be culverted to provide an extension of the existing culvert under Hugo Johnston Drive;
- A section of the existing Anns Creek culvert will be extended to allow for filling of the land directly west of Great South Road; and
- Clemow Stream will require realigning and culverting to allow the new off-ramp to Sylvia Park Road to be constructed. This will involve sections of the stream being culverted to divert it around new bridge piers.

For the permanent diversions, new channels will replicate the form and morphology of existing natural channels where ever practicable. The following factors will be considered when forming new channels:

- The composition of the stream bed (material type and particle size);
- The hydraulic characteristics of the channel (including its gradient and flow capacity);
- Whether fish passage needs to be provided; and
- The existing riparian vegetation and any proposed new riparian planting to be provided.

The installation of culverts and associated erosion control and protection structures will require the temporary diversion of streams in most instances. Diversion channels will be stabilised using geotextile liner prior to water being diverted. Water will be discharged back into the natural channel downstream of the works.

Culverts and erosion control and protection structures will then be installed in the dry stream bed as quickly as possible. Temporary erosion and sediment control methods (as detailed in *Section 12.15: Erosion and sediment control* of this AEE) will be used around the works to limit sediment runoff into the stream. Once all the in-channel works have been completed water will be diverted back to the final channel.

The area used for temporary diversions will be stabilised following works.

7.6 Neilson Street Interchange (Sector 1)

Construction of the Neilson Street Interchange involves the connection between the Project and SH20, and the Onehunga area via Neilson Street and Galway Street. Retaining walls are required on either side of the new SH20 overbridge, along Orpheus Drive near the CMA, and on the Neilson Street off and on-ramps to SH20. The alignment is located close to existing transmission towers which may need to be raised to achieve the required clearance for construction.

The key construction features for the Interchange are:

- New interchange bridge over SH20 and associated on/off-ramps;
- The widening of SH20;
- A new trenched section of EWL (including stormwater detention tank and pumping infrastructure) with a local road over the trench;
- New pedestrian bridge over the EWL to align with New Old Māngere Bridge;
- Link Road between Galway Street extension and Onehunga Mall/Onehunga Harbour Road; and
- A new at grade intersection at Galway Street.

These key features are shown on the design drawings in *Plan Set 11: Construction Activities.*

The general sequencing of the work may be as follows:

- Local road diversions (e.g. temporary Galway Street link and signalising the intersection with Neilson Street);
- Relocate the gas main and other utilities;
- Construction of temporary pavement for traffic diversions for construction of the new ramps on the northern side of the interchange;
- Constructing the Neilson Street southbound off-ramp;
- Construction of northbound on-ramp;
- Construction of the SH20 overbridge and embankments;
- Construction of the new pedestrian bridge over EWL;
- Construction of temporary pavement for traffic diversions for construction of the trench;
- Construct the Project connection;
- Construction of local road bridge to Onehunga Wharf; and
- Construction of Galway Street connections.

Orpheus Drive will be temporarily closed at the southern end to allow construction of the northbound on-ramp. Access to the port and properties on the northern side of Onehunga Harbour Drive, e.g. The Landing will be maintained during construction.

Earthworks will be required adjacent to the shoulder of the widened SH20 and associated ramp connections for the Neilson Street Interchange. The earthworks will involve fill for the SH20 overbridge and cuts required for new SH20 ramps. Earthworks are largely expected to balance within the sector with additional engineered fill required for construction of the bridge embankment approaches.

Existing vegetation within the footprint of the works will be cleared to enable construction of the Interchange. Some of the pōhutukawa trees located immediately south of SH20 between the northbound off-ramp and Orpheus Drive will need to be removed as part of the works.

7.6.1 Bridges and other structures

The SH20 overbridge will be constructed from precast concrete Super Tee girders with spans of up to approximately 28m, and supported on in situ concrete piers with circular columns. The piers and one abutment will be carried by reinforced concrete bored piles, approximately 900 mm in diameter.

Bridge construction will involve:

- Temporary traffic management including changes to existing median and adjacent lanes, temporary realignment of motorway lanes, with safe entry and exit points onto the motorway for construction traffic;
- Bored piles at each pier position with access to each pier position by the piling rig, and then cranes to lower the reinforcing cage;
- Concrete pile caps, followed by columns and the pier capping beam constructed at each of the piers and the abutment; and
- Bridge beams crane erected one span at a time. This requires access to each span by the vehicles carrying the girders and the erection cranes and late night closure of the motorway in one direction at a time will be required.

Construction of the bridge spans adjacent to the Transpower tower requires working under and adjacent to the overhead lines. This will require restrictions on crane movements and will require raising the line height. One of the piers is directly under the lines and the use of a low height piling rig may need to be investigated to reduce the extent of overhead line raising required.

The construction of the trench at Onehunga Harbour Road will commence with the construction of a temporary road to divert the existing Onehunga Harbour Road north of the proposed trench walls. This will be followed by construction of the northern and southern trench walls. These walls consist of 750mm diameter concrete piles know as a secant pile wall. From this point, the trench will be excavated to the underside of the base slab. When the underside of the base slab is reached, the base slab, sump slab and walls can be constructed and temporary props reused in other locations.

As space is constrained around the Neilson Street Interchange retaining walls are proposed. These generally fall into two categories:

- Mechanically stabilised earth walls (MSE) for approach embankments to the Neilson Street Interchange and other fill locations, e.g. at the Galway Street connections. There are 21 retaining walls that are over 3 m in height; and
- L shaped walls, these tend to be smaller walls and can be used in cut situations as well.

7.7 Foreshore (Sector 2) including local roads connections (Sector 6)

Construction of the new road embankment, headland, stormwater treatment areas and the local road connections will involve:

- An embankment along the foreshore on both existing land and new coastal reclamation;
- Landscape features within new coastal reclamation;
- Stormwater treatment systems within the new landscape features;
- Local road and other road connections at Galway Street, Captain Springs Road and the port link road; and

- A pedestrian cycle connection at Alfred Street.

The key construction features are shown on the design drawings in *Plan Set 11: Construction Activities.*

The general sequencing of the work may be as follows:

- Access from Galway Street and Captain Springs Road and establishing the main construction yard at Waikaraka Park;
- Enabling works including vegetation clearance (predominantly mangroves) and construction of the cut off trench and new gas pipeline on the northern side of proposed road;
- Dredge a channel between the construction yard and the dredging location in the Inlet to provide all tide access to the mudcrete production area;
- Construct the outer edge of the embankment/landscape features from Neilson Street to Captain Springs Road. This area will provide an enclosed construction environment for the embankment and the bund. This bund will be constructed from mudcrete within the Project footprint;
- A barge will be setup on the other side of the embankment in a sub tidal environment. This barge will collect (dredge) mud from the Inlet to use as mudcrete on site. The mudcrete will be made onsite and placed along the embankment and containment bund;
- Where works are over existing landfill, excavation of contaminated material will be required and the material disposed of at approved sites. Raft type construction (where the road sits on top of the landfill) is proposed in these areas with the "raft" supported on steel 'I' beams piles to minimise settlement; and
- The road formation can then be constructed using mudcrete on the coastal side of the embankment and imported fill.

The section below discusses the anticipated construction methodology for the reclamation works in more detail.

7.7.1 Reclamation works

The foreshore embankment will require reclamation along a 2900 metre length of the Māngere Inlet between the Neilson Street Interchange and the eastern end of the reclaimed embankment. The proposed reclamation will require a large quantity of bulk fill material (approximately 800,000m^3).

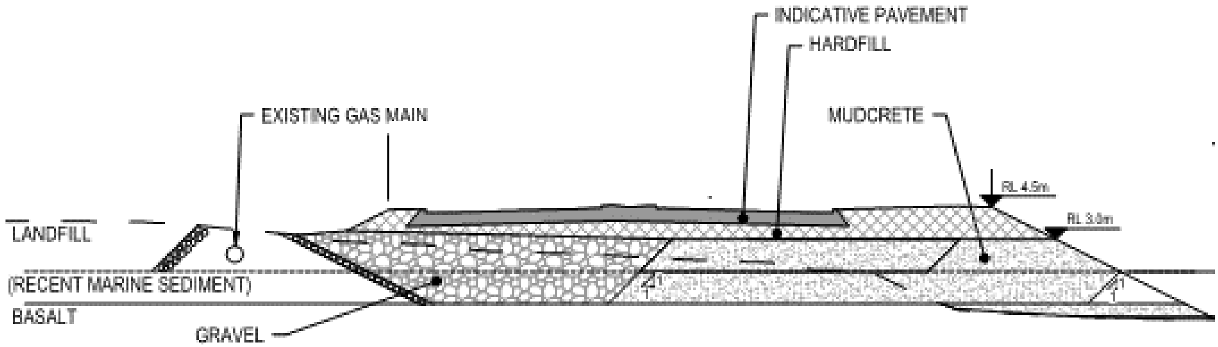
The reclamation works will be constructed using;

- Stabilised marine sediments – mudcrete;
- Bulk fill – material used to raise the embankment to the proposed design level;
- Rock armour – used to combat wave attack/erosion; and
- Pavement material – for the pavement layers.

Rock rip-rap from the current shoreline will be recovered and reused where possible on the outer face and will be supplemented by imported rip-rap material. The fill requirements take into account additional considerations such as natural coastal erosion, stability of underlying sediments and settlement.

While the embankment design differs along the length of the foreshore, Figure 7-2 shows a typical indicative cross-section for the section between Galway Street and Waikaraka Cemetery where the embankment is located partially on land and partially within the CMA. This shows the likely mix of materials required for the road embankment. More detailed cross-sections of the embankment and landscape features can be found on design drawings 321-324 in *Plan Set 7: Typical Cross-Sections*.

Figure 7-2: Indicative embankment configuration for Galway Street to Waikaraka Cemetery

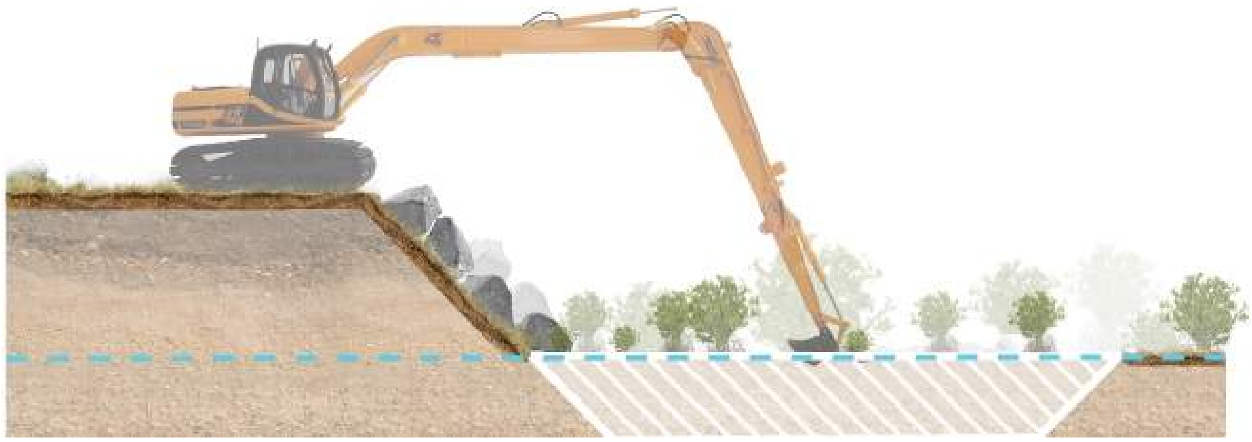


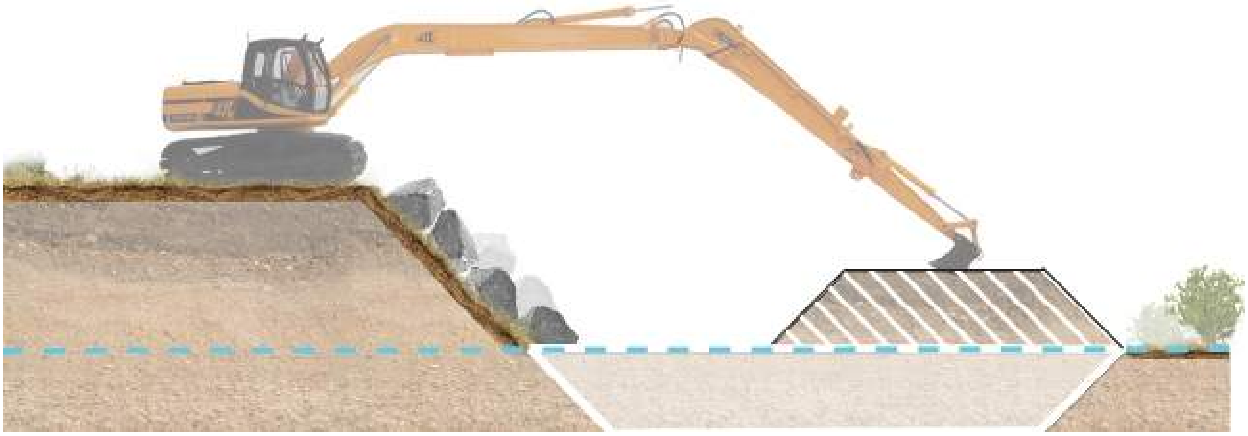
**Not to scale; dimensions approximate*

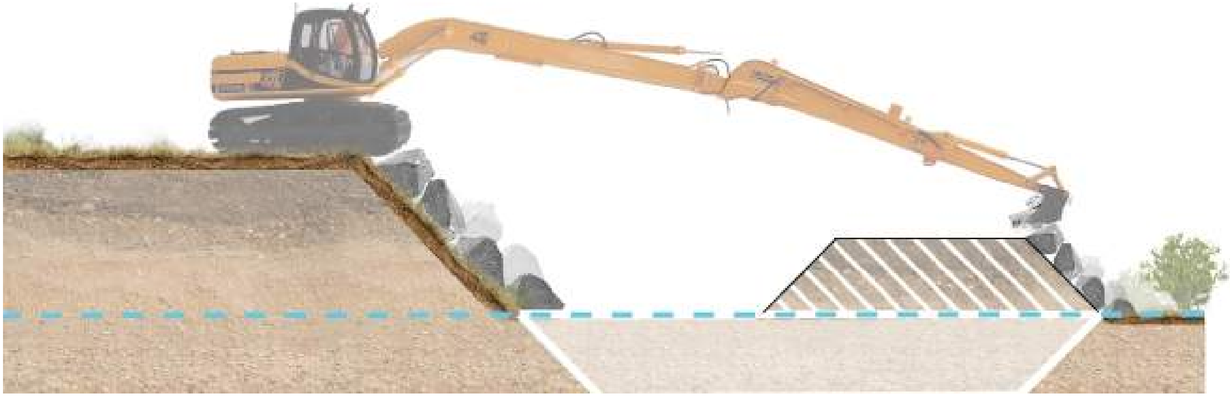
The outer portion of the embankment will be formed with mudcrete and the remainder of the embankment will be formed with engineered fill. Figure 7-3 shows the general construction sequence for the reclamation which is:

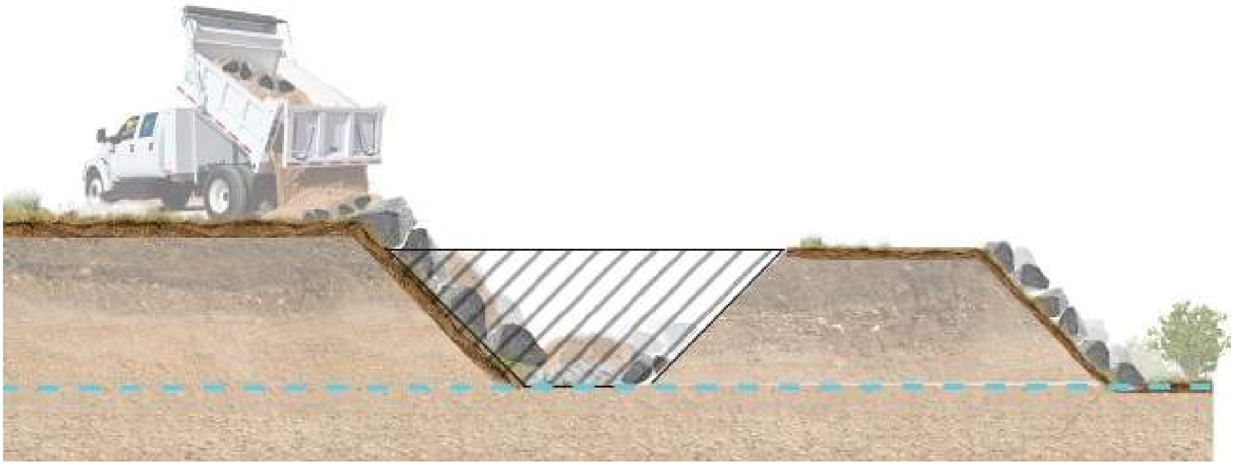
1. Clear existing mangroves using excavator. Undertake in-situ mudcrete foundation for the embankment.
2. Construction a mudcrete bund using dredged material from within the reclamation footprint and from the dredging area in the Māngere Inlet (see Figure 7-4).
3. Using existing and imported riprap, construct coastal protection.
4. Import fill to complete embankment construction. Complete riprap coastal protection.

Figure 7-3: General construction sequence for the reclamation









It is currently envisaged that the mudcrete will be produced by dredging marine sediments from the Māngere Inlet and mixing these with cement and then placed back in the excavated area as ground improvement. Alternatively, the excavated marine sediments may be replaced with imported granular (gravel/rock) fill, or strengthened by in situ mixing with cement.

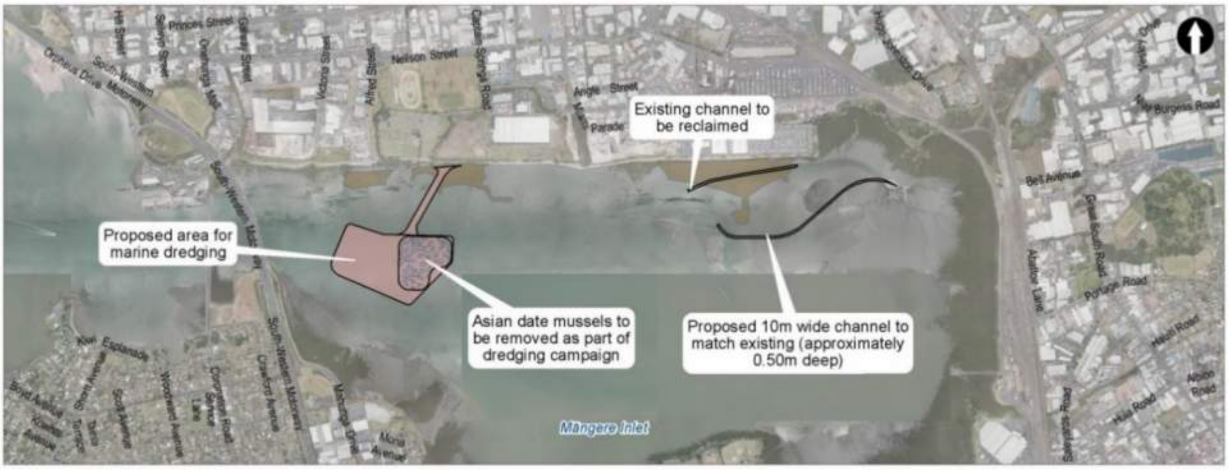
The dredged marine sediments will be sourced from the following areas:

- 100,000m^3 of in situ material under the embankment to form a stable foundation;
- 100,000m^3 sourced from within the wetland footprints and used to form the seal or liner for the wetlands and to create the main embankment for the road;
- 250,000m^3 sourced from within the headland footprints; and
- 300,000m^3 sourced outside of the Project footprint to form the outer landscape features to contain the wetlands.

The marine sediments required from outside the Project footprint will be dredged from a 15 ha subtidal area as shown on Figure 7-4. A temporary dredged channel will be formed to transport the dredged material to the Project area.

An alternative approach may be to import material to the site. At this stage, the Transport Agency is seeking consent for marine dredging, but also wishes to retain flexibility for the import of material depending on the final design and contractor’s proposed methodology.

Figure 7-4: Dredging site and low tide channel



The dredging, if undertaken, will be undertaken by a long reach excavator located on a barge. The barge will be relocated based on where sediments are being won. Dredged sediment will be placed in a receiving barge or a conveyor and transported to the processing plant within the construction yard.

Figure 7-5 shows a barge set up similar to that which may be used for the dredging.

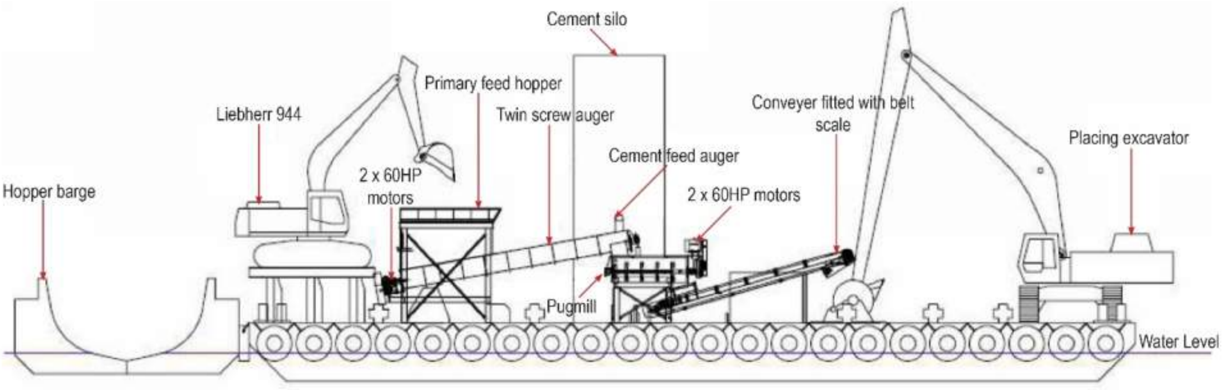
Figure 7-5: Typical dredging barge

It is anticipated that dredging will occur for approximately 12 months for the material won from the dredged area. The timing will be tide dependent so is likely to be undertaken at night time when required. Other dredging within the Project footprint could occur for a further 12 months.

Mudcrete will be produced at a rate of approximately 1,000m^3 per day. This will use about 80 tonnes of cement per day. The cement will be stored in small-medium sized silos within the Waikaraka Park construction yard. The silos will incorporate a bag filter system to remove particulates from the air.

Figure 7-6 shows a typical set up for a marine based mudcrete plant. This type of set up could be used for the in situ mixing of mudcrete along the foreshore. For other areas, a land based operation will be used and will consist of similar plant and layout.

Figure 7-6: Typical marine based mudcrete plant



Once the dredged marine sediments are mixed with cement to produce mudcrete, the material will be transported to the required location using a conveyor system along the foreshore. This will be a mobile system and will be relocated depending on the area being formed. Another transport system would be to place the material in trays and move it to the disposal site with mobile plant. The figures below show examples from other projects of reclamation using mudcrete.

Figure 7-7: Reclamation using mudcrete for Upper Harbour Crossing (SH18, Greenhithe)

Figure 7-8: Reclamation using mudcrete at Fergusson Container Terminal

Following completion of the embankment and the outer bund, the stormwater treatment areas and pipework can be installed. These wetland areas will require the construction of a sealed layer beneath them to minimise ground water/seawater intrusion. Tidal gates will be installed in the outlets to allow discharge at low tide.

7.7.1.1 Occupation of the CMA during construction along the foreshore

Construction of the road embankment, landscape features, wetlands, boardwalks and other coastal elements will require temporary and permanent occupation of the CMA. *Section 6.0: Description of the Project* sets out the temporary (construction) and permanent occupation of the CMA for these works. These areas are shown on the design drawings in *Plan Set 5: Coastal Occupation* in *Volume 2: Drawing Set*.

In summary, the construction will require temporary occupation of the CMA consisting of the physical footprint of the new road embankment, landscape features and stormwater wetland as well as an additional area for construction activities/disturbance beyond the permanent footprint.

Feature	Permanent occupation and reclamation	Additional temporary occupation	Total construction area
Road embankment	6.5 ha	11.65 ha	**35 ha**
Landscape features and stormwater wetland	17 ha		
Dredging site	-	15 ha	**15 ha**

7.7.2 Construction of local road connections

Construction of the local road connections/intersections include the following:

- Galway Street/Neilson Street Intersection;
- Captain Springs/ Neilson Street Intersection; and
- Port link road.

The intersection of Galway Street with Neilson Street will provide a key link for Onehunga to the Project and SH20 networks. Due to the current nature of Neilson Street being an arterial connection, construction works will be undertaken during off-peak hours to minimise impacts on the existing road network.

The connection from EWL via Captain Springs Road to Neilson Street is a key link into the local area and will require improvements to the existing roads. The key construction features are:

- Widening of the existing intersection;
- Relocation of existing services; and
- Accommodation works.

The port link road will require construction works on historic landfills. The key construction features are:

- Removal of contaminated material and constructing over the landfills;
- Connection to existing Miami Parade intersection;
- Relocation of existing services; and
- Accommodation works including security fencing.

As construction of the local road connections will be across areas of closed landfills some excavation of contaminated material will be required. Construction will be similar to the main EWL using raft type construction.

Earthworks will be required for the embankment interface works and local road construction. There will be limited excavation within landfill materials with these left in situ wherever possible and suitably capped. Where cut is required into the landfill material this will be removed and disposed of to an approved disposal site.

7.8 Anns Creek viaducts and Great South Road Intersection (Sector 3)

Construction of the Anns Creek viaducts will involve:

- An at grade signalised intersection at Hugo Johnston Drive;
- West of Hugo Johnston Drive, the viaduct structure will span across the Southdown rail siding and across the CMA; and
- East of Hugo Johnston Drive, the viaduct will span across the NAL continuing over Great South Road providing a grade separated intersection with EWL/Great South Road/Sylvia Park Road.

Retaining walls are proposed at the abutment at the western end of the viaduct over the CMA, adjacent to the connection to Hugo Johnston Drive and at the eastern abutment near Great South Road. The walls range in height from 3m to 6m.

The key construction features for this area are shown on the design drawings in *Plan Set 10: Construction Activities.*

The general sequencing of the work may be as follows:

- Construction yard setup at the southern end of Hugo Johnston Drive;
- Relocate the gas main and other utilities;
- Demolition of part of the Southdown Co-generation Plant;
- Construction of temporary staging over the CMA and Anns Creek;
- Piling and installation of the bridge piers during a Block of Lines[39]. This will take priority due to limited time frames to work within the rail corridor. This can be done alongside the piling and installation of piers to the west of Hugo Johnston Drive;
- Constructing the embankment at Hugo Johnston Drive may be undertaken at the same time as the piling and pier installation to the east of Hugo Johnston Drive, depending on how access is used from Great South Road;
- A section of the viaduct east of Hugo Johnston Drive is likely to be of steel construction to allow greater spans to avoid sensitive ecological areas adjacent to Great South Road;
- Installing the deck of the bridges east of Hugo Johnston Drive with any construction over the rail corridor undertaken during a Block of Line;
- Installing the deck on the bridges to the west of Hugo Johnston Drive along with the construction of the EWL/Great South Road/Sylvia Park Road intersection;
- Construction of the viaduct over Great South Road will be undertaken in stages maintaining two lanes of traffic in both directions on Great South Road. Bridge beams will be lifted in at night requiring partial road closures, detours will be put in place; and
- Relocation of a Transpower high voltage transmission tower to facilitate construction of the extended viaducts at the Great South Road intersection.

Access within this area is limited and therefore enabling works will be required to establish access to the southern side of the Southdown Co-generation Plant and construct the embankment at the base of Hugo Johnston Drive. The embankment ties together the two bridge structures that cross over the rail lines.

Earthworks in this area are associated with construction of the bridge embankments at Hugo Johnston Drive and the intersection at Great South Road/Sylvia Park Road. A number of haul roads will need to be temporarily constructed to access and construct the viaducts over the rail corridor as well as relocate the gas pipeline.

Existing vegetation within the footprint of the works will need to be cleared. This includes approximately 150m^2 of terrestrial vegetation in Anns Creek East and approximately 100m^2 in Anns Creek West.

The section below discusses the anticipated construction methodology for the Anns Creek viaducts in more detail.

[39] A period when the rail operator has a planned shutdown of the rail line.

7.8.1 Coastal works for viaducts

The construction of the Anns Creek viaducts to the west of the Southdown rail siding will require works in the CMA. Moving east of the NIMT, the alignment crosses Anns Creek, an area of ecological and geological value. A construction methodology similar to the CMA components has been adopted due to the similar ecological and natural character features found in both areas. The general construction sequence for the viaducts will involve construction of the piles, then piers and then the superstructure. Construction of the viaducts could take approximately two years each.

The viaducts will consist of single structures of approximately 800m, generally 515m in length supported on single column piers. Spans for the new ramps will be generally 35m (and longer for a section within Anns Creek East) steel beams and will be supported by piers of approximately 2,100mm. The piers are likely to be constructed of reinforced concrete and supported on piled foundations.

Construction within Anns Creek Estuary and Anns Creek East will require temporary staging platforms to provide access for the piers and other structures. To avoid areas of ecological and geological value the staging for Anns Creek Estuary will be located on the southern side (seaward) of the alignment and through Anns Creek East it will be generally located on the northern side (landward) of the alignment. The design drawings in *Plan Set 11: Construction Activities* shows the indicative location of the temporary staging.

Within Anns Creek Estuary and Anns Creek East, pier and construction exclusion areas have been identified. These are areas of significant ecological and geological value. These areas have been mapped and are shown on the design drawings in *Plan Set 11: Construction Activities*. The piers and construction access will be located to avoid these areas.

The construction staging has been assumed to be in the form of a bridge structure constructed of steel piles driven into the seabed/land with a steel decking and concrete or timber deck slab. The temporary platforms could be in place for up to 18 months, depending on the final construction sequence. Access tracks to the platforms will be required and will be a suitable size and width to provide for pilling rigs, cranes, excavators and trucks. Figure 7-9 shows an example of temporary staging similar to that anticipated for the Project.

Figure 7-9: Temporary staging used for Great North Road Interchange (SH16)

Figure 7-10: Construction of the substructure at Great North Road Interchange (SH16)

The bridge piers are expected to be cast in-situ reinforced concrete. Construction would typically comprise fixing the steel reinforcement for the piers, placing the formwork and pouring the concrete using either a concrete skip or by pumping through a pipeline. The pier could be constructed in several vertical lifts and the formwork moved up the pier shaft.

Once the foundations and piers are in place, the superstructures will be constructed. Precast concrete girders or steel girders will be used for the superstructure. A crane will be used to lift the girders into place on the pier crossheads. Once in place, reinforcement will be fixed and the slab cast with concrete placed either by concrete skip or pumped via pipeline.

An alternative method of construction to erect the girders might be to use a launching gantry, located above the span being erected, which will lift the girders into place. The effects of these are considered comparable but cranes have been assumed as "worse case" for construction.

Following completion of the construction works the temporary platforms will be dismantled with the temporary piles removed.

7.8.1.1 Temporary occupation of the CMA for construction

Construction of the Anns Creek Estuary viaducts and other coastal elements will require temporary and permanent occupation of the CMA*. Section 6.0: Description of the Project* sets out the temporary (construction) and permanent occupation of the CMA for these works. These areas are shown on the design drawings in *Plan Set 5: Coastal Occupation* in Volume 2.

In summary, the construction in Anns Creek will require the following occupation of the CMA:

Project element	Permanent occupation	Additional temporary coastal occupation	Total construction area
Anns Creek Viaduct	0.8 ha	0.2 ha	**1.0 ha**
Bridge piles	0.01 ha	0.02 ha	**0.03 ha**

7.9 Sylvia Park Road and SH1 ramps (Sector 4)

Construction of the Sylvia Park Road and SH1 ramps involves:

- Widening of Sylvia Park Road to four lanes and space to construct new structures linking to SH1;
- Relocation of Transpower towers near SH1;
- Construction of southbound on and northbound off-ramps across Mt Wellington Highway, Clemow Drive and the NIMT;
- Stormwater diversion and treatment adjacent to SH1; and
- Construction of a shared path linking from Great South Road to Mt Wellington Highway and then into Sylvia Park Town Centre.

The key construction features are shown on the design drawings in *Plan Set 10: Construction Activities.*

The general sequencing of the work may be as follows:

- Relocation and increasing the height of electricity transmission towers;
- Construction of box culverts and associated stormwater works on the western side of SH1;
- Piling and pier placement of on/off-ramps with all works over SH1 and Mt Wellington Highway;
- Widening on the south side of Sylvia Park to cater for the westbound lane and northbound off-ramp from SH1;
- Construction of the northbound off-ramp;
- Widening of the southbound lane on SH1; and
- Construction of the southbound on-ramp.

Earthworks activities will involve clearing and filling of the sites located to the south of Sylvia Park Road. It is expected that a considerable amount of the excavated material in this area will be unsuitable and/or contaminated and will not be able to be reused. Unsuitable material will be removed and disposed of at an approved site with imported engineered fill placed under the widened carriageway, Sylvia Park Ramps embankment and wetland perimeter.

The existing stormwater drainage system on the eastern side of SH1 will require significant upgrading. This work is likely to include construction of a double, large diameter, culvert or box culvert at Great South Road to replace the small pipes. Pumping due to existing low point location is proposed along with stormwater detention and treatment.

The section below discusses the anticipated construction methodology for the SH1 ramps in more detail.

7.9.1 SH1 Mt Wellington Ramps

The SH1 Mt Wellington ramp structures will be constructed using both from precast concrete Super T girders with spans generally up to 35m and steel box beams up to 60m both supported on in situ concrete pier caps and single circular column piers approximately 1.8m in diameter. Each column is typically carried by a reinforced concrete bored pile, approximately 2.1m in diameter, except for a number of the piers along Sylvia Park Road where pad foundations resting on the basalt flows beneath are proposed.

The ramps consist of two long bridges connecting EWL to the SH1 motorway, one off-ramp and one on-ramp. Two transmission towers are required to be moved and raised by Transpower. An additional tower will be required between these two towers. The existing lattice towers will be replaced with monopoles.

Bridge construction commences with the installation of the bored piles at each pier position and under the abutments. This requires access to each pier position by the piling rig, and then the cranes to lower the reinforcing cage. Most of the piles will penetrate through or into basalt. Drilling and grouting of the underlying basalt will be required.

Concrete bridge beams may be erected by a launching gantry working along the structure from one end to the other, and the contractor may also need to use crane erection along the Sylvia Park Road section due to the length of the viaducts and the number of bridge spans.

The figures below show examples of pier construction which are similar to that anticipated for the Project.

Figure 7-11: Ramp columns

Figure 7-12: Construction of superstructure using a gantry

The steel box beam sections of the on-ramp will be erected by crane. The beams will be erected progressively in stages and temporary support towers will be required at the splices. Late night motorway closures will be required for erection of beams over live traffic.

For the girders to be erected over occupied areas and roads or rail lines, the closure of the area below the works will be required during critical activities.

Construction areas for the on-ramp piers near Tip Top corner are very restricted. Occupation of the motorway shoulder will be required for this work.

Construction of the spans adjacent to Transpower towers and where the lines cross the ramps, requires working under and adjacent to the overhead power lines. This will require restrictions on crane movements and may require raising the towers. The use of a low height piling rig together with a launching gantry may reduce the extent that the lines need to be raised.

7.9.2 Retaining walls (Sector 4)

As space is constrained along Sylvia Park Road and on SH1, a significant number of high (6m) retaining walls are proposed in this area. Rock bolts or soil nails are proposed to retain a section of the existing slope between Tip Top and Panama Road on the eastern side of SH1. The retained height will be up to 4m.

7.10 SH1 Auxiliary Lanes and Ōtāhuhu Creek Bridge (Sector 5)

Construction of the SH1 Auxiliary Lanes and Ōtāhuhu Creek Bridge will involve:

- Constructing an additional lane on SH1 northbound and southbound from the Sylvia Park ramps through to Princes Street; and
- Construction of a new Ōtāhuhu Creek Bridge with removal of the existing culverts.

The key construction features are shown on the design drawings in *Plan Set 10: Construction Activities.*

The general sequencing of the work may be as follows:

- Site establishment, vegetation removal, utilities relocations, temporary traffic management and establishing erosion and sediment control measures;
- Widening of SH1 northbound lane;
- Construction of new bridge east of SH1 over Ōtāhuhu Creek;
- Construction of Ōtāhuhu Creek northbound lane bridge extension including declamation;
- Widening of SH1 southbound lane;
- Construction of Ōtāhuhu Creek southbound lane bridge extension;
- Median barrier construction, pavements and ancillary works; and
- Retaining wall and noise wall construction.

Earthworks will be associated with the carriageway widening along SH1 with associated bridge and stormwater works. Existing vegetation within the footprint of the works will need to be cleared including existing landscape planting within the motorway corridor and mangroves adjacent to the Ōtāhuhu Creek Bridge.

The section below discusses the anticipated construction methodology for the Ōtāhuhu Creek Bridge in more detail.

7.10.1 Ōtāhuhu Creek Bridge

The Ōtāhuhu Creek Bridge comprises precast concrete girders with spans up to 15m supported on bored piles and a small pier cap. The piles are located on the existing motorway batter slopes.

Ōtāhuhu bridge construction will commence with the staged erection of the new local road bridge, removal of the existing SH1 culverts and construction of the new SH1 bridge involving multiple traffic switches to facilitate the necessary lane configuration required for temporary traffic management.

Construction will commence with the installation of the bored piles on one side of the motorway. Following completion of the piles and construction of the small pile cap, the girders will be crane erected. Following this the settlement slab and remaining works will be completed. The work will be carried out in two stages to provide sufficient working area and access.

Construction of the first bridge will require temporarily shifting the motorway lanes and median across to provide adequate working area and safe access to the site. On completion of the first bridge the process will need to be reversed and the second bridge constructed.

Foundations for these bridge piers and abutments are expected to be piled. Bridge piers are generally concrete columns and are approximately 900mm diameter. Approximately 14 piers will be located within the CMA.

Abutments are concrete seats upon which the bridge beams can be supported at each end of the bridge. It is proposed that the bridge deck will consist of precast concrete beams.

Temporary staging may be required to install the piers but the existing structure may minimise this subject to traffic management requirements.

As part of the Ōtāhuhu Bridge works, an area of approximately 4,500m^2 on the southern side of the creek may be declaimed, with the location and extent depending on the final design details and construction methodology for the work.

The removal of the existing culverts will also be staged. Construction methodology is likely to include the diversion of water away from one culvert. This culvert will then be removed in stages by removing the slab and then walls. Potential concrete dust generated during works can be managed in a number of ways. For example, isolating the works area from operational culverts, installation of erosion and sediment control and watering or vacuuming during and after works.

Construction of the Ōtāhuhu Creek Bridges and other coastal elements will require temporary and permanent occupation of the CMA. Section 6.5.2 of this AEE sets out the temporary (construction) and permanent occupation of the CMA for these works. These areas are shown on the design drawings in *Plan Set 5: Coastal Occupation* in *Volume 2*.

In summary, the construction will require the following occupation of the CMA:

Project element	Permanent footprint	Additional temporary coastal occupation	Total construction area
Ōtāhuhu Creek bridge	0.12 ha	0.16ha	**0.28 ha**

7.11 Panama Road Bridge (Sector 5)

Construction of the Panama Road Bridge involves:

- Constructing a new raised overbridge to the south of the existing structure; and
- Raising Panama Road including the tie in to Hillside Road and McLennan Road.

The key construction features are shown on the design drawings in *Plan Set 10: Construction Activities.*

The general sequencing of the work may be as follows:

- Site establishment, vegetation removal, utilities relocations including works to transmission lines, temporary traffic management and establishing erosion and sediment control measures;

- Piling and pier installation for the new overbridge;
- Partial construction of new bridge;
- Road works along Hillside Road and Panama Road west;
- Road works along McLennan Road and Panama Road east;
- Deconstruction of existing bridge;
- Complete construction of the new bridge;
- Tie in of the overbridge on Panama Road; and
- Works to reinstate/modify residential site accesses.

The bridge will be constructed from precast concrete girders with spans up to 30m, and supported on an in situ concrete piers with circular columns. The pier and abutments are carried by reinforced concrete bored piles, approximately 900mm in diameter.

Construction of the bridge will commence with the installation of the bored piles for the central pier in SH1. This requires access to the central pier position and abutments by a piling rig and cranes. Provision of appropriate working areas at each abutment and pier will be required to facilitate the construction. This will involve reducing lane widths on SH1 with temporary realignment and barriers and a reduced speed limit on the motorway.

On completion of the piles, concrete pile caps, followed by columns and the pier capping beam will be constructed at the pier and the abutments. Bridge beams will be crane erected one span at a time. This requires access to each span by the vehicles carrying the girders and the erection cranes. For the girders to be erected over live traffic lanes, late night closure of the motorway in one direction will be required for a short period.

A staged construction is proposed keeping one lane of traffic controlled by signals operating at all time.

Following construction of the new overbridge, the existing bridge will be demolished. The existing bridge will be cut into sections and removed during late night closures of the motorway.

7.12 Princes Street Interchange (Sector 5)

Construction of the Princes Street Interchange involves:

- A new bridge over SH1 and removal of the existing bridge;
- A signalised intersection at Princes Street and the northbound off and northbound on-ramps on the western side of the motorway;
- A signalised intersection at Frank Grey Place and Princes Street on the eastern side of the State highway; and
- A signalised intersection at Frank Grey Place and the southbound off and the southbound on-ramps east of the motorway.

The key construction features are shown on the design drawings in *Plan Set 10: Construction Activities.*

The general sequencing of the work may be as follows:

- Site establishment, vegetation removal, utilities relocations including works to transmission lines, temporary traffic management and establishing erosion and sediment control measures;
- Piling and pier construction for the new overbridge will be undertaken in the motorway;
- Construction of the Frank Grey Place/Princes Street intersection;

- Construction on the north side of the bridge to be undertaken while the existing bridge remains live to reduce traffic impacts;
- Demolition of the existing bridge and construction of the south side of the new bridge;
- Construction of the southbound on/ off-ramps and Frank Grey Place; and
- Construction of the northbound on/ off-ramps and Princes Street West.

Earthworks required for the construction of the interchange will be limited to the widening of the SH1 carriageway along with reconstruction of the bridge abutments at Princes Street. Excavation north of the Princes Street Bridge will also be undertaken to reshape and extend the existing wetlands at the southbound off-ramp.

The overbridge will be constructed from precast concrete Super T girders with spans up of up to approximately 27 m, and supported on an in situ concrete pier with circular columns. The pier and abutments are carried by reinforced concrete bored piles, approximately 900 mm in diameter.

Construction of the overbridge will follow the same methodology as for the Panama Bridge as set out in Section 7.11.

As space is constrained along SH1 retaining walls are proposed in order to reduce encroachment where possible outside the existing motorway designation. Generally these are low walls (1m to 3m) however around the Princes Street Interchange a number of larger walls are also proposed. Where cut into existing embankment is required adjacent to the northbound carriageway, if basalt is encountered rock bolting maybe considered.

7.13 Construction management plans

Construction of the Project will be managed through the implementation of a suite of project plans including health and safety management plans, quality management plan and construction management plans. The construction management plans form an integral part of how construction activities are managed to address the social, environmental and cultural effects identified in *Part G: Assessment of effects of the environment* in this AEE. *Part H: Management of effects on the environment* in this AEE, sets out what these plans will contain and the process for their approval and implementation.

PART D

CONSIDERATION OF ALTERNATIVES

8.0 Consideration of Alternatives

Overview

An extensive option evaluation process was undertaken to arrive first at a Preferred Corridor, and then a Preferred Alignment within the Preferred Corridor. Alternatives were assessed at all stages of Project development, including use of existing corridors. The Preferred Alignment was confirmed to be the construction of new road infrastructure in the Onehunga – Penrose area with connections to SH1 and SH20. Further design refinements were undertaken to the Preferred Alignment reflecting the detail of the assessment of effects on the environment undertaken at that stage of the Project.

The option evaluation process involved a robust, comprehensive and iterative process which commenced at a large scale, considering options across the Onehunga – Penrose area, and then progressed to consideration of detailed alignment and design.

The initial phase involved identification and consideration of over 40 project components, which were reduced to a Long List of 16 corridor options. From these, six Short List corridor options were identified and considered in greater detail and a Preferred Corridor was identified. Once the Preferred Corridor was identified a wide range of alignment options were considered, to identify the Preferred Alignment within the Corridor.

An assessment framework was developed and applied that reflected the desired transport outcomes and captured the expected environmental and social impacts.

The process involved a multi-disciplinary team, use of Multi Criteria Analysis (MCA), then a design review to inform decision-making, extensive consultation with stakeholders and landowners and further iterative amendments to the options to account for new information and stakeholder feedback. Throughout the process, consideration has been given to feedback received, especially from key stakeholders and affected landowners and to the relevant planning provisions, especially regarding reclamation and opportunities for the avoidance of significant adverse effects.

This section outlines the consideration of alternatives and includes:

- Alternative methods;
- Alternative routes;
- Alternative sites and locations;
- Alternative alignments and interchanges / connections to the network; and
- Alternative designs, including construction methods and alternative measures to avoid, remedy and mitigate identified adverse effects on the environment.

This Assessment of Alternatives has been prepared in a number of separate parts:

- This chapter contains (for both the Preferred Corridor and the Preferred Alignment):
  - A high level overview of the processes used to identify (and assess) options;
  - a summary of the processes used to identify a Preferred Corridor option and a preferred alignment within that corridor;
  - a summary of the option scoring and analysis;
  - option refinements following consultation and technical review; and
  - further considerations used to identify the preferred corridor and alignment.

- The *Report 1: Supporting Material for the Consideration of Alternatives* in *Volume 3*: *Technical Reports* presents the detailed assessments, MCA criteria, scoring and drawings for the corridor options and for the alignment options.

The initial phase of the Project focused on identifying the most appropriate corridor for the Project. It commenced at a broad scale and systematically narrowed the geographic area of assessment to the identified route and alignment options. At each stage of this process, the existing natural and built environment was taken into account, as well as social and cultural values.

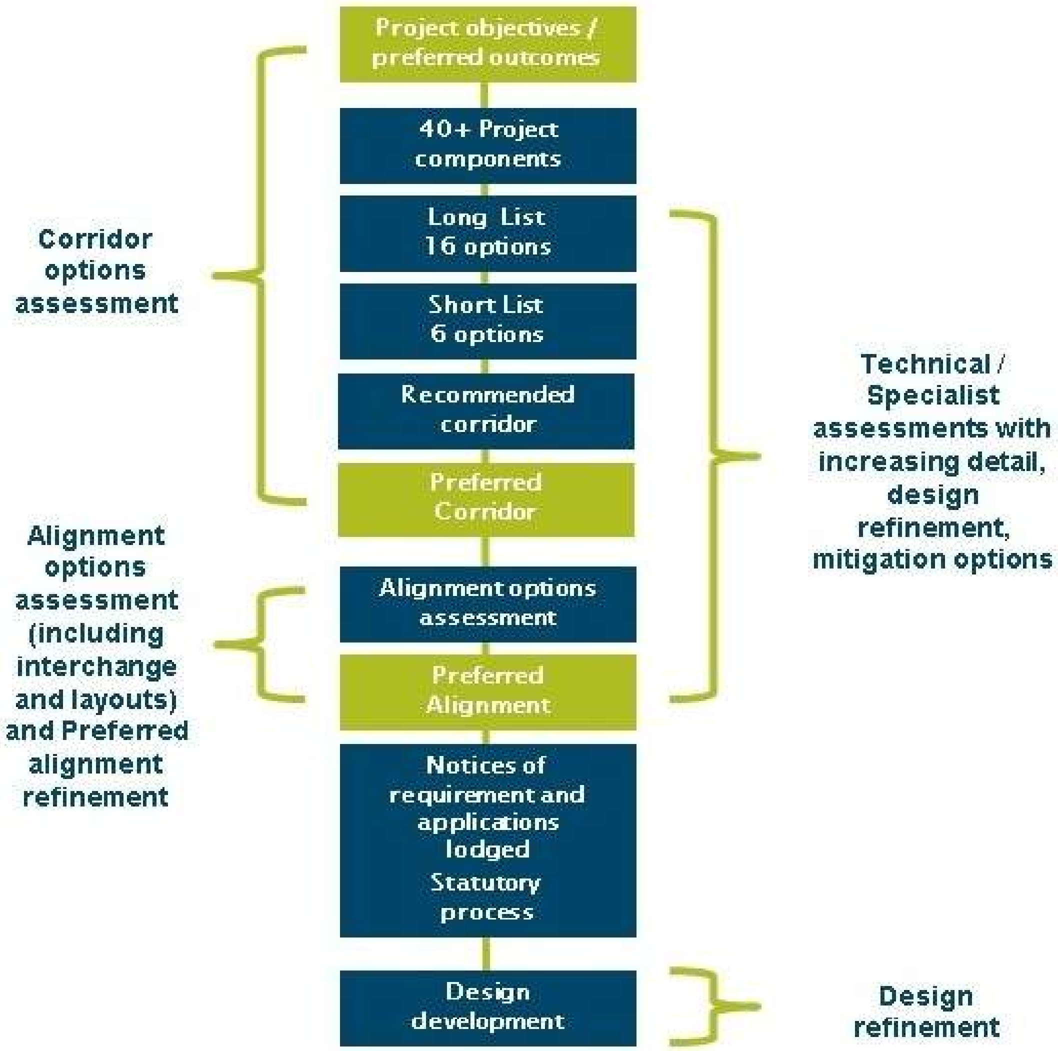
The preliminary assessment was primarily based on desk top analysis and the outcomes of preliminary consultation. Subsequently, the options assessment was supplemented by more detailed field investigations and targeted stakeholder and community engagement activities and feedback. The information derived from this process was fully considered and incorporated into the decision-making process during the development of the Preferred Alignment.

The Project has also been influenced by project partners and key stakeholders including Mana Whenua, Auckland Council, Auckland Transport and Department of Conservation (DOC). This chapter sets out the decision-making process involved in the evaluation of alternative routes, sites and methods, with reference to the relevant statutory requirements, and the key steps involved in the assessment process, which were broadly as follows (and as illustrated in Figure 8-1 below):

- Assessment of corridor options;
- Assessment of alignment options; and
- Preferred alignment.

Further detail regarding alternatives to address specific or potential environmental effects associated with the Project is provided in *Volume 3: Technical Reports*.

Figure 8-1: Summary of the Assessment of Alternatives



The assessment methodology has incorporated:

- The use of a MCA to assist in identifying potential effects and assessing the different components and options (including the development of project specific criteria);
- Engagement with stakeholders, affected landowners and the public at various stages of assessment;
- Iterative changes to the design as more detail and information was obtained from engagement and technical assessment; and
- Monitoring of the effect of changes to the design against the objectives.

8.1 Problem identification

The Project started with identification, assessment and prioritisation of problems within a wide study area stretching from Onehunga (north west), Sylvia Park (north east), East Tāmaki (south east) and Māngere (south west). Key problems identified with the transport network related to a lack of reliable public transport between Māngere and Sylvia Park and the constrained connections into and out of Onehunga-

Penrose. Working with key stakeholders and drawing on information gathered through consultation, these two problems were well defined.

Following the assessment of the problems, the Transport Agency made a decision to focus on addressing the immediate problems north of the Māngere Inlet (e.g. by increasing the capacity of the existing network or adding a new road and connections)[40]. This connection would address the constrained connections into and out of Onehunga-Penrose. As outlined in *Sections 2 and 3* of this AEE, the Transport Agency identified the benefit of constructing new infrastructure to connect SH20, the Onehunga Town Centre and industrial area and SH1.

To enable design of a solution that addressed the problem, objectives for the transport connection were defined. These set aspirations to be achieved in the delivery of a solution but did not define a specific solution. The objectives are listed in *Section 3.0 Project Development* of this AEE.

The assessment of alternatives for the purposes of the RMA commenced once the Transport Agency identified the need for intervention through the development of existing or new road infrastructure to assist to address the identified problems. The alternatives to be considered by the Transport Agency were those that are within its powers (i.e. the purpose for which it is approved as a requiring authority).

8.2 Purpose of this chapter

Under the RMA, a consideration of alternative routes, sites and methods of undertaking the work is relevant in relation to the NoRs and to some aspects of the activities for which resource consent is sought. Section 171(1)(b) of the RMA requires a territorial authority, when considering a NoR, to have particular regard to:

> *"Whether adequate consideration has been given to alternative sites, routes and methods of undertaking the work (if a requiring authority does not have an interest in the land sufficient for undertaking the work, or it is likely that work will have a significant adverse effect on the environment)."*

The Transport Agency does not have an interest in all of the land required for the Project. While the Crown will continue to acquire the necessary property interests after the NoR has been lodged, it will not have completed the property acquisition process prior to the NoR being determined. Consequently, consideration of alternative sites, route and methods needs to be undertaken. The alternatives considered by the Transport Agency were those that are within its powers to undertake.

The Transport Agency must robustly assess alternatives, but it is not obliged to select any particular option, including the one that scores the 'best' under any particular assessment system used. Section 171(1)(b) of the RMA only requires that a requiring authority give adequate consideration to alternatives. It is for the Transport Agency to choose which alternative to adopt.

A consideration of alternatives is also required under other provisions of the RMA (such as the Fourth Schedule) and under various provisions of the relevant planning documents. In particular, there is also a policy framework flowing through the statutory documents from Part 2 of the RMA to the New Zealand Coastal Policy Statement (NZCPS) and the AUP (OP) – that directs consideration of alternatives, particularly when considering reclamation and in the coastal environment. These matters are addressed partly in this chapter and partly in the other relevant parts of this AEE.

[40] Auckland Transport is pursuing a separate solution to the public transport problem.

8.3 Alternative corridor options

8.3.1 Project context

During the development of the Project a wide range of information about the economic conditions, the performance of the transport network and values of the natural environment was collated and analysed. The relevant parts of that information and the broader context for the Project are comprehensively outlined in other sections of this AEE.

8.3.2 Indicative Business Case Phase: development of corridor options

The first step in the identification of the Preferred Corridor was the identification of a number of route components. Route components were pieces of existing road network that could be upgraded or areas where new road infrastructure could be created that could feasibly assist in addressing the problem identified regarding the constrained connections into and out of Onehunga-Penrose. The identification of segments assisted with the development of options and components of options. The components were primarily identified in a series of specialist workshops involving a range of specialists and representatives of the Transport Agency.

These segments were:

- Segment A – SH20 north of the Gloucester Park Interchange[41]
- Segment B – Gloucester Park Interchange
- Segment C – Gloucester Park Interchange to Captain Springs Road (approximately)
- Segment D – Captain Springs Road to Great South Road
- Segment E – Great South Road to SH1
- Segment F – Southern Motorway Widening

[41] The term “Gloucester Park Interchange” was used in the Indicative Business Case when referring to the Neilson Street Interchange. They refer to the same area.

8.3.2.1 Project components

Over 40 project components were developed and selected to represent a range of intervention from low levels of new investment (i.e. limited new road infrastructure) to options which involve much greater intervention and investment (i.e. more extensive new road infrastructure) and to cover a variety of locations. The Project components are illustrated in Figure 8-2. The colours indicate components/sections assessed.

Figure 8-2: The corridor project components identified

The segments were assessed using a range of criteria (which are discussed in more detail below) to identify transportation performance and potential effects. Where similar components were identified, the best alternative proceeded to the development of the long list of options. When there was no equivalent alternative, the component was progressed to the development of the long list.

Some components located at the eastern or western end of the Project could be independent from those at the other end, and could therefore be prejudiced depending on which option they were included in. As a result, the options were designed to also be able to differentiate such components that is, by having ‘sister’ options that only differed by that one component).

8.3.2.2 Long List of corridor options: 16 Options

Taking into account feedback from a series of stakeholder workshops in August and September 2014 and the outcomes of assessment against various criteria, the viable components were reviewed and packaged into a long list of 16 viable options. Different combinations of components were used to form the 16 options. The options are outlined in Table 8-1 and maps can be found in *Appendix A: Long List Individual Option Assessment* contained in *Report 1: Supporting Material for the Consideration of Alternatives*, *Volume 3*.

Table 8-1: Long list options

Long List Reference No	Corridor Option
Option 1	Existing route upgrade with freight lanes
Option 2	Existing route upgrade with new SH1 ramps at the South Eastern Arterial
Option 3	Existing route upgrade to SH20 with new inland route to new SH1 ramps at Mt Wellington
Option 4	Existing route upgrade to SH20 with new foreshore route to new SH1 ramps at Mt Wellington
Option 5	Galway Street to SH20 with new inland route to new SH1 ramps at Mt Wellington
Option 6	Galway Street link to SH20 with new inland route to existing SH1 ramps at Mt Wellington
Option 7	Galway Street link to SH20 to new Waikaraka / inland route to new SH1 ramps at Mt Wellington
Option 8	Galway Street link to new SH20 interchange with new SH1 ramps at Mt Wellington
Option 9	Neilson Street route to new SH20 interchange with new inland route to new SH1 ramps at Mt Wellington
Option 10	Galway Street link to SH20 with new rail corridor route to new SH1 ramps at Mt Wellington
Option 11	Galway Street link to SH20 with new rail / local road route to new SH1 ramps at Mt Wellington
Option 12	Galway Street link to SH20 with new inland route to new SH1 ramps near Panama Road
Option 13	New SH20 Onehunga interchange with new foreshore route to new SH1 ramps near Panama Road
Option 14	New SH20 Onehunga interchange with new foreshore / inland route to new SH1 ramps at Mt Wellington
Option 15	New SH20 Onehunga interchange with full foreshore route to new SH1 ramps at Mt Wellington
Option 16	New full foreshore motorway connection SH20 to SH1

The long list of options comprised a mix of upgrades to existing roads and construction of new roads. It included lower cost through to higher cost options. These were compared with the 'do minimum' approach, which represented the expected baseline if none of the options were implemented but taking into account the anticipated land use growth and investment in the transport system across Auckland.

The long list of options was designed in sufficient detail, to allow broad assessment of transport outcomes and high level technical/environmental assessments. The outputs from the assessments were used to evaluate the long list options through an MCA framework.

8.3.2.3 Criteria and scoring

Project specific transportation performance measures were developed which focused on how to best measure the performance of the options against the identified benefits. The separate assessments reflect the different problems and benefits identified during the initial consideration of an east west connection. The performance measures were developed so they were quantifiable where possible. The 13 performance measures address transportation, safety and access matters and are described in full in *Appendix B: Transport Performance Benefits and Measures of Performance* contained in *Report 1: Supporting Material for the Consideration of Alternatives* in Volume 3. The purpose of using an MCA was to gather information on the widest possible range of effects so the Transport Agency could have a broad range of information.

The performance of the options against the intended project benefits (which subsequently formed the basis of the Project Objectives) was one of a number of areas under the MCA. The three transport related benefits identified during the Project development phase were:

- Benefit 1: An improvement in travel times and travel time reliability between businesses in the Onehunga-Penrose industrial area and SH1 and SH20;
- Benefit 2: An improvement in safety and accessibility for cycling and walking between Māngere Bridge, Onehunga and Sylvia Park; and
- Benefit 3: Improvement in journey time reliability for buses between SH20 and Onehunga town centre.

The MCA criteria were developed by senior specialists in their fields with input from a range of experts and stakeholders including Mana Whenua. The criteria were designed to ensure that issues of concern to all specialist disciplines and stakeholders could be assessed for all options.

The criteria are set out in *Appendix C: MCA Key Result Areas and Criteria for Corridor options* contained in *Report 1: Supporting Material for the Consideration of Alternatives* in Volume 3. The criteria cover the following broad areas:

- Transport outcomes and hence performance against objectives;
- Cost / benefit;
- Consentability;
- Constructability;
- Urban design and townscape;
- Social;
- Natural environment;
- Health; and
- Cultural and heritage.

Investigation and refinement also assisted in providing more in-depth assessment of each of the options. This included traffic modelling and technical assessments, which ultimately informed the MCA assessment and identified a recommended alignment.

An eleven point MCA scale was used for the assessments ranging from +5 (significantly positive effects), 0 (neutral) through to -5 (significantly adverse / negative effects). The assessment is a continuum and the scoring for each key result area was informed by the individual assessment against the defined criteria, but each score for each criterion was an overall qualitative assessment on the basis of the technical expert opinion.

Relevant experts provided input to the MCA process. This incorporated preparation of individual assessments evaluating the options followed by MCA workshops. The workshops provided the forum for collating, discussing and challenging the evaluations with relevant experts participating and reporting on different key result areas and criteria. The process considered and evaluated each of the long list options against all criteria.

Assumptions for the option assessment were also recorded to provide consistency across all assessments. As an example it was assumed that the proposed cycle path would be located north of an alignment. Some broad issues were also reported on by more than one expert i.e. heritage, natural environment, planning and constructability.

A final assessment was issued by each team lead in relation to their criterion. The final scores were therefore the result of expert assessment and opinion.

a. **Specific outcomes and important contextual factors**

A number of specific desirable outcomes and important contextual factors were identified during the development of the Project and the options evaluation. Some of these were included as specific criteria in the MCA, but it was recognised that their differentiation could get lost amongst the averaging and aggregating inherent in such MCA processes. Subsequently, the following specific outcomes and contextual factors were expressly considered in both the option selection and subsequent design development:

- Limiting land acquisition from industrial activities where such take would adversely impact on the viability of such areas;
- Limiting effects on the safe and efficient access to businesses along the Church–Neilson Streets corridor;
- Providing transport outcomes that will not compromise the land use plans of the Auckland Council (in particular the intention to support industrial land uses in Onehunga and Penrose);
- Limiting conflicts between freight vehicles and buses;
- Limiting impact on travel times for through traffic on SH1 and SH20; and
- Providing appropriate social, cultural and environmental outcomes.

Some of these factors reflect the Transport Agency's statutory functions and the general requirements of the RMA (providing for appropriate social, cultural and environmental outcomes) and others were incorporated into all design options as a minimum requirement (e.g. limiting impact on travel times for through traffic on SH1 and SH20 through extra lanes).

b. **Results**

The result of the MCA of the Long List of corridor options was to report on and present the outcomes of the MCA. This included an analysis for each option with detailed reasons for progressing or abandoning an option for further investigation.

The outcomes are presented in a number of different forms:

- An Assessment Summary with the key advantages, disadvantages and comments in a tabular form – as set out in *Appendix D: Assessment Summary of Long List Corridor Options* contained in *Report 1: Supporting Material for the Consideration of Alternatives* in Volume 3.
- Individual Option Assessments with a route map, a text summary of the assessment outcome, a visual representation of the scores in each key area and a short comment on those key criteria – as set out in Appendix A: Long List Individual Option Assessment contained in *Report 1: Supporting Material for the Consideration of Alternatives* in Volume 3.
- Multi Criteria Analysis Summary is a tabular summary of the assessment for each option against each criterion – not included in this report but included within the business case documentation.

8.3.2.4 Short list of corridor options

Following completion of the Long List assessment, six options were selected to progress to the short list for further detailed assessment and consultation. It was also found that the better-performing options on the Long List could be grouped into three categories depending on whether they used the existing roads, a wholly new road or a mix of existing and new roads. The six options represented a combination of low and high investment options. Where a group of options from the Long List displayed similar characteristics the "best" option was chosen to move forward, but overall the Short List was devised to provide a range of low-high investment options in a range of new and existing corridors. As a result the six options with the best MCA scores were not necessarily taken forward to the Short List.

The shortlisted options and the reasons for their selection are set out in Table 8-2[42]. The figures below illustrate the six options.

Table 8-2: Short listed options

Long List Option No.	Description	Reason for shortlisting	Shortlist Option No.
1	Existing route upgrade with freight lanes	Represents low change, impact and cost option	A
2	Existing route upgrade with new SH1 ramps at the South Eastern Arterial / SH1 interchange	Represents a moderate cost option with slightly greater opportunity to address problems in the network	B
5	Galway Street link to SH20 with new inland route to new SH1 ramps at Mt Wellington	Moderate cost option providing transport benefits (this was 'best performing; from group of similar road upgrade options)	C
8	Galway Street link to new SH20 Interchange with new inland route to new SH1 ramps at Mt Wellington	Represents an alternative interchange configuration from that in Option 5	D
13	New SH20 Interchange with new foreshore route to new SH1 ramps near Panama Road	Represents high cost option that fully separates through traffic from Neilson Street / Church Street but would have greater impacts on some environmental aspects (e.g. from reclamation)	E
14	New SH20 Interchange with new foreshore route to new SH1 ramps at Mt Wellington	Similar to Option 13 but provided for more eastern connection to SH1 and opportunity for full connection to East Tāmaki	F

[42] These reasons are contained in Table 7.2 of the Indicative Business Case.

Figure 8-3: Short list Option A

Figure 8-4: Short list Option B

Figure 8-5: Short list Option C

Figure 8-6: Short list Option D

Figure 8-7: Short list Option E

Figure 8-8: Short list Option F

Building on the work done for the Long List assessment further concept design work was undertaken on the short listed options. This included further geometric investigations and consideration of operational performance, safety concerns, ground conditions, service location, utilities and environmentally sensitive areas. Option B had the most significant alterations as additional capacity was added to the design to address the anticipated extra traffic that would be attracted to the corridor.

It was also considered whether additional concept design work would have improved the performance and / or lessened the impacts from the other long list options. The conclusion was that no different outcome would be achieved even if further design work was undertaken.

The assessment of the short list options involved the following steps:

- Assessment against the transportation performance measures;
- Assessment of environmental and social context of the area and implications of each option;
- An MCA to compare the results for each option;
- Assessment against Project Objectives; and
- Overall consideration and decision.

a. **Transportation performance**

The first step in the assessment of the short list options was to assess the transportation performance of each option in greater detail using the Project specific transportation performance measures, as outlined in *Appendix B: Transport Performance Benefits and Measures of Performance* contained in *Report 1: Supporting Material for the Consideration of Alternatives* in *Volume* 3.

A few additional measures were included to reflect the increased level of design and the need for finer comparison between options. For comparison purposes an assessment was also undertaken of a 2013 Do Minimum scenario (which represents an existing environment baseline) and 2026 Do Minimum scenario (which represents a future environment without the Project). Quantifiable measures and results were used where possible and a final score assigned for each measure (using the eleven point scoring system). The full results of that assessment are contained within *Appendix E: Transport Performance Assessment Detail* contained in *Report 1: Supporting Material for the Consideration of Alternatives* in *Volume 3*.

The options scored variably across the different measures; some of the most significant differences were as follows:

- Option A was the poorest performing option on nearly every measure providing little improvement to the existing congested connections to SH1 and SH20 and poorly connected pedestrian/cycle links. While this option generally had less adverse impacts on the physical environment (as it represented little change from the existing environment) it did not provide potential positive impacts as other options did (e.g. for land use and social variables);
- Option B provided improved connectivity to SH1 via the existing corridor, however, this led to a significant increase in traffic on that corridor, and created adverse transport outcomes accessing properties. It was also found to not be an enduring solution, as the new problems created within the corridor would inevitably lead to the need for further upgrades or new infrastructure. It was similar to Option A in the MCA evaluation in terms of impacts, with the exception of the connection at SH20 and potential impacts on the Outstanding Natural Feature (Te Hōpua Tuff Ring);
- Options C and D did provide improved transport outcomes and contributed to the objectives of the Project. However, these options had limited ability to provide 'enduring transport benefits', particularly when compared with Options E and F. Specifically, poor conditions were found on the sections where the existing corridors were retained as the major access route; and
- Options E and F had the most enduring benefits and created the most resilient network, noticeably more than Options C and D and significantly better than Options A and B.

b. **Environmental effects and social impacts assessments**

Following the Transport Performance assessment, a more detailed assessment of the environmental and social context of the area and the implications for each option were commissioned through eleven specialist reports. The reports were based on expert, independent analysis to assist the assessment of options and scope future consenting. The reports covered:

- Heritage;
- Visual and landscape amenity and urban form;
- Noise;
- Air quality;
- Social impact;
- Groundwater;
- Contaminated land;
- Erosion and sediment control;
- Stormwater;
- Ecology; and
- Coastal processes.

Typically, the level of environmental and social effect was consistent with the scale of the new infrastructure proposed under an option. However, a number of general key issues were raised by the assessments and were particularly relevant factors in the assessment of alternatives, including:

- All reclamation options had the opportunity to achieve environmental enhancement and benefits through capture of leachate and contaminants resulting from historic activities;
- All options would involve new stormwater treatment to some degree and this would have a positive impact on the quality of stormwater run-off and water quality in the Manukau Harbour;
- Options that created a new alignment would have a positive impact on residential amenity where they removed traffic from town centres and residential areas;
- All options that passed by Anns Creek needed particularly careful design and consideration of effects given the significant environmental values associated with that area. Likewise, all options that involved new structures in the vicinity of Te Hōpua Tuff Ring would need particularly careful design and consideration of effects;
- The heritage and coastal assessments did not support any options that impacted on Mutukāroa-Hamlins Hill. This view was supported by Mana Whenua who consider the area to be wāhi tapu; and
- There would be construction effects and disruption due to direct effects and construction traffic. An "off-line" alignment would likely reduce both these types of effect.

Potential effects of the Project on the important environmental and cultural values associated with Anns Creek, Mutukāroa-Hamlins Hill, ONLs and reclamation in the Coastal Marine Area (CMA) were discussed in detail in the relevant assessments. All of those areas have significant values that are reflected in relevant planning documents. The need to avoid effects on these values or if avoidance was not possible then remedy or mitigate as much as possible such effects, was expressly part of the considerations and assessments.

c. **Multi Criteria Assessment of Short List**

The third step in the assessment was a full MCA of the Short List using the same criteria and eleven point scoring method used in the Long List. Consistent with the Long List, assessment scores were assigned to each individual criterion and then an overall score for a key result area/group of criteria was assigned. For example, scores for all the criteria related to "Urban Design and Townscape" were individually identified and then an overall score for "Urban Design and Townscape" was identified.

The outcomes of the Short List MCA are outlined in *Appendix F Short List MCA Results* contained in *Report 1: Supporting Material for the Consideration of Alternatives* in Volume 3. At this stage of the process the estimated cost was also identified for each option, but cost was not a specific criterion in the MCA.

The MCA process was not designed or intended to simply identify the option with the best MCA score and recommend that as the Preferred Corridor.

However, for completeness the total scores for the short list options (with no weighting) were:

- Option A = -4
- Option B = -23
- Option C = -4
- Option D = -8
- Option E = -18
- Option F = -8

A weighting exercise was undertaken in respect of the transportation performance of each option in order to ensure that the key transport benefits of the Project – improving travel times and travel reliability between business in the Onehunga-Penrose industrial area and SH1 and SH20 – were given appropriate prominence in assessing options. These transport benefits directly correspond to the Project objectives (i.e. the Transport Agency's reasons for undertaking the work). The weightings were:

- 75% for Benefit 1;
- 12.5% for Benefit 2; and
- 12.5% for Benefit 3.

The key conclusions of the weighted MCA are:

- Options E and F offer the greatest connectivity between the Onehunga-Penrose freight hub and SH1/SH20. In this way, these options best achieve transport benefit 1 (improved travel times);
- Options C and D offer direct and mostly off-road cycle options so best achieve transport benefit 2 (improved cycle and walking access); and
- All options improve journey time reliability for buses between SH20 and Onehunga Town Centre so assist to achieve Benefit 3, although Option F does this the best.

The total scores for the short list options, inclusive of weighting for the transport components, were:

- Option A = -3.8
- Option B = -22.9
- Option C = -3.9
- Option D = -7.9
- Option E = -17.9
- Option F = -8.0

The overall scores for each Option only changed marginally as a result of the weighting.

d. Consultation on Short List

Consultation was undertaken on the Short List Options with the public and key stakeholders. The responses received during that consultation related to:

- Transport performance including traffic volumes and congestion, providing for freight, multi-modal and public transport, rail and general transport performance. There was support for walking and cycling;
- Affordability and cost of options including the importance of value for money;
- Concern for loss or residential and business land;

- Concerns for community severance with Neilson Street upgrade options or severance to foreshore for foreshore options;
- Protection of environmental features including Gloucester Park, Te Hōpua, Anns Creek and Mutukāroa-Hamlins Hill;
- Enabling the safe and efficient movement or freight; and
- Business disruption during construction.

8.3.2.5 Recommended corridor option selection

The decision on the Recommended Corridor (which eventually became the Preferred Corridor) option took into account the performance against Project Objectives, the information contained in the various specialist assessments undertaken, the outcomes of consultation and the results of the MCA.

A summary of the information obtained and analysis undertaken for the short listed options is contained in *Appendix G Summary of Short List Options* for and the more detailed assessment of the options is contained in *Appendix H Short List Individual Option Assessment* contained in *Report 1: Supporting Material for the Consideration of Alternatives* in Volume 3.

Options A, B and D did not perform well against the transport, and other, criteria so were discounted on that basis.

In relation to Option C (upgrade with new Galway Street and inland connections):

- It performed well from a transport perspective and achieved the Project Objectives in the short term;
- The benefits were not enduring i.e. they only last for the medium term before problems arise again and new solutions would be required, such as further investment in the area. In particular by 2036 the traffic volumes in the western section of Neilson Street are predicted to have reached a level that makes property access difficult and would result in an unacceptable level of service;
- The route would affect areas of high environmental values around Anns Creek, which would need to be considered carefully but would not involve reclamation or extensive works in the Te Hōpua Tuff Ring;
- There was some potential for environmental enhancement in the Anns Creek area but no opportunity for enhancement work along the foreshore;
- Some land from business would be required especially through the inland port; and
- Subsequent investigations as part of the Route Alignment MCA and Consultation has also identified potential impacts from construction on the Southdown Reserve and over the existing KiwiRail designations which were not known at the time of the MCA but represent problems with Option C.

In relation to Option E (new foreshore connection):

- This performed well from a transport perspective and had enduring transport benefits;
- The option minimises acquisition of business land, in comparison to Option C, but involves acquisition of residential land in Mt Wellington instead of business land along Sylvia Park Road;
- Due to the route's location alongside residential land, and along the foreshore, it performs poorest from an environmental and social/community perspective; and
- The option does provide opportunities for enhancement due to the foreshore location.

Taking into account all the relevant material Option F, a full link between SH20 and SH1 with connections to the local road network, was chosen as the Preferred Corridor. It was recommended that further analysis be undertaken. Key factors in that recommendation were:

- Option F had superior transport performance and delivered the most enduring benefits, especially compared to upgrading parts of Neilson Street. By having the most enduring benefits it would maximise return on investment and remove or delay the need for further investment in the area;
- Option F best delivered the Project Objectives of improved connectivity, travel times and reliability (including travel time savings of 4 to 7 minutes depending on route), and greater resilience along the Nelson/Church corridor (via removal of up to 10,000 vehicles per day);
- Option F did not involve any substantial acquisition of residential or any business land along Neilson Street but did involve land requirement around the inland port and around Miami Parade;
- The potential need for reclamation and the NZCPS provisions in locations of high environmental value were balanced against the potential opportunities for environmental betterment; and
- The option gives opportunities for positive environmental outcomes which were of great interest to key stakeholders, especially Mana Whenua.

It was identified that further work was required to determine how best to deliver Option F. This would include consideration of staging, conceptual design refinement, methods to avoid, remedy or mitigate potential adverse effects and continued collaborative engagement with stakeholders.

8.3.3 Option refinement for preferred corridor

The outcomes of the assessment of the long list and short list options were contained within the Indicative Business Case that was presented to the Transport Agency Board in December 2014.

The Board confirmed the Recommended Corridor, which then became the “Preferred Corridor” and also requested that additional assessment be undertaken regarding:

- Key stakeholder engagement;
- Refining the Recommended Corridor particularly a foreshore route (requiring reclamation) compared to an inland;
- Staging options due to possible funding constraints; and
- Cost refinement.

a. **Further stakeholder engagement**

During the first half of 2015 additional engagement occurred with delivery partners and key stakeholders including discussions with Mana Whenua, Transpower, DOC, Auckland Transport, Auckland Council, Auckland Business Forum and KiwiRail. The engagement was targeted at ensuring risks and opportunities were fully understood during development of the Recommended Corridor.

b. **Option refinement**

In response to the requests for additional assessment from the Transport Agency Board, two alternative route options were assessed:

- An arterial route partially along the foreshore and then partially through the industrial land along Miami Parade and the inland ports; and
- An arterial route fully along the foreshore.

Design refinement and further assessment and analysis of each alternative alignment was undertaken. The outcomes were:

- Identification that the heavy industrial land traversed by the inland route was likely to be heavily contaminated due to the historic use of the land. The foreshore route would minimise earthworks required on known contaminated land.

- That the foreshore route offered potential to deliver positive environmental outcomes through containment of existing contaminants. For this reason, some key partners (such as Mana Whenua) indicated strong support for this route.
- The foreshore route would minimise the land required from heavy industrial land, which was identified as a scarce resource to be protected by Auckland Council and was of significant value to the landowners themselves.
- The foreshore route involved higher existing environmental values than an inland route. However, technical assessments and discussions with project partners indicated that design and mitigation measures could minimise effects on these values and fit with the policy direction.

On balance the foreshore route was preferable because it performed best from a transport perspective, provided network resilience, and provided opportunities for the integrated treatment of the foreshore edge and to bring back mauri of the Māngere Inlet. In addition, feedback from key stakeholders and project partners indicated a preference for the foreshore route if environmental impacts are effectively mitigated where possible and opportunities to contain existing contaminants were implemented.

Further analysis of the likely traffic movements indicated that a connection to Captain Springs Road, rather than Angle Street, delivered marginally better transport outcomes while also providing more flexibility in delivering the route in stages.

It was also considered whether any of the changes, but especially adopting the full foreshore route alignment, would have altered the previous scoring undertaken in the MCA and the decisions reached about the Preferred Corridor. None of the changes were considered to be of sufficient significance to alter the previous scoring and ranking of options or the ultimate decision for Option F.

c. **Transport Agency decision**

The further work was completed and a report presented to the Transport Agency Board in May 2015. At that meeting the decision was made to approve a staged, complete link between SH1 and SH20, based on Option F, as amended through the additional information, as the Preferred Corridor.

The Transport Agency Board directed further public engagement on the Preferred Corridor was to be undertaken and development / further investigation of this approach.

8.3.4 Option refinement

8.3.4.1 Corridor refinement

Further refinements to the form of the alignment (i.e. Option F) were then investigated and assessed. The refinements were focused on improving transport outcomes and capturing some of the wider opportunities highlighted through stakeholder engagement. The investigations were a natural extension of the analysis to date, as the Project progressed through the investigation and design phase.

The refinements included:

- Confirmation of the foreshore route variation on the eastern side of Captain Spring Road as opposed to an inland route;
- Confirmation of Captain Springs Road as the main north-south connection to the existing Neilson Street/Church Street corridor rather than an interim connection via Angle Street;
- Inclusion of a connection to Hugo Johnston Drive from the new corridor; and
- Enhanced connections surrounding Gloucester Park including connections to Orpheus Drive.

It was identified the connection to Hugo Johnston Drive:

- Improved transport performance, with improved connection to the industrial area and greater network resilience;
- Reduced traffic on Church Street and Great South Road and improved the performance of the Great South Road / Sylvia Park Road connection;
- Could involve works on contaminated land;
- Would increase delays for through traffic on Hugo Johnston Drive and at the Hugo Johnston Drive/Church Street intersection;
- Would result in direct impacts on properties along Hugo Johnston Drive not previously affected by the Preferred Corridor;
- This connection could not be added to Short List Options A and B; but it could be added to Short List Options C, D, E and F so did not affect the relative MCA scores for each of those options; and
- The inclusion of this connection would not impact on the selection of the recommended corridor.

Enhanced connections around Gloucester Park were investigated in order to respond to feedback from stakeholders, enhance the ability to deliver the benefits and address safety concerns. The refinements included:

- A connection between Onehunga Wharf and Orpheus Drive; and
- Increased connection from the Onehunga Wharf to Onehunga Mall / Onehunga Harbour Road through a grade separated link.

The merits of these options considered included:

- The Orpheus Drive connection would improve general traffic, walking and cycling access to the foreshore;
- A local access to the Onehunga Wharf was strongly supported by the local community but had the potential to increase impacts on Te Hōpua Tuff Ring and require more land acquisition;
- The future use of the Onehunga Wharf was unknown; and
- The inclusion of this connection would not impact on the selection of the recommended corridor.

A final assessment was undertaken as to whether any of the refinements would materially affect the previous option assessments. The conclusion was that the refinements (either individually or collectively) did not materially affect the previous assessments; therefore there was no need to repeat the MCA process.

8.3.4.2 Transport performance

The transport performance of the Preferred Corridor was reviewed again at this stage of the project development in order to ensure that the analysis and assumptions within the previous stages were accurate. This process reiterated that existing transport problems impose significant congestion and reliability costs and restrict local and regional growth which the project seeks to address. The wider benefit of congestion relief within the existing corridor, and separation of local and through traffic, was expected to be enhancement of the transport network performance and stimulation of economic activity.

From a transport perspective vehicle volumes on the western section of Neilson Street would exceed desirable capacity immediately if constraints were removed at either end without addressing the middle part of the alignment. This indicated a need for work on all the corridor to occur sequentially.

8.3.4.3 Stakeholder feedback

From April to July 2015, further stakeholder engagement was held. The details of this are set out in *Section 9.0: Engagement* of this AEE.

The outcomes of this engagement influenced the development of the Preferred Corridor which is discussed below.

8.3.4.4 Transport Agency decision

The assessment of the various refinements was compiled into the Draft Business Case that was presented to the Transport Agency Board in December 2015. Formal approval from the Board to progress with the Preferred Corridor and develop a preferred alignment was given on 11 December 2015.

8.4 Development of the preferred alignment

Once the Preferred Corridor was confirmed the second major phase of the route identification commenced. This process sought to confirm a Preferred Alignment within the Preferred Corridor and therefore involved a more detailed analysis than the consideration of options for the Preferred Corridor.

The design philosophy set parameters for the design options. Key parameters included:

- An arterial road with local connections;
- A design speed of 70kph on the arterial;
- Capacity for large freight vehicles; and
- Development of a Landscape and Urban Design Framework to influence the project connections, form and place-making influence.

The further refinement of the alignment was undertaken through an integrated design process with a multi-disciplinary design, legal, planning and specialist team. A detailed MCA process was undertaken of key project features along the corridor, each with workshops attended by technical specialists.

The first step in the identification of the Preferred Alignment was to divide the project into six sections and identify a number of options for each section. Each section has a range of different issues to consider, with some commonalities across the alignment. Key issues that were identified and developed further fed into the MCA process.

8.4.1 Option development

During the selection process for the Preferred Corridor, desktop assessments, site visits and consultation with stakeholders identified a number of constraints and opportunities along the corridor. This information, along with mapped constraint data (e.g. extent of Outstanding Natural Features (ONF)) was compiled to identify alignment opportunities, constraints and design outcomes being sought from the EWL. This information together with design safety considerations and physical technical considerations informed the development of alignment options.

These alignment options were then subject to the MCA process discussed below. Selected specialists and experts participated in design workshops to inform option development; this resulted in new alignment options being developed prior to the MCA assessment and some further options were identified as an outcome of the process.

8.4.1.1 Geographic areas evaluated

The following geographic areas (also referred to as sections) were identified as requiring separate MCA evaluation. These geographic areas do not necessarily correlate to the ‘sectors’ detailed in *Section 6.0: Description of the Project* of this AEE. The design options are detailed in *Appendix J Workshop Information Packages* contained in *Report 1: Supporting Material for the Consideration of Alternatives* in Volume 3 (which includes some of the information issued to the assessment team for each of the sectors). The options are summarised below.

a. **Neilson Street Interchange**

Four options were considered for connections between SH20 and the EWL and local road connections (Neilson Street and Onehunga Harbour Road). The options were:

1. A standard motorway interchange with signalised intersections and a bridge connection of SH20 (refer to Figure 8-9).
2. Retention of the existing interchange, trenched connections between SH20 and EWL and no bridge over SH20 (refer to Figure 8-10).
3. Free flow linkages between SH20, local roads and EWL rather than signalised. Bridge connection over SH20 (refer to Figure 8-11).
4. An additional freeflow option (developed in response to issues and evaluation comments received on the other three Options, was considered at a later stage of the process (refer to Figure 8-12).

Figure 8-9: Neilson Street Option 1

Figure 8-10: Neilson Street Option 2

Figure 8-11: Neilson Street Option 3

Figure 8-12: Neilson Street Option 4

b. **Bund design foreshore / coastal edge**

Eight[43] options were evaluated in this area. Options considered alignments mostly on land, mostly in the CMA, partially on CMA and land and both inland and coastal stormwater treatment options. The options were:

1. Inner Inlet bridge with no permanent reclamation, proprietary stormwater and a shared path on the southern side of the bridge.
2. Prior to the MCA workshop it was confirmed this option (which involved a tunnel) would not be assessed further due to the inability for a tunnel design to provide the necessary connections to Alfred Street, Captain Springs Road and the MetroPort land. Without those connections the route would not be able to achieve the Project Objectives and so this route was not pursued. A tunnel design also presented significant engineering and technical design challenges.
3. Reserve edge embankment alignment constructed over the existing foreshore, propriety stormwater treatment, new shared path on southern side of embankment.
4. Reserve edge embankment outside of property boundaries with additional outer bund including a wetland for stormwater treatment and shared path.
5. Inner Inlet embankment to be constructed in the Māngere Inlet adjacent to land, no stormwater treatment.
6. Outer Inlet embankment approximately 50m from coastal boundary with wetland between foreshore and embankment. Shared path to remain and new one to south of embankment.
7. Prior to the workshop it was confirmed this option would not be assessed further.
8. Inland alignment within private property and the majority over landfills. Proprietary stormwater treatment, existing shared path to remain.
9. Inner Inlet embankment immediately outside CMA with mechanical stormwater treatment capturing road and regional stormwater. Exiting shared path to remain and a new one to the south of the embankment.
10. Inner Inlet embankment adjacent to the land with additional outer bund for stormwater wetland capturing road and regional stormwater. Existing shared path to remain and a new one to the south of the embankment.

c. **Anns Creek to Great South Road (including Hugo Johnston Drive)**

Four options were evaluated through the MCA. The options were:

1. Bridge structure through Coastal Protection Area / SEA Marine 1 avoiding majority of ecological features, bridging over rail corridor, grade separation at Hugo Johnston Drive (refer to Figure 8-13).
2. Bridge structure through Coastal Protection Area / SEA Marine 1, avoids some property but further into ecological features, at grade signalised intersection at Hugo Johnston Drive (refer to Figure 8-14).

[43] Originally there were 10 options, but only eight were considered as part of the MCA. All options retained their original option number.

3. Bridge structure through Coastal Protection Area / SEA Marine 1, avoids some property but further into ecological features, at grade non-signalised intersection at Hugo Johnston Drive including a roundabout to south of alignment (refer to Figure 8-15).
4. Bridge structure avoiding coastal and ecological areas, encroaching more into private property, and slip lanes at Hugo Johnston Drive. This option was developed in response to issues and potential adverse effects identified with Options 1-3 which all impacted on the CMA (refer to Figure 8-16).

Figure 8-13: Anns Creek Option 1

Figure 8-14: Anns Creek Option 2

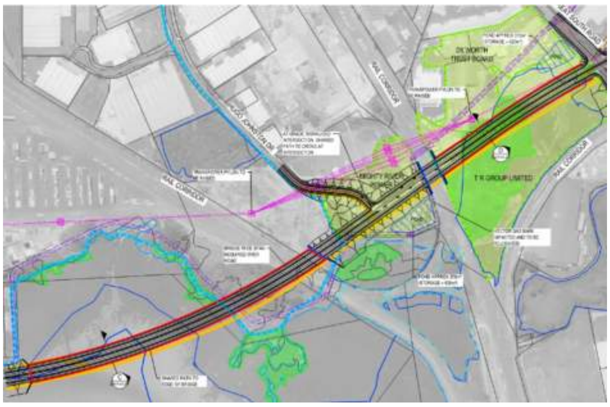


Figure 8-15: Anns Creek Option 3

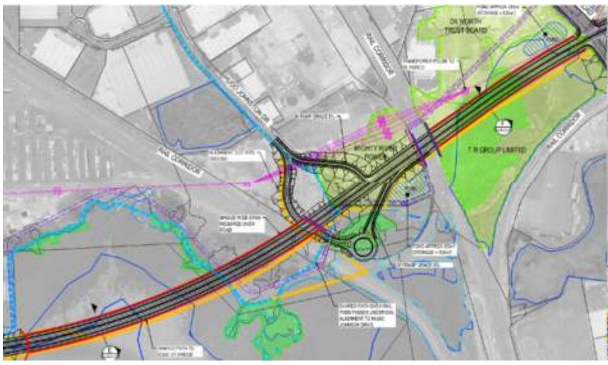
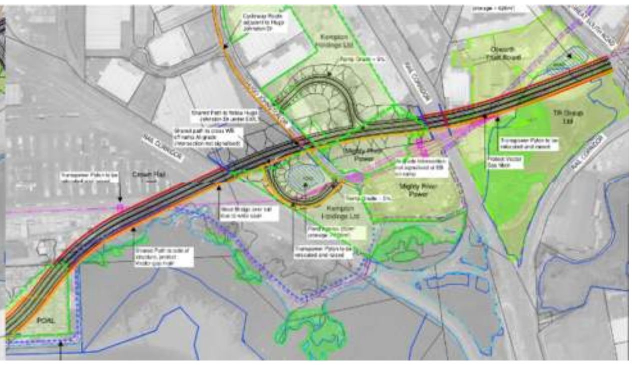


Figure 8-16: Anns Creek Option 4



d. **Princes Street Interchange**

Five options were evaluated through the MCA process. The options were:

1. A new overbridge to the north of the existing bridge, lining up with Princes Street. It included modified on/off ramps to SH1 and signalised pedestrian and cycling crossing facilities (refer to Figure 8-17).
2. A new overbridge on the existing alignment, lining up with Princes Street east. It included relocation of the southbound on-ramp entry to the north of the bridge (refer to Figure 8-18).

2B. Similar to Option 2 but included additional mitigation options.

3. A single point urban interchange with all four ramps connecting at a single signalised interchange. It included an alignment north of the existing and a modified Princes Street east alignment (refer to Figure 8-19).

4. A full diamond interchange with the bridge to the north of the existing (refer to Figure 8-20).

Figure 8-17: Princes Street Option 1

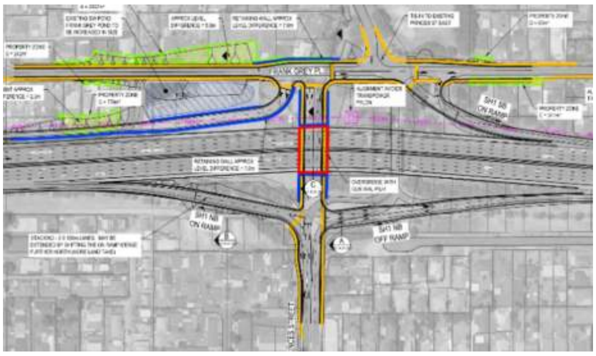


Figure 8-18: Princes Street Option 2

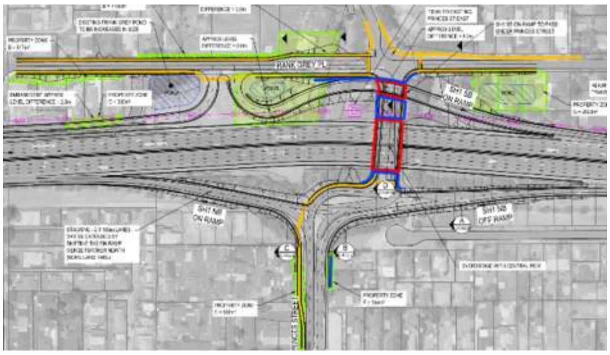


Figure 8-19: Princes Street Option 3

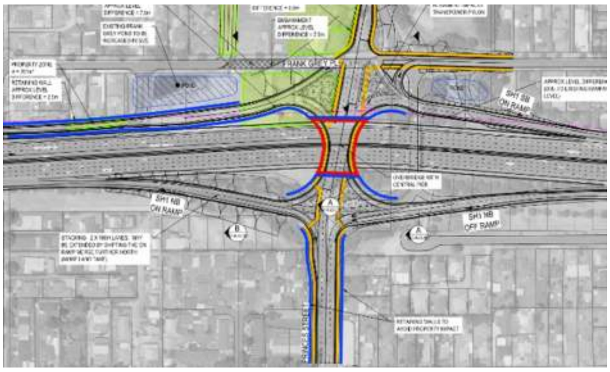


Figure 8-20: Princes Street Option 4

e. **Ōtāhuhu Creek crossing**

There were four options evaluated through the MCA. The options were:

1. New single span bridge across the culvert, retaining the existing culvert and SH1 structure.
2. New four span bridge extension with an abutment on either side of culvert, piers either side of creek and no retaining.
3. Extending embankment into causeway for extra lane and culvert extension.
4. Replacement of culvert and embankment with a new bridge over SH1.

f. **Design option workshop**

In addition to the detailed MCA, design option workshops were held for specific locations where differences related primarily to land required or feasibility of alignments so a comprehensive MCA was considered unnecessary. The locations were:

- **Neilson Street / Captain Springs Road intersection** – the impacts specifically relate to land use impacts on open space land and commercial properties, as well as integration with the local road / cycle network. To differentiate between alignment options, detailed engagement with landowners (particularly Auckland Council (Parks) and the Maungakiekie-Tāmaki Local Board) informed selection of the design option; and

- **Sylvia Park Road to SH1** – the design and safety constraints identified through this section were complex. At the time of undertaking option evaluations, two practicable options had been developed, one informed by the significant land use constraints in the area (being significant land uses and infrastructure), the other by safety considerations for the alignment. In summary, the constraints of this area include:
  - meeting appropriate Transport Agency safety standards;
  - maintaining important local road connections, including the future Auckland Transport bus connections at Sylvia Park Road and the Mt Wellington Highway / Sylvia Park connection;
  - recognising the significant physical constraints of Transpower's transmission lines through this area;
  - recognising the vertical constraints of significant Watercare infrastructure (particularly at Great South Road);
  - seeking to avoid major land uses where possible and maintaining accesses to properties, including Pacific Rise; and
  - minimising impacts on sites of significant cultural value (including Mutukāroa-Hamlins Hill and the identified wāhi tapu site / area at the Mt Wellington Interchange).

While it was anticipated that there would be further option development for alignment design in this area (responding to these constraints) no MCA was undertaken on 'alignment options' as it was concluded that the detail of design between options was more appropriately considered in the next phase of assessment (e.g. once environmental assessments and landowner consultation has been undertaken).

Following the workshops, three hui were held with Mana Whenua which involved the following components:

- Presenting and discussing options;
- Discussing the MCA process and Mana Whenua input to this process (cultural values report); and
- Gathering feedback on the design options being considered.

Two workshops were held with Auckland Council to present and discuss options.

8.4.1.2 Multi Criteria Analysis criteria

The criteria for the alignment options MCA were based on the criteria used for the earlier MCAs under the Long List and Short List Corridor options. Specific topic areas and criteria were reviewed and developed taking into account the Transport Agency objectives, key RMA matters (in particular sections 6, 7 and 8 of the RMA) and directives of National Policy Statements and Plans. A copy of these criteria is provided in *Appendix I MCA Criteria for Alignment options* contained in *Report 1: Supporting Material for the Consideration of Alternatives* in Volume 3 along with the scoring system used. The criteria relate to the following topics:

- Performance against Project Objectives;
- Road safety;
- Construction;
- Operation;
- Social and economic;
- Natural environment; and
- Cultural and heritage.

The MCA was a qualitative evaluation of different options against each criterion using a collaborate workshop with a range of technical experts. For the purpose of evaluation, the assessment was based on a standard set of design options presented to all experts.

For consistency, the assessment was undertaken on the basis of design options 'without mitigation'. This was undertaken so that the cost evaluation of options was consistent to the impact assessed. However, in addition to the assessment, specific comment was recorded on the ability for the effects assessed to be mitigated (this is discussed further in the process summary below).

8.4.1.3 Scoring

An eleven point scale (consistent with earlier phases of MCA) was used ranging from +5 (significantly positive effects), 0 (neutral) through to -5 (significantly adverse / negative effects). Attachment I provides a summary of the scoring matrix used. The matrix provided guidance to the qualitative assessment.

It is noted that scores were not provided for 'Mana Whenua values' (one criteria) on the basis that the Mana Whenua groups identified and recorded issues and where relevant alignment preferences, rather than a single score (which was considered insufficient to reflect their broader scope of values).

8.4.1.4 Multi Criteria Analysis process

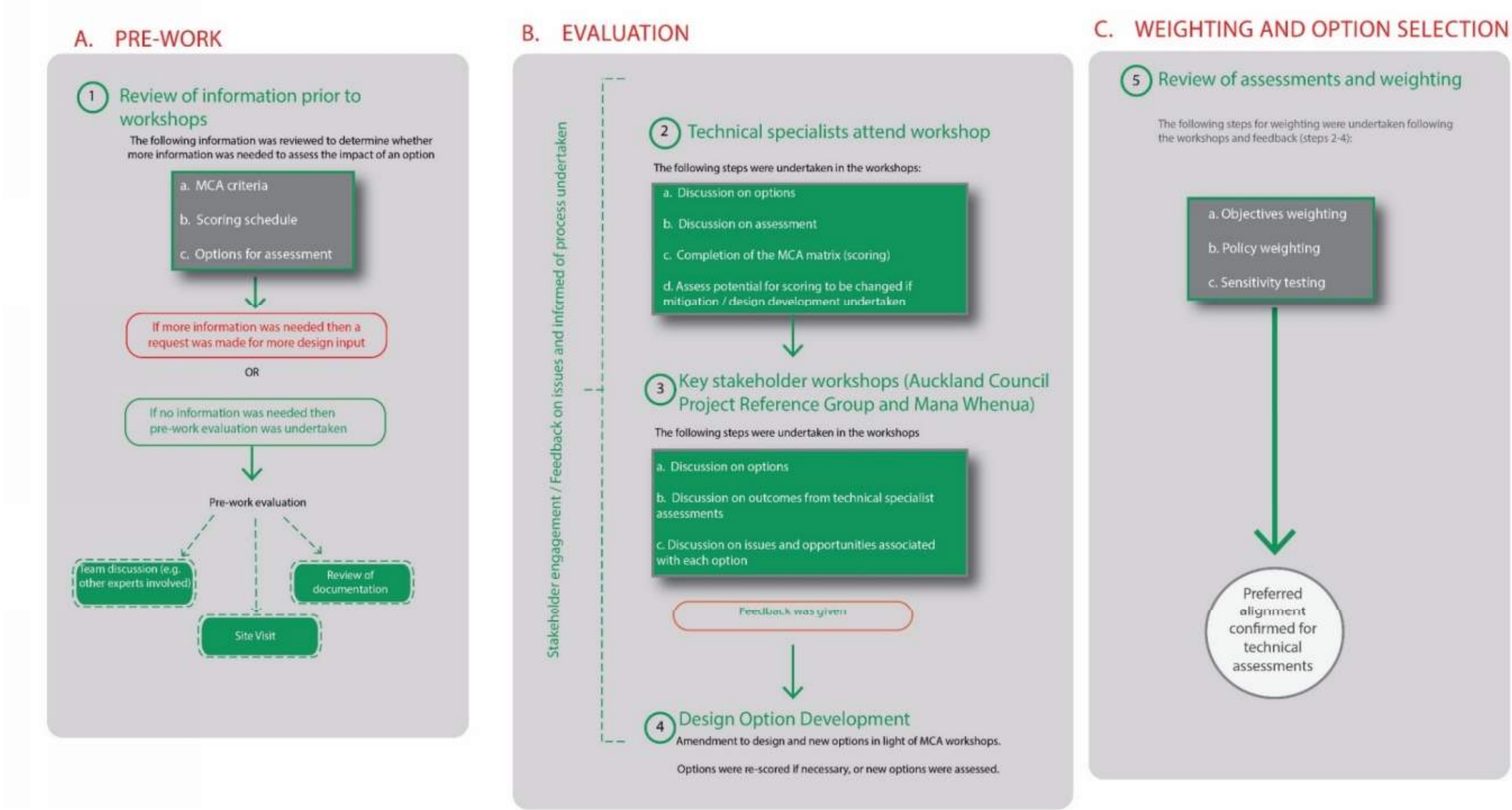
The process for MCA evaluation followed these key steps:

- **Briefing** - An information package was prepared and circulated for each geographic area for discussion and evaluation at the MCA workshops. Each package contained a short memorandum providing background and summarising each option, detailed design plans and cross sections and extracts from the planning documents to identify key environmental features. The full suite of plans for each option is contained in *Appendix J: Workshop Information Packages* contained in *Report 1: Assessment of Alternatives* in Volume 3.
- **Pre-Workshop Assessment** - This phase involved investigations and collecting base information to inform the option assessment. In some instances, (e.g. in the case of the foreshore bund options), an initial briefing session workshop was held with experts to explain the design variations of options (prior to the assessment workshop).
- **Workshop Assessment** - At each section workshop[44], the nominated experts provided an assessed score (using the 11 point system) for each of the options presented. The purpose of a workshop in this step was to gain a shared understanding of the design options and to discuss impacts / considerations of the experts in reaching the MCA scoring under specific criteria. Where appropriate, outstanding issues were identified. All scores from the workshop assessment were 'preliminary' to enable assessment by Mana Whenua prior to finalising.
- **Finalised assessment** - Following the workshop and Mana Whenua inputs the assessments were completed.
- **Design development** - The final step of the option assessment was to confirm if the scoring undertaken could be substantially changed if mitigation / design amendment was made. If this opportunity was identified, further design development was undertaken. In a number of cases, this resulted in 'new design options' or sub-options being identified (e.g. Option 2b at Princes Street Interchange, and Option 4 in the case of the Neilson Street Interchanges). In these cases, further assessment was undertaken to confirm the revised scoring for the new option/sub-option being considered.

[44] Workshops were held over April and early May 2016.

- **Weighting** - This step considered the feedback from key stakeholders. Tests have been undertaken to consider the weighting of the criteria against different RMA policy matters and the overall Project objectives. The weighting process was used to sensitivity test the MCA results.
- **Recommended Option** - This final step included a review of the MCA results, the implications of weighting and the stakeholder engagement inputs to the process.

Figure 8-21: Multi Criteria Analysis process



8.4.1.5 Weighting

Following the collation of raw scores for each option further analysis was undertaken to assist with understanding the advantages and disadvantages of certain options and to assist in identifying a Preferred Corridor. The use of weightings allows for sensitivity testing of the scores for each option and gives an indication of the robustness of the outcome. Further detail is provided on the identification of weightings is contained in *Appendix K: Weightings for MCA Scores for Alignment options* contained in *Report 1: Supporting Material for the Consideration of Alternatives* in Volume 3.

Seven different weighting systems were used:

- Transport / Project Objectives emphasis;
- Mana Whenua values driven by the priorities identified by Mana Whenua in the project engagement;
- Natural environment;
- Land requirements and impact on industrial activity;
- Landscape and geological;
- Social and community, recognising that these are RMA section 7 matters and social well-being is a core component of section 5 of the RMA; and
- Sections 5 and 6 of the RMA balance: Sought to apply a balanced approach to the competing matters, including the economic enablement as represented by Project Objectives and the section 6 matters of national importance while giving some emphasis to other relevant section 7 matters.

8.4.2 Outcomes of Preferred Alignment Assessment

8.4.2.1 Multi Criteria Analysis reporting

The record of the discussions and outcomes of the MCA workshops are contained within *Appendix L: Work Notes for Alignment options* contained in *Report 1: Supporting Material for the Consideration of Alternatives* in Volume 3.

The figures below provide a graphical summary of the outcomes from the MCA evaluation and reporting on the key considerations which informed the option selection for each segment. The ‘best performing’ option identified from the assessment process is highlighted in red for each sector, with those criteria scoring as ‘positive’ showing above the neutral line (in the blue area of the figure) and those scoring ‘negatively’ showing below the neutral impact line (in the red area of the figure).

As noted above, Mana Whenua did not provide a single ‘score’ for the Mana Whenua values criteria. Where relevant, comment is provided on their preference for options considered in each sector.

Figure 8-22: Neilson Street Interchange

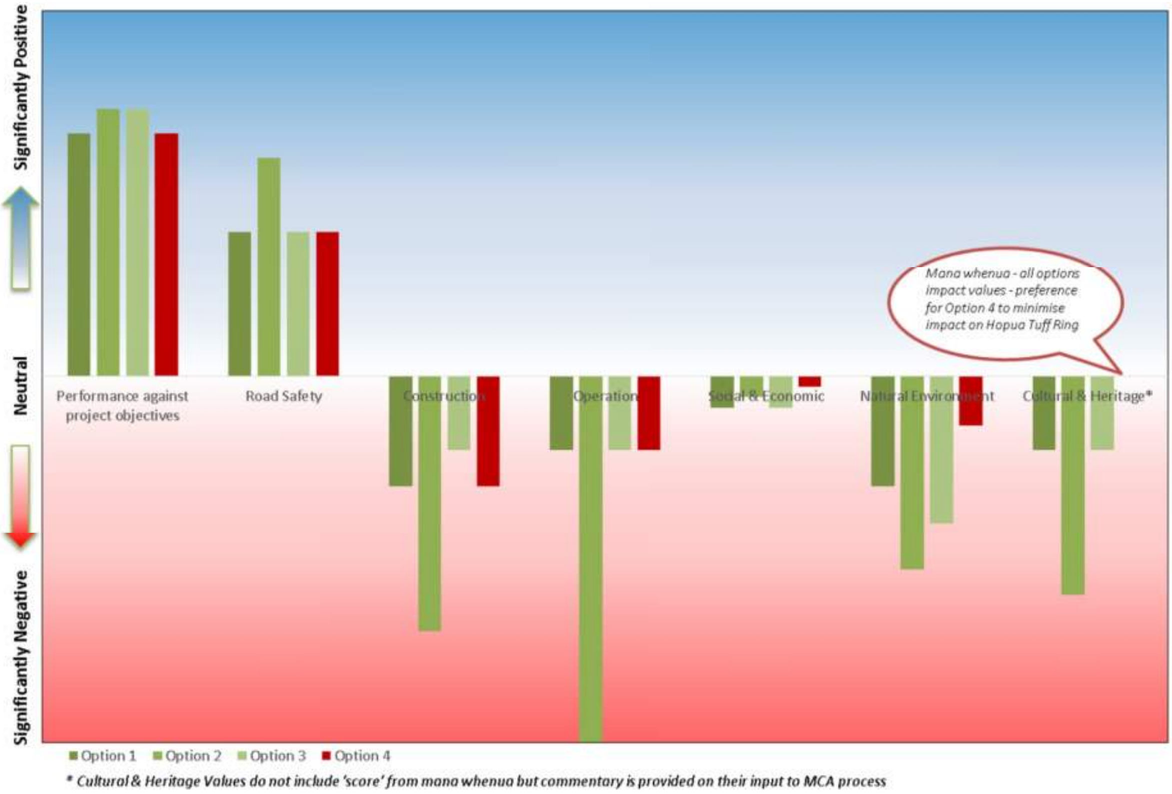


Figure 8-23: Foreshore options

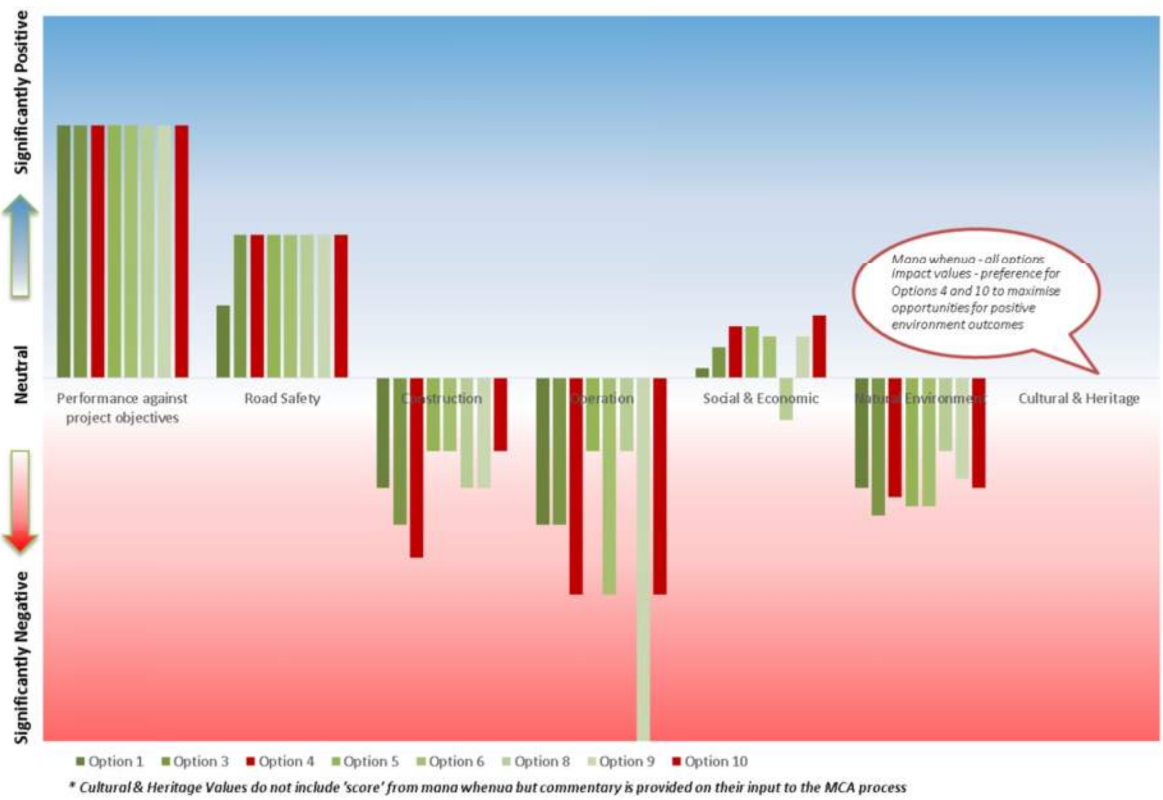


Figure 8-24: Anns Creek

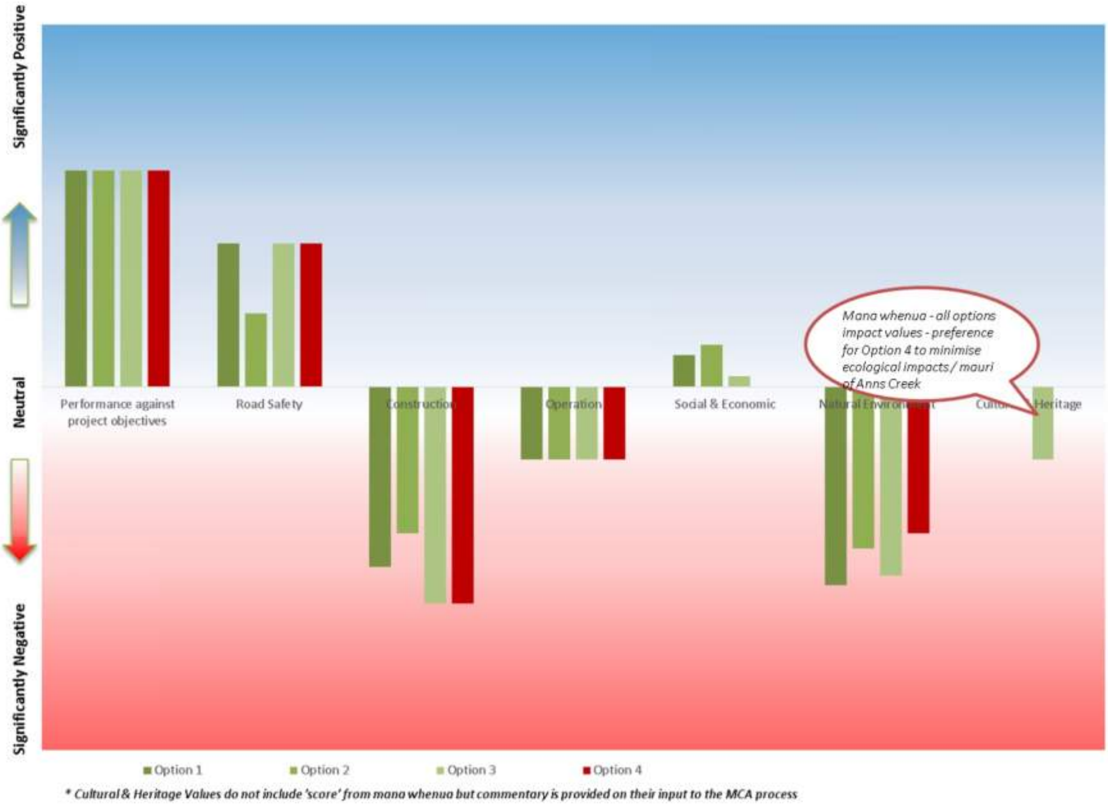


Figure 8-25: Ōtāhuhu Creek

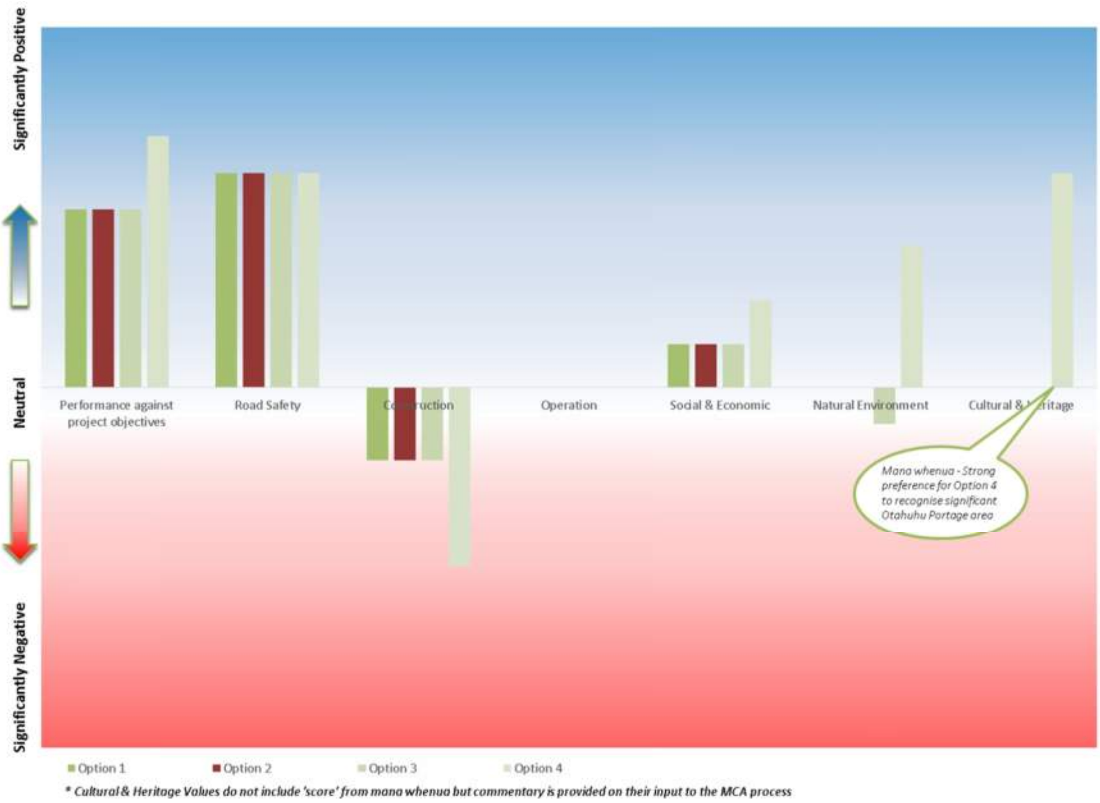
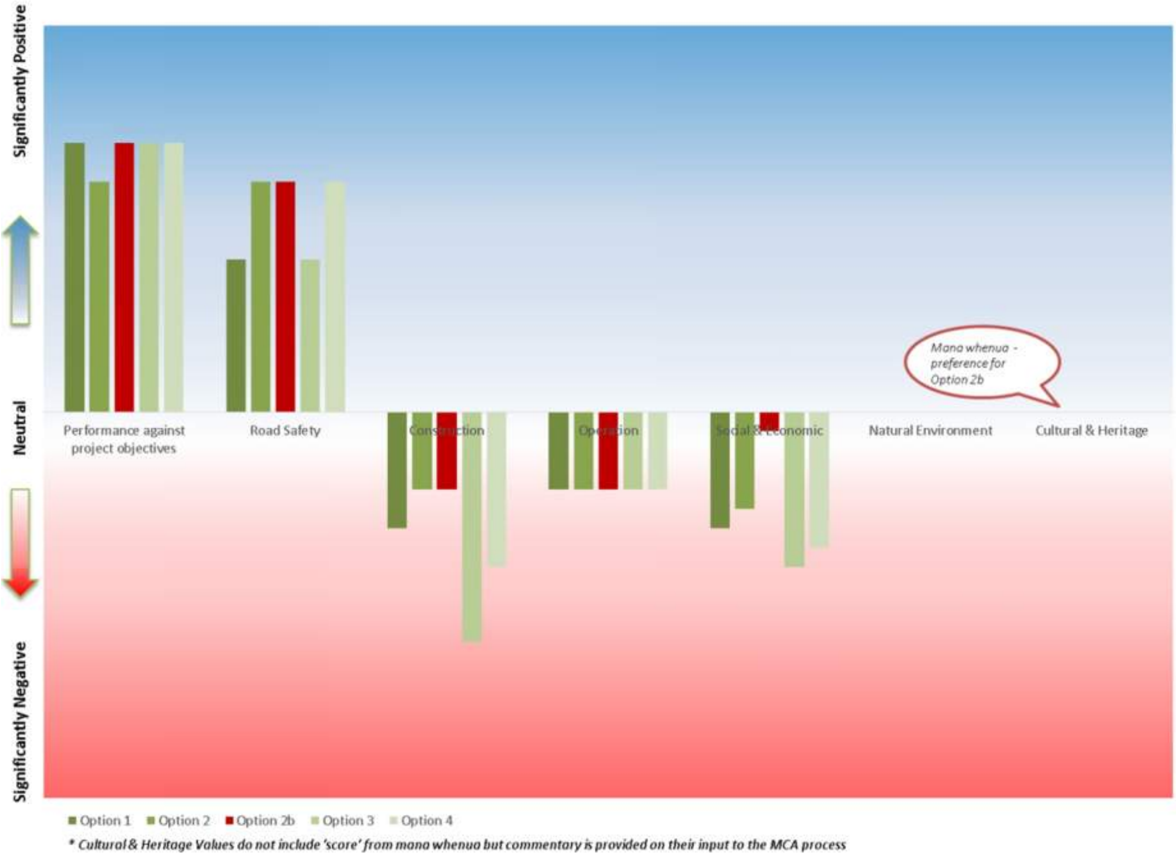


Figure 8-26: Princes Street Interchange



These raw scores then had a range of weightings applied to them. The weighted scores are contained with *Appendix M: Weighted MCA Scores for Alignment Options* contained in *Report 1: Supporting Material for the Consideration of Alternatives* in Volume 3.

8.4.2.2 Stakeholder engagement outcomes

From February 2016, consultation and engagement was undertaken with stakeholders. The purpose of this engagement has been to:

- Inform stakeholders and landowners of project progress to date, and programme going forward including opportunity for ongoing engagement; and
- Consult with key stakeholders on issues and opportunities associated with options being assessed through the MCA process to input into the decision on the Preferred Alignment.

Engagement has focused on key stakeholders (Auckland Council, Mana Whenua, and Auckland Transport). In addition, engagement has been undertaken with community representatives, major landowners, utility providers and other groups to inform the technical assessment of options. The outcomes of the engagement are summarised below.

In summary, key matters identified through stakeholder engagement that has informed design development and option assessment in this process includes the following:

- The importance of avoiding impacts on sensitive locations, geological and ecologically important values. In particular, this included:
  - Avoiding any permanent land modification of Te Hōpua tuff ring (identified as an ONF);
  - Avoiding the remnant lava flows along the coastline of the Māngere Inlet;

  - Avoiding Anns Creek, particularly identified SEAs and Coastal Protection Areas; and
  - Avoiding the urupā / culturally significant area at Mt Wellington.
- The importance of the area for economic activity, including:
  - Recognising the scarcity of business land in Auckland;
  - Maximising opportunities for traffic movement between Onehunga and Penrose; and
  - Avoiding stop-start traffic.
- Opportunities for environmental enhancement of degraded coastal environment:
  - Restoring the natural character of the coastal environment;
  - Managing stormwater and leachate discharges to Māngere Inlet to improve water quality of receiving environment;
  - Opportunities to restore ecological values of Anns Creek and foreshore wading areas;
  - Improving access to and along the CMA;
  - Re-establishing significant portage and coastal values of Ōtāhuhu Creek; and
  - Improving resilience to climate change for land at Onehunga – Penrose.
- The importance of opportunities to revitalise Onehunga Town Centre and the foreshore, including opportunities to improve connections between the community, foreshore, town centre and port.
- The importance of opportunities to create connections (or avoid barriers) to other modes of transport, particularly walking and cycling, and rail (including future rail).
- Improved recreational access to the foreshore and Māngere Inlet (including walking and cycling movements).

8.4.2.3 Outcomes of the evaluation by sector

The following sections describe the key considerations and factors that were involved in choosing the preferred option in each section. As with the selection of the Preferred Corridor, the decision on the preferred option for each sector was informed by the MCA scoring, consultation feedback, relevant planning considerations and how each option met the Project Objectives.

a. **Neilson Street Interchange**

All options considered maintain the opportunity for a mass transit connection to Auckland Airport.

Option 2 (retention of the existing interchange, trenched connections between SH20 and EWL and no bridge over SH20) was dismissed on the basis of the potential adverse effects (including on environmental and Mana Whenua values) and cost. In addition this option did not contain commensurate benefits or contribute to the Project Objectives sufficiently (e.g. transport performance) to balance those potential adverse effects.

The transport difference between Options 3 and 4 (both free flowing linkages) is marginal. However, Option 4 performs consistently better against other criteria, particularly reducing impacts on the ONF values.

Comparing Options 1 and 4, Option 4 performs better in most cases. Option 4 is better particularly in respect of social and economic aspects, Mana Whenua values, and consideration of the relevant policy tests including the potential impacts on the coastal environment and ONF values.

On this basis, **Option 4 was carried forward for design, detailed technical assessment and engagement**[45].

Key issues identified for further design and assessment investigation were:

- Opportunities to reduce impacts on the ONF values through more detailed assessment of the values of Te Hōpua tuff ring, design response, and urban design opportunities to celebrate the feature;
- Enabling continued connectivity between Old Māngere Bridge and Onehunga Town Centre;
- Integration of the southern section of EWL with Onehunga Wharf alignment;
- Maintaining opportunities for rail integration with design of structure at Galway Street (noting all design options provided for a future mass transit to the airport connection);
- A connection at Orpheus Drive and Onehunga Wharf;
- Assessment of the Aotea Sea Scouts Hall and integration with EWL; and
- Local road improvements and the interface with the local network (i.e. how to get the benefits out of Neilson Street with less traffic).

b. **Foreshore alignment**

Option 9 (involving an inner Māngere Inlet alignment with mechanical stormwater treatment) scored very poorly on operational costs and risk assessment for the environmental outcomes it would deliver. This scoring included the safety considerations for maintenance requirements on the mechanical treatment system. Although it scored positively for stormwater management there was a risk because the scale of the technology is untested.

Option 1 (involving a bridge design) and Option 3 (involving a reserve edge embankment alignment with no opportunity for catchment stormwater treatment) both scored poorly on:

- Mana Whenua values, reflecting the limited opportunity to address stormwater / leachate management to the Māngere Inlet (which was important to Mana Whenua based on their feedback), which was identified as a potentially significant opportunity with other options;
- The potential for leachate disturbance from piling within contaminated land; and
- The limited ability to restore the natural character of the coastal environment in the treatment of the coastal edge.

Option 5 (involving an inner Māngere Inlet embankment) addressed leachate discharges but had no opportunity for the management of wider catchment stormwater. Option 5 also increased the inland flood risk.

Option 6 achieved the stormwater management opportunities for the wider catchment, but did little for leachate (unless managed with the stormwater treatment) and required the road to be constructed on the outer bund. Due to the constraints of the road alignment, the naturalisation of the coastal edge may have required additional intrusion into the CMA. Option 6 also created a consequential increase in flooding risk for the land north of the bund if the storage capacity of the treatment area was exceeded.

Option 8 (involving an inland alignment) had the least opportunity for positive outcomes for stormwater management, leachate capture and natural character restoration, while still being an alignment 'close' to the coast. Given the significant potential impacts of disturbance at Waikaraka Cemetery it was assessed

[45] Subsequent to this outcome an alternative design was put forward by the Onehunga Business Association. This was assessed by the Project team as discussed further in *Section 8.4.3.3* of this AEE.

with some reclamation at the western edge, which would then require bridging or crossing the Manukau Foreshore Walkway. This option also had potential significant land impacts on established industrial areas. The cost assessment for Option 8 provided for land cost, but not business disruption (which was potentially significant). It was recognised that this construction design might be appropriate in some areas of the alignment, particularly where there is an opportunity to construct the alignment without piling into the basalt thereby avoiding potential groundwater impacts.

Options 4 (reserve alignment with outer bund) and 10 (inner Māngere Inlet alignment with outer bund) had potential for positive stormwater and leachate management as well as opportunities for restoration of the natural character of the coastal edge and public access to and along the CMA. Option 4 had potential impacts on groundwater with the piling methodology proposed, particularly in areas of basalt. However, it was identified that if an alternative construction method could address this potential impact, it had the potential to reduce the extent of reclamation. This was considered beneficial from coastal processes, policy and ecological perspectives (noting existing ecological values are low to low-moderate, though there is an area of foraging for wading birds).

For the foreshore construction methodology, there could be areas of the foreshore where the soil composition and the historic use of clean fill meant it could be implemented without the leachate impact. This could apply to Option 4 or Option 8. Options 4 and 10 both provided the best opportunity for creation of a 'naturalised' foreshore edge providing public access to and along the coast and new ecological habitat. The leachate and stormwater treatment opportunities along with the restoration of a naturalised coastal edge were identified as very important by Mana Whenua for respecting and restoring the mauri of the Māngere Inlet.

On this basis, **Options 4 and 10 were taken for detailed technical assessment and consultation**, and design development sought to achieve the following outcomes:

- Provide for EWL alignment and local road connections;
- Restore and rehabilitate the natural character of the coastal environment and coastal edge;
- Provide public access to and along the CMA, including pedestrian and cycle connectivity;
- Improve water quality of the receiving coastal environment through the management of stormwater and leachate discharges (including opportunities for catchment-wide integrated solutions); and
- Improve resilience for future coastal inundation as a result of climate change related sea-level rise, which has the potential to increase flooding risk and potential for leachate disturbance.

Other matters which were to be addressed during, and in parallel with, the design process were:

- Reducing the extent of reclamation to the greatest extent practicable, particularly in identified areas of ecological value whilst recognising constraints of basalt and significant land use constraints;
- Understanding the problems in the existing environment, including the state of receiving environment and causes of environmental degradation, to better design treatment options;
- Liaison with Auckland Council on the ongoing operation of stormwater and leachate management systems;
- Development of an environmental strategy to determine the outcomes for the Māngere Inlet, including ecological impacts and mitigation/off-sets;
- Development of a public access strategy and urban design outcomes for the design development of the foreshore, including linkage at Alfred Street for pedestrians / cyclists; and
- Construction methodology for any reclamation and structures, and coastal processes of these options.

c. **Anns Creek**

All the options would have potentially significant adverse effects and significant issues were identified with all options.

Option 1 had industrial land impacts east of the rail corridor and impacts on the Southdown Reserve (which had consequential stormwater impacts), but it avoided areas of valued terrestrial ecology. There was little opportunity to address the discharges from leachate and stormwater along this area to the CMA. This option impacted on the valued coastal environments.

Options 2 and 3 impacted the Southdown Co-generation Plant but avoided the Transpower towers and other industrial land uses. These options impacted the area of terrestrial ecological value along with the Coastal Protection Area 1 / SEA Marine 1. Both options also avoided Southdown Reserve.

Option 4 sought to address the impacts on the CMA (including Coastal Protection Area 1 / SEA Marine 1) by locating the alignment on land along the northern foreshore. However due to the need to maintain a safe road design, there were consequential increases in property impact. These impacts included increased industrial land acquisition, impacts on Southdown Reserve and impacts on Transpower towers requiring relocation of two or three towers.

On the basis of this, the approach for **further design and technical assessment was a modified Option 4** to provide for signals at Hugo Johnston Drive to reduce travel speeds on the EWL which reduced the impact at Southdown Reserve. This would shift the alignment further to the south (south of the Southdown Co-generation Plant) and this would potentially impact on the valued ecological area and natural features at Anns Creek.

Other matters which were to be addressed during, and in parallel with, the design process were:

- Minimising impacts on Southdown Reserve;
- Opportunities for relocation of the heliport operations to address land use impacts associated with the foreshore option;
- Further understanding ecological values for the CMA, Anns Creek and Southdown Reserve and how impacts could be mitigated;
- Understanding business land impacts and overall business activity functionality of this area in the context of the wider City;
- The cycleway alignment through the area and connecting to Great South Road;
- Impacts on Transpower and First Gas assets; and
- Further understanding values of natural features in Anns Creek and mitigation of impacts.

d. **Great South Road – Sylvia Park Road – SH1**

Whilst a number of options were identified along this alignment, only one horizontal alignment option was identified as practicable for safety and land use reasons whilst seeking to avoid the transmission lines and encroachment into Mutukāroa-Hamlins Hill. This option provides for:

- An at grade intersection at Great South Road / Sylvia Park Road;
- Widening of Sylvia Park Road to the south (including acquisition of private property);
- A structure for south-facing ramps from Sylvia Park Road to SH1; and
- Auxiliary lanes on SH1 from new ramps to and through the Princes Street interchange.

Other matters which were identified as needing to be addressed during design and assessment to consider the potential opportunities to avoid, remedy and mitigate 'localised' impacts included:

- Detailed assessment of the safety implications of the alignment, including the design of the north-bound off-ramp from SH1;
- Cycleway connection to Sylvia Park;
- Land use impacts, particularly at Mt Wellington and Sylvia Park Road;
- Access to businesses at Great South Road / Sylvia Park Road intersection;
- Potential impacts and access to Mutukāroa-Hamlins Hill;
- Integration with significant infrastructure (Transpower and Watercare in particular); and
- Local road accesses and integration of EWL with local road / passenger transport corridors.

In subsequent engagement with key stakeholders, the consideration of options for either an at grade or grade separated intersection at the EWL / Great South Road / Sylvia Park Road intersection was raised. Further assessment of alternatives was undertaken for this intersection, with the result being a revised alignment incorporating a grade separated intersection. This is discussed further in Section 8.4.3.6 of this AEE.

e. **Ōtāhuhu Creek**

All options provided for a potential pedestrian and cycle connection over the Ōtāhuhu Creek.

Option 3 (extending the causeway and culvert extension) was dismissed because of its coastal process and natural environment impacts. The cost saving of this option was marginal, particularly if a standalone pedestrian and cycle bridge was also to be built.

Option 4 (replacement with a bridge) performed best in terms of long term environmental outcomes and, in particular, coastal processes, public access and recognising the culturally significant portage. However, the option had significant cost implications and potential adverse impacts during construction including disruption on SH1 and due to congestion could affect industrial land uses (and the general public).

Given these issues, detailed **technical assessment and engagement on Option 2** (new bridge with abutment), which avoids adverse effects on coastal processes (relative to Option 1) and provides better opportunity for pedestrian and cycleway provision was identified to be taken forward. While slightly higher cost than Option 1, it is able to be constructed quicker which was important for the operation of SH1. In addition, further assessment of the opportunities and positive environmental outcomes of Option 4 were also to be considered.

f. **Princes Street Interchange**

The interchange at Princes Street needs to be upgraded and replaced.

Options 1 (overbridge to north) and 3 (single point urban interchange) were not recommended as they did not perform as well for pedestrian and cycle connections which is a core Project objective. Option 4 (full diamond interchange) performed slightly better than Option 2b (overbridge south with mitigation) for pedestrians and cyclists, but potentially increased residential land acquisition. Depending on the design of the on-ramps to SH1, queues on local through traffic would be affected differently (either positively or adversely); this is relevant to both Options 2b and 4.

Following evaluation, safety review confirmed that Option 2b could address operational and safety requirements. On this basis, **Option 2b was taken forward** for design and technical assessment.

8.4.3 Further refinement incorporating feedback and technical assessment

Design, technical assessment and engagement with landowners, stakeholders and the general public identified a number of potential new alternatives or provided additional information on the already identified alternatives. This information identified a series of design and route amendments. The most significant amendments are discussed below.

8.4.3.1 Great South Road Intersection

Traffic modelling for the preferred option indicated that a new at grade East West Link / Great South Road / Sylvia Park Road intersection would have high traffic volumes, particularly in peak periods. The level of service (LoS) offered by the preferred option ranged from LoS D to E in 2026 with potential to decrease to LoS E to F in 2036. Long term performance of the intersection is a potential future risk as traffic volumes increase associated with Auckland's planned growth. In addition, during public engagement key stakeholders raised concerns about the potential for significant congestion at this intersection. Alternative designs for an at grade design did not sufficiently respond to this issue. A grade separated solution for the new East West Link / Great South Road / Sylvia Park Road, intersection has therefore been developed to respond to this issue, including improved cycle and pedestrian access, improved level of service for all movements including a substantial improvement for east west movement, and a more enduring and resilient design compared to the at-grade design.

The option development and evaluation process is set out in section 8.4.3.6.

8.4.3.2 Connections to Port of Onehunga

Feedback and technical assessment confirmed the most appropriate alignment in the vicinity of Neilson Street and Te Hōpua tuff ring was the chosen free flow option, with the exception of the connection to the Port of Onehunga.

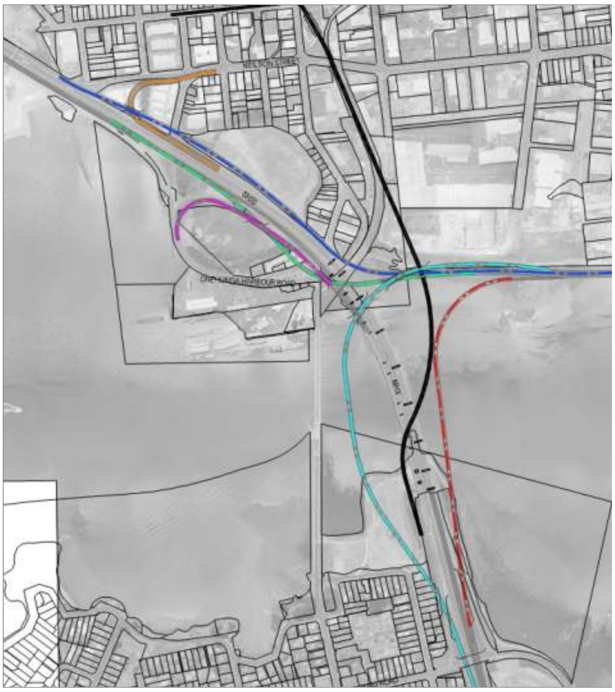
Auckland Council, Panuku and various members of the Onehunga community identified the potential impact the Project could have on the connections between the Onehunga Wharf and Onehunga Town Centre. The preferred option involved an at grade section of road adjoining the Wharf with a local road overpass directly connecting the Onehunga Wharf and Onehunga Mall.

In response to this feedback an alternative design was developed which involved constructing a trench along Onehunga Harbour Road with an at grade local road crossing over the deepest section adjacent to The Landing Hotel. The design increased construction costs and construction effects but will not affect the natural geological feature of Te Hōpua Crater. The trenching of the EWL will assist to provide better connections to the Onehunga Wharf, achieve a better urban design outcome and reduce the "barrier effect" potentially created by other options assessed.

8.4.3.3 Alternative Neilson Street Interchange

During the engagement process in 2016 (refer to Section 9.5: Pre-lodgement engagement (2016) of this AEE) an alternative design for the Neilson Street Interchange was put forward by the Onehunga Business Association. The design presented by the Onehunga Business Association was conceptual. The Project team undertook further design of this alignment in consultation with the Onehunga Business Association. The outcome of this design development is referred to as the OBA Option and is illustrated in Figure 8-27.

Figure 8-27: OBA Option



More detailed information regarding the OBA Option can be found in Appendix O of *Report 1: Supporting Material for the Consideration of Alternatives* (Volume 3). The design is similar in form to the earlier Option 2 design which was developed from an interchange design put forward by The Onehunga Enhancement Society earlier in the option assessment process. The assessment of Option 2 is summarised at Section 8.4.2.3(a).

A review of the OBA Option was undertaken by comparing it to Option 2 on the basis of the similarities between Option 2 and the OBA design. This assessment included a review against the same MCA criteria previously applied to the assessment of Options 1-4 of the Neilson Street interchange. Where the potential scoring of the OBA Option against the MCA criteria was considered potentially different from the evaluation and scoring of Option 2 (refer to Section 8.4.1.1a of this AEE) further assessment was undertaken.

The assessment comparing Option 2, the OBA Option and the preferred Option 4[46] indicated:

- The OBA Option has greater time savings for some vehicle movements, but increased congestion for others. Particularly it provided improved travel times for movements between the EWL and SH20 southbound, but resulted in operational or capacity issues for SH20 between Queenstown Road and SH20A.
- Overall, the OBA Option performed the same for travel time savings and bus access as Option 2 and Option 4, but slightly worse for walking and cycling connections. The lower performance for cycling and walking arises due to higher traffic flows on Onehunga Mall and complexity in the regional cycle/walking path connections to the east (crossing the ramp connections between EWL and SH20 (south).
- The OBA Option scored better compared to Options 2 and 4 for transport safety given simpler connections from SH20 to EWL.
- The OBA Option scored more poorly due to higher construction and operation costs compared to Option 4. The cost is significantly more than Option 4 due to the use of a tunnel and more structures.
- The OBA Option scored more poorly for all environmental criteria compared to Option 4. None of the options were specifically considered in respect of impacts on coastal processes in the earlier MCA process (this was because no options considered at that time involved change to the existing bridge structures or new bridge structures across the Māngere Inlet).
- In terms of the social outcome criteria, the options were the same or very similar in respect of the scores for access to the coast, built form and amenity, connectivity (for connection to the Onehunga

[46] To enable fair comparison between options, the scores reported relate to the original Option 4 alignment, not subsequent design development that has been undertaken .

Town Centre) and economic viability. However, the OBA Option did not score as well for quality of living, construction impact and heritage.

- The OBA Option would not provide better connectivity between Onehunga Town Centre and the Port of Onehunga than Options 2 or 4 because of the presence of a number of new structures and overpasses and fewer walking and cycling routes.
- The evaluation of the OBA option is further elaborated in Appendix O to *Report 1: Supporting material for the Consideration of Alternatives* in Volume 3.

From this process, Option 4 was affirmed as the most appropriate option to progress (subject to responding to the design issues identified for Option 4 from the initial MCA evaluation as set out in Section 8.4.2.3 of this AEE).

A full MCA workshop and assessment was undertaken for the OBA Option in December 2016 and followed the process set out in this section. This MCA involved a range of relevant experts who scored the OBA option in their relevant discipline. The scores against the relevant criteria were largely the same (or worse) than the earlier assessment of the OBA Option. As a result, none of the outcomes of this process altered the conclusions of previous assessments and decision making set out above.

8.4.3.4 Foreshore alignment and design

Whilst a combination of two options was preferred, only one option that had the inner embankment on land and the outer embankment in the coast was presented to the public and stakeholders during consultation.

Feedback from key stakeholders and public expressed the importance of minimising the amount of the CMA to be reclaimed. This approach to minimise reclamation is consistent with the provisions of the NZCPS and the AUP (OP). Further design and technical assessment identified that the adverse effects of the construction of the road through the former landfill areas could be adequately remedied or mitigated to a greater degree than previously expected (although not entirely avoided). However, avoiding any physical works within Waikaraka Cemetery remained a key constraint and meant that it was not practicable to apply a single design option along the whole of the foreshore.

In light of this additional information, it was considered the more inland option between the eastern edge of Waikaraka Cemetery and the Ports of Auckland property was preferable as it reduced the area for reclamation while the additional adverse effects could be addressed. This involved constructing the road embankment on land to the greatest practicable extent, and the stormwater treatment wetlands within reclamations of the CMA. Meanwhile, for the part of the foreshore directly to the south of Waikaraka Cemetery the option to avoid physical works in the cemetery was identified as the most appropriate in light of the historic and amenity values of the cemetery.

Along with the identification of an alignment incorporating the parts of two options, a revised design for the foreshore edge was developed. This reduced the potential extent of reclamation and the effects on Waikaraka Cemetery. This is explained in greater detail in *Technical Report 6: Landscape and Visual Impact Assessment* and *Technical Report 12: Stormwater* Assessment contained in Volume 3.

8.4.3.5 Anns Creek Estuary and Anns Creek

The original route alignment assessed by the specialists and outlined in public engagement followed the northern shoreline of Anns Creek Estuary, crossed the railway lines, proceeded south of the Southdown Co-generation Plant and through the centre of Anns Creek to an intersection with Great South Road and Sylvia Park Road. A number of amendments to the alignment in this area were proposed as a result of landowner feedback and technical assessment.

Technical assessment and information from KiwiRail identified that the proposed crossing of the railway lines would result in noticeable impacts on the operation of those lines and a potential additional line which may be constructed in the future. KiwiRail has a designation for railway purposes for this area. This means that no work by other parties, including other requiring authorities can be undertaking in this corridor without formal approval of KiwiRail. KiwiRail's approval may be withheld of conditioned if proposed works prevent or hinder its railway activities.

As a result of this feedback the previously selected option could not be implemented and consequently Options 2 and 3 (involving a bridge structure across Anns Creek Estuary) needed to be considered again. This also re-considered parts of the Option 4 alignment where the alignment had minimal land requirement from the Southdown Co-generation Plant. A new Option 5 was developed as an alternative design. Technical assessment identified that moving the alignment from land and constructing a bridge would result in more adverse effects on ecological values than the previously selected option. This was taken into account when designing the location and orientation of the bridge (in Option 5) that would minimise the adverse effects as much as possible. This impacted on the alignment or "launch point" of the bridge on the industrial land to the east of the Anns Creek Estuary.

Technical assessment of the ecological and ONF values in Anns Creek East identified a number of highly sensitive and valued areas with unique and irreplaceable fauna within the proposed alignment. As a result the alignment was moved to the north to avoid as far as practicable these sensitive locations. Particular care was taken with the location of the bridge piers and the construction areas to further reduce the potential effects. The alignment chosen in Anns Creek (as shown in Option 5 Appendix N to *Report 1: Supporting Documents for the Consideration of Alternatives*). sought to balance the need to minimise the ecological effects and the impact on the railway line, while avoiding the Southdown Co-generation Plant and most importantly ensuring the design of the structures was safe and efficient. Although the preferred alignment avoids the Plant the designation will extend into that site to accommodate potential construction activities or any potential amendments to the alignment.

8.4.3.6 Great South Road Intersection

Following completion of the traffic modelling of the Preferred Alignment (as described in *Section 8.4* of this AEE) and feedback from a number of stakeholders (including Auckland Transport and road user groups), concerns were raised in respect of the long term operation and level of service of the Great South Road and Sylvia Park Road intersection. In particular that the intersection would result in longer than anticipated delays for east west traffic and the performance and level of service offered by the intersection would decrease over time and be unable to accommodate predicted future traffic flows. Additional assessments have been undertaken to determine if a different design, such as full grade separation, would improve the long term transport performance and level of service of this intersection. The option development and summary of outcomes for the intersection are set out below.

a. Option development

In response to issues noted in *Section 8.4.3.6* above, a number of alternative designs for the intersection were identified which allowed for at grade and grade separated connections and provided a through traffic movement for the east west traffic flow without the need to stop at the intersection. Options for grade separation included designs to put the EWL under Great South Road. However, these options were determined to be constrained and impracticable, particularly as a result of the location of significant underground services and ecological values of Anns Creek.

The options involved structures over Great South Road, with full movements to the EWL provided from Great South Road via a signalised intersection and connections to the elevated structures. The option assessment was constrained by the location of the existing Great South Road intersection, properties and surrounding protected features such as Mutukāroa -Hamlins Hill. An initial Project Team workshop was held to identify key opportunities and constraints using the planning, social, cultural and environmental assessments undertaken to date. From this, two new alignment options were developed. The options are shown in the drawings in *Appendix P Great South Road Intersection Assessment* contained in *Report 1: Supporting Documents for Consideration of Alternatives* in Volume 3.

Option 1: An extension of the viaducts over Anns Creek, grade separated over the Great South Road and Sylvia Park Road intersection and terminating at an at grade alignment east of the Great

South Road intersection. It included modified connections to Great South Road (refer to Appendix P of Report 1 for details).

Option 2: Extension of the existing Anns Creeks viaducts over Great South Road and Sylvia Park Road via a continuous bridge structure connecting to SH1 at Mt Wellington. It also included modified connections to Great South Road (refer to Appendix P of Report 1 for details). The net result of this design option is that the EWL would be completely separate from Sylvia Park Road.

These two options were then evaluated through an MCA and also compared to a base option which was the previous at grade intersection design.

b. Multi Criteria Analysis Criteria, Scoring, Analysis Process and Weighting

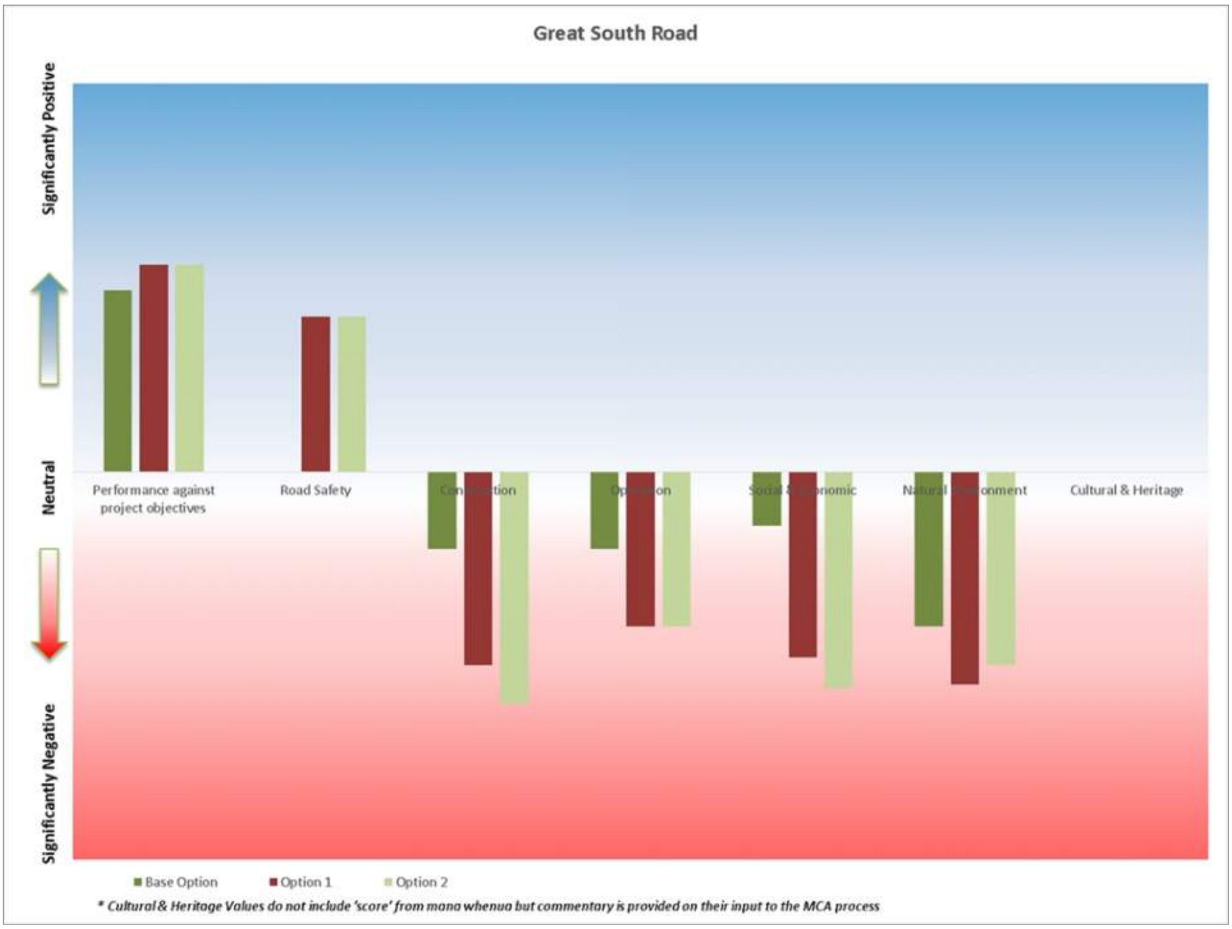
The MCA for Great South Road grade separation used the same assessment criteria as earlier options assessment (as set out in Sections 8.4.1.2 to 8.4.1.5 of this AEE). No weighting was applied to the MCA scores though, since only two options were assessed. Sections 8.4.1.2, 8.4.1.3, 8.4.1.4, 8.4.1.5 of this AEE outlines the MCA process, criteria and scoring used, including for the grade separated Great South Road intersection options.

c. Multi Criteria Analysis reporting

A record of the MCA outcomes for the Great South Road options assessment is contained within *Appendix P: Work Notes for Alignment Options* contained in *Report 1: Supporting Documents for Consideration of Alternatives* in Volume 3.

The figure below provides a graph summary of the outcomes from the MCA evaluation and reporting on the key considerations for the Great South Road intersection.

Figure 8-28: Great South Road



d. Stakeholder engagement outcomes

In a manner consistent with the development of earlier options, further consultation was undertaken with key stakeholders. This consultation was targeted to potentially affected landowners, Mana Whenua, Auckland Council, road user groups and Auckland Transport. The purpose of the additional consultation has been to:

- Inform stakeholders and landowners of the revised design, the reasons behind it and the revised programme going forward; and
- Consult with key stakeholders and landowners on additional issues associated with the revised design to enable opportunity for these issues to be considered in design refinement.

In addition, engagement has been undertaken with utility providers and other groups to inform the technical assessment of options. The key matters identified through stakeholder engagement that have informed design development and option assessment include:

- The importance of provision for pedestrian and cycling connections through the area given the higher speed environment and built form / structural elements of the option;
- Minor design amendments to address access and operational concerns for Stratex;
- Minor design amendments to enable the operation of other businesses in the area; and
- Design detail for structures to avoid the pier exclusion area in the Anns Creek area.

e. Outcomes of evaluation

The evaluation of the options at Great South Road was informed by the MCA scoring, consultation feedback, relevant technical considerations and how each option met the Project objectives. As with earlier assessments, the intention of the MCA process was to provide a summary of issues for decision making rather than being a decision making tool in itself.

Options 1 and 2 both performed better in terms of improved travel times between businesses and user safety when compared to the base option (i.e. the at grade intersection design). These criteria are reflective of the Project objectives.

Both Options 1 and 2 had higher adverse impact scores on the social and environmental criteria when compared to the at grade design option. These increased adverse effects were particularly noted for landscape, urban design and social criteria. At the time of assessment, the treatment of both pedestrian/cycle connections and overall operational speed of traffic on the EWL were issues impacting this scoring. In particular, the latter issue related to the urban form, landscape and character impacts of the EWL through the Anns Creek to Sylvia Park Road area (which is characterised as an 'industrial arterial area'), and the potential to generate cumulative impacts (e.g. increased traffic speeds and changing character of the Project) that would adversely impact on the visual, amenity, natural character and social outcomes of the Project further to the west (the foreshore section of the Project). These issues were identified as of significant concern.

Alignments involving grade separation of the intersection were considered to better meet the objectives of the Project, particularly Objective 1 (To improve travel times and travel time reliability between businesses in the Onehunga-Penrose industrial area and SH1 and SH20).

Options 1 and 2 involved a large number of similar features and characteristics. MCA scores for Options 1 and 2 were also very similar, and both met the Project objectives better than the base option.

Option 1 was preferred instead of Option 2 due to the following factors:

- Option 2 was significantly more expensive to construct than Option 1;
- Option 2 had greater construction impacts and affected the quality of access to nearby Mutukāroa-Hamlins Hill; and
- Option 1 further reduced the conflicts between road users and therefore improved road user safety compared to the base option and Option 2.

In selecting Option 1 it was identified that further detailed design work was required to:

- Address the quality and nature of pedestrian and cycle connections; and
- Maintain the urban arterial design philosophy of the Project for the foreshore section.

Following the MCA, further design development has been undertaken to address the issues and outcomes identified above. This has resulted in:

- Provision of a full grade separated shared path (at 4m width) across the Great South Road intersection, on the southern side of the EWL Main Alignment;
- Design and performance criteria for the shared path, that require it to:
    - o be appropriately landscaped or to be retained as a more visually prominent element along Sylvia Park Road (maintaining appropriate separation between the road and pedestrian/cycle facilities);
    - o acknowledge the Kāretu portage;
    - o contribute to the urban design and landscape outcomes of the area (e.g. as a design statement shared path);

  - o Provision for connections between the shared path and Mutukaroa (via the Great South Road intersection);

- Design outcomes and proposed elements to respond to the need for the Mangere Inlet frontage (the urban arterial component) to be sufficiently different in appearance from the balance of the EWL to the east (the industrial arterial component), including a strong transition between these two components.

8.4.3.7 State Highway 1 widening

The originally preferred alignment option retained the existing culverts across the Ōtāhuhu Creek either side of SH1. Acknowledging the effects of culverts, the opportunity to replace the culvert with a bridge and 'declaim' some land was identified. This proposed bridge would open the historic portage potentially having social and cultural benefits. The ability to repurpose this bridge for pedestrian and cycle use was identified as a key opportunity to provide benefits to the local community and was therefore considered to be preferred.

8.4.3.8 Land adjoining the Māngere Inlet foreshore

Consultation and discussion with affected landowners identified potential impacts on a number of occupiers within the area of land owned by Ports of Auckland along the Māngere Inlet foreshore. This area of land includes the heliport which has specific operational requirements (through the civil aviation rules) and therefore specific locational requirements. The Agency has been actively engaging with affected landowners to reach a mutually acceptable outcome, in light of the potential impacts. However the aspirations and requirements of the various landowners remained uncertain and at the time of lodgement a mutually acceptable agreement had not been reached.

In order to provide additional flexibility to reach a mutually acceptable agreement the designation footprint was extended to include all of the site owned by Ports of Auckland. Some of that land may be used for construction.

8.4.4 Preferred alignment

The numerous MCA processes, feedback from key stakeholders and the wider community, and revisions to the design have resulted in the Preferred Alignment. The Transport Agency approved the Preferred Alignment for lodgement in November 2016.

8.4.5 Ongoing assessment of design refinements

The Preferred Alignment will be developed further in the detailed design phase. Alternative design refinements will continue to be considered as an integral part of the detailed design process. Alternatives may cover bridge designs, embankment cross sections, options for discharges and mitigation. Design refinements may also be required in response to safety audits, and maintenance and operational requirements.

PART E

ENGAGEMENT

9.0 Engagement

Overview

Consultation and engagement has been undertaken from 2013 to 2016 on key issues in the Project area and to get feedback on various options proposed for the Project corridor, and more recently for the Preferred Alignment in 2016. Engagement has been ongoing with Project partners including Auckland Council, Auckland Transport and Mana Whenua, as well as key stakeholders including representative groups (for the community, business and freight communities) and the wider public/community. Engagement has involved a number of methods, as appropriate, including one-on-one meetings, workshops, hui, public open days, newsletters and online material. Engagement has been undertaken in accordance with recognised good practice and feedback has been important in developing various options as the Preferred Alignment design has progressed.

9.1 Introduction

This section provides an overview of partner, stakeholder and public engagement[47] for the Project. It summarises engagement during each phase of the Project including the tools and activities implemented, the parties engaged and the engagement outcomes. To guide engagement, a *Community and Stakeholder Engagement Plan*[48] was developed and implemented in accordance with the Transport Agency's *Draft State Highway Public Engagement Guidelines 2016* (Public Engagement Guidelines). The plan sets out the key objectives and principles for engagement and is consistent with the International Association for Public Participation (IAP2) industry best practice guidelines.

The purpose of the engagement process and the common issues and themes raised by partners, stakeholders and the community are briefly summarised in this section.

9.2 Relevant legislation and policies

Reflective of the Transport Agency's policy[49], substantial consultation with potentially affected parties, partners, key stakeholders and the wider community has been undertaken for the Project. The engagement has extended through the issues identification, corridor evaluation and preferred corridor identification and alignment assessment processes.

9.3 Engagement strategy

In accordance with the Transport Agency's *Public Engagement Guidelines*, the need for and scope of public engagement for this Project has recognised the potential for both positive and adverse social, environmental, economic and cultural effects, that there is a high level of public interest in the Project and that there is significant scope for the feedback and input received through engagement to assist in the decision making on the corridor, alignment and design of the Project.

[47] As the Project has been undertaken following the IAP2 spectrum of public participation, the overall term of 'engagement' has been used in respect of the process of public and stakeholder participation on this Project. The engagement process been a mix of 'informing', 'consulting', 'involving' and with some partner organisations (including Auckland Council) this has also included 'collaboration'.

[48] East West Link Alliance, 2016.

[49] NZ Transport Agency, Transit's Public Engagement Manual, 2008.

For each phase of the Project, the level of partner, public and stakeholder participation has been guided by the IAP2 participation spectrum approach. This approach specifically seeks that engagement transparently identify the goal or outcome of the engagement process and determine how this outcome can best be delivered through a spectrum of engagement processes ranging from informing (providing information and education), through to empowering (whereby decision making is handed to parties in the engagement process). The strategy acknowledges that there are both different levels of interest in the Project by different parties, and different outcomes being sought from those being engaged. It is also recognised that there are different outcomes being sought at different stages of the Project development from the various parties involved in the engagement process. The spectrum of engagement is summarised in Figure 9-1.

Figure 9-1: Engagement approaches used on the Project[50]

INCREASING IMPACT ON THE DECISION

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision. We will seek your feedback on drafts and proposals.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will work together with you to formulate solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

Source: IAP2, Participation Spectrum 2014

9.3.1 Engagement principles

All communication and engagement has been guided by a set of engagement principles that draw from the Transport Agency's Public Engagement Manual but have been specifically developed for the Project.

The principles for this Project are:

- Targeted, thorough, proactive, respectful and honest communication;
- Clear, understandable language and tone;
- Open, transparent engagement with all stakeholders;

[50] It is noted that the NZ Transport Agency guidelines group Consulting and Involving from the IAP2 phases set out in this figure.

- Timely engagement to enable the views and values expressed to input into the design and technical assessment programme;
- Be clear about what decisions have been made and what people can influence;
- Make information accessible to different stakeholders, acknowledging the different needs and expectations of stakeholders;
- Maintaining a no surprises environment; and
- Demonstrating responsiveness.

9.3.2 Engagement objectives

The objectives of engagement varied depending on the Project phase of development and the desired outcomes of engagement during that phase. However, in general the overarching engagement objectives for the Project are:

- To comply with the policy requirements and organisation commitments of the Transport Agency in respect of consultation;
- To increase stakeholder and public awareness of the Project, what it seeks to achieve, timeframes and next steps (informing);
- To allow partner and stakeholder input into issues and opportunities within the Project area (consulting and involving);
- To enable targeted stakeholder input into developing the design for the Project alignment (collaborating);
- To enable targeted stakeholder and landowner input into mitigation of effects on the environment and conditions (involving and collaborating); and
- To allow for early landowner negotiations to help achieve the Project objective of being construction ready by October 2018 (involving and in respect of property mitigation collaborating).

9.3.3 Communication and engagement tools

A range of communication and engagement tools were used during different stages of the Project. This included informing the community and stakeholders, surveys, focused design workshops and receiving meeting, written, email and phone feedback. Table 9-1 provides a summary of the engagement and communication tools implemented on the Project.

Table 9-1: Engagement and communication tools

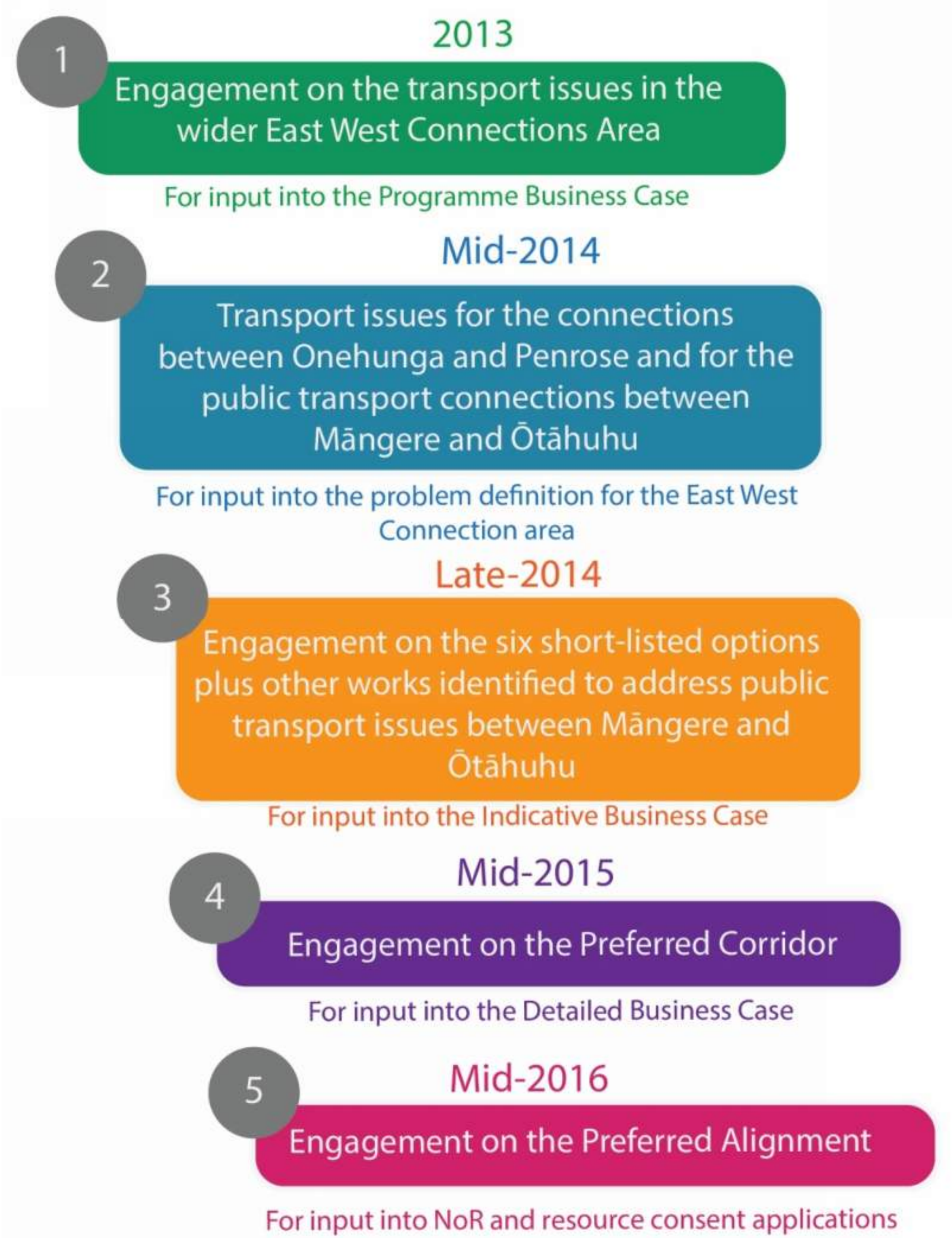
Communication tool	Description
Project telephone number	A toll-free telephone number was set up so members of the community could provide feedback or ask questions directly of the Project team, including setting up and arranging meetings. This number has run (and continues to run) over the course of the Project.
Project website: https://www.nzta.govt.nz/projects/projects/8528	A Project-specific webpage was set up on the Transport Agency's website where Project information was regularly updated. This included a general overview of the Project, updates on the current phase of the Project, Project publications and the latest news. The website provided feedback questions and invited members of the community to provide electronic feedback to the Project team.
Media releases and advertisements	A combination of media releases and paid advertisements were used (including print and radio media) to keep the community informed of key Project milestones and upcoming opportunities to obtain more information (open days) and provide Project feedback.

Communication tool	Description
Community Open Days	At different stages of the Project open days were held within the local Project area (e.g. on each event a series of open days were held in each round of engagement in both the Onehunga and Ōtāhuhu areas). Open days provided the community opportunities to ask face to face questions to members of the Project team and to provide their feedback. This included access to Project specialists from the design, planning and environment teams as well as representatives from the Transport Agency.
Stakeholder Workshops	Over the Project, a number of meetings and stakeholder workshops have been held to discuss particular elements of the Project and to involve different stakeholder groups. These have included workshops on transport issues, corridor and alignment options and design options for interchanges and local road connections.
Project hui	With Mana Whenua as key stakeholders, a number of hui have been undertaken, both as a Project-specific hui (with those Mana Whenua groups that have chosen to participate) and with the Southern Integration Group (a forum established by the Transport Agency to address a number of southern transport projects). Hui have been held to identify transport and cultural issues, to input to and participate in option evaluation processes (including MCA) and to inform and gather feedback on the Project design / mitigation design measures.
Letter box drops	Door knocking and follow up letterbox drops were undertaken to provide Project information to directly affected property owners along the alignment. This was either to inform them of upcoming opportunities to meet face to face with the Project team or to formally notify them of key Project information. Letterbox drops (if landowners were not home) were followed up with phone calls to arrange face to face meetings.
Face to face meetings	Face to face meetings were held to gather property specific information from business and residential property owners as well discuss potential property-specific impacts associated with the Project.

9.4 Previous engagement on the Project

Prior to the recent engagement on the Project in 2016, engagement was undertaken between 2013 and 2015. This is summarised in Figure 9-2 and outlined in more detail below.

Figure 9-2: Summary of previous engagement from 2013-2016



9.4.1 Transport issues in the East West Connections area

In 2013 the Transport Agency and Auckland Transport undertook public and stakeholder engagement in relation to the Business Case for East West Connections[51]. The purpose of this phase of engagement was to help the Transport Agency understand the transport issues of the area and confirm what (if any) investment was needed to address transport problems and opportunities in the Project area.

In addition, this phase of engagement assisted in the identification of key stakeholders and decision makers and commenced the process of understanding their interests and issues with respect to the Project area. This led to a strategic forum being established, which included the Māngere-Ōtāhuhu, Otara/Papatoetoe, Maungakiekie-Tāmaki and East Tāmaki Local Boards. Initial discussions in this phase also began with an Auckland Council Project Reference Group, Mana Whenua Liaison Group and representative groups of businesses across the study area.

Following the wider engagement in relation to East West Connections, consultation was also undertaken in mid-2014 looking specifically at transport issues for the connections between Onehunga and Penrose and for the public transport connections between Māngere and Ōtāhuhu (being the two priority issues identified in the first phase of issues engagement). In addition to wider stakeholder engagement, this phase of issues identification included a survey of local residents on their travel patterns and transport modes.

The outcome was a better understanding of the transport and local issues in the East West Connections area. Key transport issues (across Onehunga, Penrose, Mt Wellington, Ōtāhuhu and Māngere) identified from feedback over this phase of engagement in the Project includes:

- Congestion between Queenstown Road and Neilson Street;
- Difficulty accessing SH20 at Onehunga Mall;
- Poor reliability at Neilson Street Interchange;
- Poor cycle access between Māngere Bridge and Onehunga Town Centre;
- 1 truck every 8 seconds (7am-4pm) on Neilson Street;
- 1 truck every 6 seconds (7am-4pm) on Church Street;
- Lack of reliable public transport between Onehunga and Sylvia Park;
- No signalised access to/from key freight hubs;
- Indirect connection to SH1 southbound;
- Bottleneck at Mt Wellington;
- Poor quality cycle route at the Manukau Foreshore East Walkway (at the connection into Hugo Johnston Drive);
- High demand for railway in Ōtāhuhu area;
- Area congested and poor public transport reliability on Walmsley Road between Ōtāhuhu and Māngere;
- Disconnect between Ōtāhuhu bus and train station and general lack of public transport facilities (shelters, lights, seats) in Ōtāhuhu and Māngere;

[51] East West Connections is a joint NZ Transport Agency and Auckland Transport investigation. EWL is one of the Projects that followed that broader investigation.

- Lack of pedestrian and cycle access to Māngere Inlet;
- Poor access to Middlemore hospital from State highways;
- No access from Walmsley Road to SH20A;
- Increasing number of trucks on McKenzie Road; and
- Pedestrian and cycle safety issues on Massey Road due to high truck use.

9.4.2 Short list of corridor options

In 2014 an Indicative Business Case on the Project was prepared for the Transport Agency. This phase identified and assessed six shortlisted corridor options (with other works identified to address other priority issues in the East West Corridor). These options were developed in response to the transport and local issues identified in the Programme Business Case and earlier phase of engagement. Further information on the short-listed options is provided in *Part D: Consideration of Alternatives of this AEE*.

In late 2014 the six shortlisted corridor options were presented to a range of stakeholders, landowners and the public. In addition to informing on these options, the engagement process sought feedback on how well (or otherwise) people considered the options could solve the transport issues experienced and expected in the area (e.g. the issues that had been identified in the earlier engagement process). People were also asked to identify what they liked about the options and/or how the corridor options could be improved.

The key parties engaged during this period included Auckland Council, Mana Whenua, landowners (residential and business), business, community and environmental representative groups, utility providers, KiwiRail, government agencies and the wider public. Approximately 560 landowners were sent letters advising them that their property was identified as within the ‘area of investigation’ and were encouraged to attend a landowner meeting to hear more about the Project and give feedback.

The public engagement period formally ran over four weeks from 29 September 2014 to 31 October 2014. A variety of channels were used to lift the profile of the Project and make the public aware of the opportunity to provide feedback (including advertisements, website information, newsletters and letters to landowners/stakeholders). Over the public engagement period, the key opportunities for the public and stakeholders to receive information and provide feedback included:

- Website information;
- Four public open days in local areas along the alignment;
- A business focused stakeholder workshop;
- Four community workshops;
- Hui with Mana Whenua and mataawaka; and
- Individual and collective landowner meetings.

Meetings with key stakeholders included Auckland Council, utility providers and presentations to Auckland Council advisory panels. Alongside direct feedback received at the engagement events, about 170 written feedback responses were received in relation to the six shortlisted corridor options. Alignment workshops with Auckland Transport, Auckland Council and other key stakeholders also provided critical input.

Key feedback themes included:

- The majority of respondents in this phase of engagement did not consider the options that involved upgrading the existing transport routes to provide for an east-west connection would be sufficient to address transport problems in the area, though some acknowledged the works would be a good first step;

- Some respondents identified that the options that involved a section of new corridor to the east, but used Neilson Street for the western portion of the Project might be sufficient to address transport issues, but others did not consider it would be sufficient in the longer term and that the options would adversely impact important business land in the area;
- Some identified that the new link options would better address the transport problems of the area, though others expressed concern at the cost of these works; and
- Some supported the foreshore link corridors as they reduced impact on important business areas, others identified both opportunities and potential adverse effects of public access to the CMA and ecological values of the Anns Creek and foreshore areas in particular.

Other themes of the feedback included:

- The need to improve transport performance. Key themes in the feedback included the desire to reduce the number of traffic lights and intersections (particularly to assist with heavy vehicles movements), changes to the design of the Neilson Street Interchange and also south-bound ramps to SH1;
- The need for any new transport connections to ensure that future rail aspirations in the area are not precluded or are enabled, this included the proposals for mass transit to the airport;
- The need to improve access to Manukau Harbour and Onehunga Wharf;
- The importance of walking and cycling facilities to be provided along the seaward side of the foreshore (with connections back into Onehunga). Improved walking and cycling connections should also be provided to Māngere Bridge, Onehunga Mall, Mutukāroa-Hamlins Hill, Orpheus Drive and between Māngere, Ōtāhuhu and Sylvia Park;
- Natural features such as Anns Creek and Te Hōpua ā Rangi should be protected. The potential impacts from the Project on water quality, air quality, and noise need to be carefully considered and managed; and
- Support for bus priority lanes but some concerns about these being shared with freight vehicles on Massey Road.

The feedback from this process helped the Transport Agency evaluate these options and confirm a preferred approach.

9.4.3 Preferred Corridor Option

A further round of stakeholder engagement was undertaken between April and July 2015, including four weeks of public engagement. The aim was to inform the public and stakeholders on the preferred corridor (including how the feedback from engagement had assisted or informed the Transport Agency in their considerations).

Communication detailing the preferred approach and seeking feedback was distributed widely. Media releases were published on the Transport Agency and Auckland Transport websites, alongside promotion through media outlets. Hard-copy brochures were distributed to a range of community facilities, while stakeholders and members of the public who had previously registered an interest in receiving updates were emailed directly. Landowners still in the area of investigation were sent letters before the public announcement, and residential properties were visited by members of the Project team. Those landowners who were no longer in the area of investigation following identification of the preferred corridor were sent letters of notification.

The engagement events undertaken during this phase included:

- Four public open days – attended by about 250 members of the public;
- A stakeholder briefing – attended by about 20 stakeholder representatives, including business and community stakeholders;

- Engagement with Auckland Council – including regular meetings with the Project Reference Group and a workshop with additional Council officers;
- Landowner meetings – a series of meetings where potentially affected commercial landowners were invited to attend meeting sessions (e.g. either single or multiple owner meetings);
- Door knocking – visiting residential landowners at their properties to give more information on the preferred approach;
- Hui – a number of hui with Mana Whenua were held as part of a wider engagement process, including a site visit and commentary on specific elements of the Project; and
- An independently facilitated workshop was held with community and business representatives, in particular discussing aspirations for the Neilson Street Interchange.

During this engagement period, 1,700 pieces of written feedback were received from stakeholders and members of the public. Almost 1,400 pieces of these were received via a standardised soft copy form (a mixture of pro-forma and free text components), which was developed by Generation Zero and available online for people to use as a template for responses.

Key themes from the engagement period reflected the diverse perspectives of stakeholders and the community. Details on the feedback are summarised in the *Consultation Summary Report – Engagement on the Preferred Approach*[52].

In summary, the key issues and feedback received included:

- **Transport Performance and Provision for Transport Modes** – This feedback included comments on traffic and congestion in the Onehunga Penrose area (generally in reference to current transport problems in the area), the importance of freight for economic activity in the area, the need to provide for active transport modes (cycling and walking), support for public transport (including the need to provide or improve provision of public transport through the Onehunga and Penrose areas) and the importance of provision for rail (particularly the provision for mass transit to the airport);
- **Cost and Justification** – The feedback generally questioned the benefits of the financial investment for the Project when compared to public transport initiatives;
- **Environment and Community Impacts** – The included issues of public access to and along the foreshore and Māngere Inlet but also opportunities to improve these recreation connections and the importance of some areas for ecological value (e.g. Anns Creek). Other feedback identified the opportunity for the Project to address existing land use issues in the area and particularly the quality of discharges to the CMA from the adjoining land (stormwater and leachate discharges from landfilling);
- **Business Impacts** – This feedback related to the importance of efficient and safe traffic movement (particularly freight) for the economic functioning of the area and the importance and value of industrial land to Auckland (e.g. so that impacts on the industrial land should be avoided). However, a small number of respondents also identified the opportunity for the area to be developed for residential and commercial activity; and
- **Integration of Transport and Land Use** – The opportunity for the Project to support existing land uses, particularly the inland port and rail hub at Southdown. A number of other respondents also identified the importance of the provision of mass transit to the airport. In addition, the future development aspirations of the Onehunga Wharf was identified as an important consideration for the

[52] The Transport Agency, 2015.

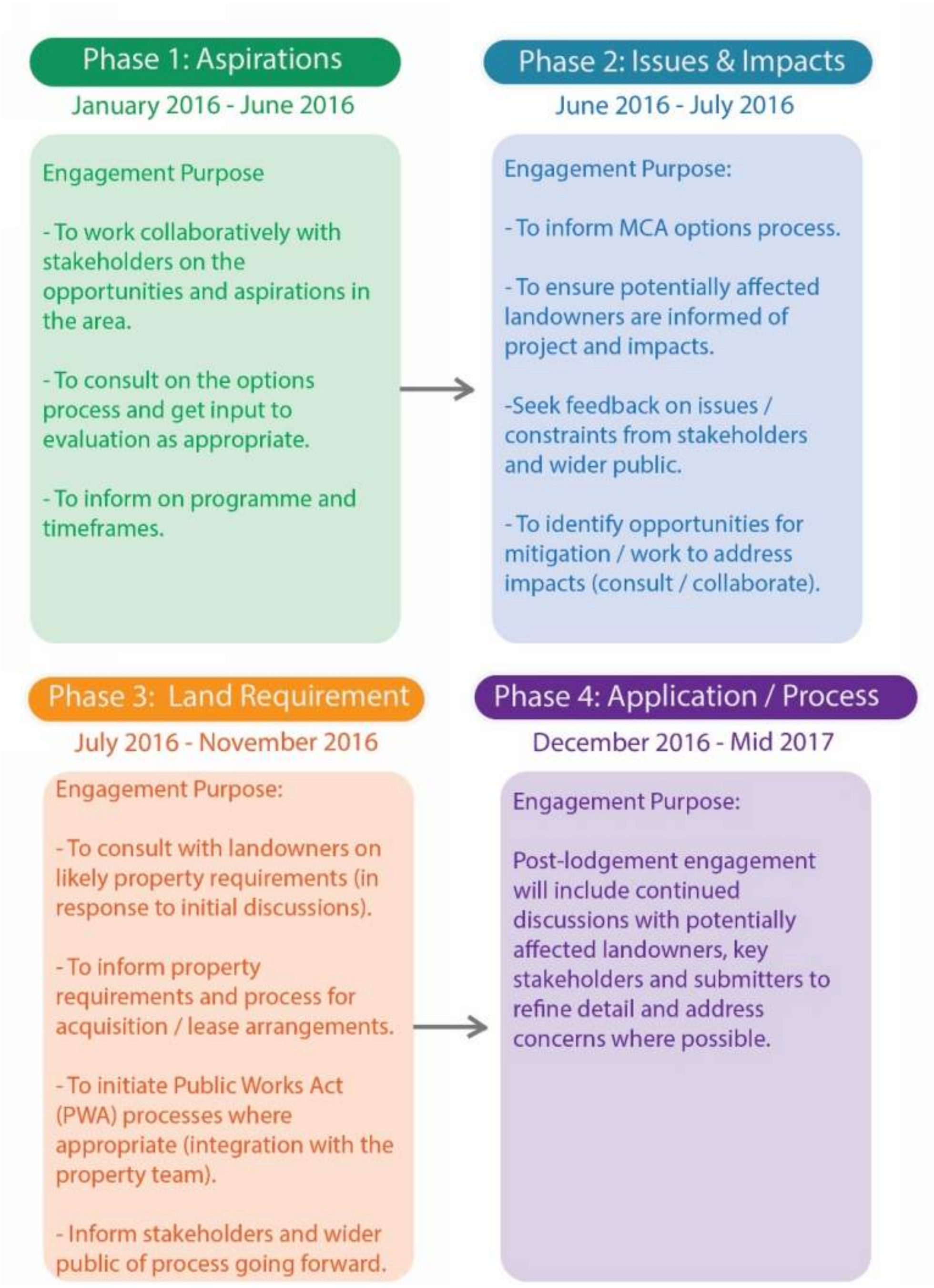
Project, with a number of respondents identifying the need for improved connections between Māngere Bridge and Onehunga (through and adjoining the Port area).

The feedback helped the Transport Agency refine and confirm the preferred approach for the Project. After that, the feedback was used to inform the design team on issues as they worked through the alignment option development and the assessment of alignment options.

9.5 Pre-lodgement engagement (2016)

Engagement continued in 2016 as the Project details were developed and documentation prepared in support of the application. Three phases of engagement occurred over this period, and is continuing and further engagement will continue post-lodgement. This engagement commenced in January 2016 and has been undertaken by the team preparing this AEE (as well as those completing the Social Impact Assessment (*Technical Report 11* in *Volume 3*)). Figure 9-3 provides an overview of these phases and the focus of the consultation / engagement during each phase.

Figure 9-3: 2016 Engagement in Project development phase



9.6 Project partners and key stakeholders

Key Project partners (see Table 9-2) and stakeholders (see Table 9-3) include a range of government and political representatives, business and freight groups, utilities community groups and potentially affected landowners. These groups have been involved since the early stages of the Project. This includes engagement relating to East West Connections of which EWL is a component.

Some local government organisations are those identified as having a role or potential role in the longer term management or operation of elements of the Project and are therefore listed as Project partners (e.g. Auckland Transport who will take responsibility for local roads connecting to the Project once constructed and operational or Auckland Council who (it is intended) will be responsible for the long term management of the stormwater wetland areas). Within Auckland Council the regulatory team have a separate relationship to the Project reference group and are engaged separately to officers so that they remain “impartial” and are therefore listed below as a key stakeholder. Political representatives are identified separately in our engagement planning processes (to recognise the specific management processes within the Transport Agency in respect of this group). DOC is recognised as a key stakeholder in respect of particular elements and outcomes of the Project (e.g. the conservation and biodiversity outcomes in the CMA).

Engagement with landowners focused on the potential business and freight impacts of the Project but also on more property specific issues. For example, understanding how individual properties that are directly affected or in close proximity to the alignment operate, as well as site access and egress.

Table 9-2 Partners for the Project

Project partners
Auckland Council, including Auckland Council Project Reference Group (officer representation from various departments at Council).
Auckland Transport
Mana Whenua: • Te Akitai Waiohua • Ngāti Te Ata Waiohua • Ngāti Paoa • Ngāti Maru Runanga • Te Kawerau ā Maki • Ngāi Tai Ki Tāmaki • Ngāti Whātua o Ōrākei • Te Runanga o Ngāti Whātua • Te Ahi Waru • Ngāti Tamaoho

Table 9-3 Key stakeholders for the Project

Key stakeholders	
Government	Panuku
	NZ Transport Agency
	Department of Conservation (DOC)
	KiwiRail
	Heritage New Zealand Pouhere Taonga

Key stakeholders	
	The Minister for Transport
Political	Auckland Council Mayor's Office
	Auckland Councillors (through the Auckland Council Development Committee)
	Maungakiekie-Tāmaki Local Board
	Māngere-Ōtāhuhu Local Board
Business / Freight Groups	National Road Carriers
	Auckland Business Forum
	New Zealand Council for Infrastructure Development
	The Onehunga Business Association
	NZ Heavy Haulage Association
	Penrose Business Association
Landowners	Residential landowners
	Business landowners
Utilities	Transpower
	Watercare
	Vector
Community Groups	The Onehunga Enhancement Society
	Bike Auckland
	Manukau Harbour Restoration Society

9.7 Engagement with Project partners

9.7.1 Auckland Council

Auckland Council is a key local government Partner for the Project; as noted in Section 6.8, the intent is that some assets to be created by the Project will be transferred to Auckland Council (e.g. in respect of stormwater, leachate management and amenity areas).

The Council was primarily engaged through an Auckland Council Project Reference Group involving staff representation from various departments at Council and Panuku. Focused meetings were also held at regular intervals with Auckland Council teams regarding existing stormwater assets, proposed stormwater design and works in closed landfills along the Onehunga foreshore.

In addition, regular meetings have been held with Council's regulatory team (both consents and NOR), acknowledging the role they will have in support of the EPA/BOI process, and subsequently implementing any consents approved for the Project.

Panuku has been included in the engagement process since late 2015. Their focus has been on how the teams can collaboratively maximise integration of the Project with the future development and transformation programme in the Onehunga Town Centre (between Onehunga to Waikaraka Park) and more specifically at the Onehunga Wharf.

9.7.2 Auckland Transport

Auckland Transport (another CCO and partner during the Indicative Business Case and Detailed Business Case phases) is also a Project partner who is leading implementation of other projects in the overall East West Connections Programme. Auckland Transport has been engaged specifically on EWL in respect of the design standards of the Project and particularly the integration of the Project with the rest of the existing local transport network (including road, pedestrian and cycleway elements) and the future programme for development projects including mass transit to the airport and AMETI.

9.7.3 Mana Whenua and Mataawaka

In February 2016, a new programme of hui with Mana Whenua was initiated which continued almost fortnightly during the year. This engagement was a continuation of Mana Whenua involvement in the Project which was originally initiated by the Transport Agency in early 2013 with the establishment of a EWL Mana Whenua group. The hui involved representatives of local iwi/hapū who discussed their aspirations for the Project area and helped characterise its cultural and environmental values.

During 2016, engagement focused on design options, minimising and avoiding adverse environmental and cultural effects, and maximising desired Project outcomes. This included Mana Whenua providing direct input to the MCA process through the analysis of cultural values. It is noted that in addition, Mataawaka[53] and the local marae (Te Puea Marae) have also been involved in engagement processes.

9.8 Engagement with key stakeholders

9.8.1 Department of Conservation

The DOC has been involved in various stages of the Project development and assessment. During 2016, meetings and site visits have been undertaken to provide staff with an understanding of the Project's general alignment and the existing environment that would be potentially affected. DOC provided feedback regarding issues that should be considered in the suite of technical environmental assessments that accompany the NoR and resource consent applications, specifically relating to the conservation and biodiversity outcomes of the Project. This has included input into characterising the values of the existing environment and reviewing and contributing to the formulation of mitigation and management measures to address potential adverse effects on conservation and biodiversity values (e.g. in sensitive environments such as Anns Creek).

Engagement with DOC staff will continue, particularly with regard to further development of ecological mitigation measures and opportunities.

9.8.2 Heritage New Zealand

Heritage New Zealand has been engaged during development and assessment of the Project. During 2016, meetings and site visits have been undertaken to provide staff with an understanding of the Project's general alignment and the historic heritage features that would be potentially affected and the potential effects of the work.

Engagement with Heritage New Zealand will continue, particularly with regard to further development of historic heritage mitigation measures and the additional approvals required for the Project under the HNZPT Act.

9.8.3 Network utility providers

The Project team has worked closely with utility providers throughout development of the alignment and design refinement to understand the location of existing services and the implications of asset relocation

[53] Mataawaka are Māori living in Tāmaki Makaurau who are in not in a Mana Whenua group (i.e. they may associate with an iwi elsewhere in New Zealand).

or protection. Utility providers that have been engaged include Transpower, Watercare (a CCO) and Vector. Engagement with utility providers is ongoing.

9.8.4 Directly affected landowners

Directly affected landowners are landowners with property located within the Project footprint (e.g. the planned extent of works)[54]. Potentially affected landowners were identified in 2014 and 2015 and sent letters to let them know they were 'in the area of investigation'. Immediately adjoining landowners have also been engaged.

In June 2016, the Project footprint was identified on the basis of the Preferred Alignment and included approximately 150 properties (of which approximately 90 were zoned residential and the remaining were zoned business or mixed use). As a result of further detailed design work, including response to the consultation and engagement feedback on the draft scheme design presented in June 2016, further amendments have been made to the Project footprint (which ultimately is reflected in the Project description in *Section 6.0 Description of the Project* in this AEE)[55].

In mid-June 2016, a letter was hand delivered or posted to all potentially affected landowners. The letter included some information about the Project, key messages and Frequently Asked Questions (FAQs). Project team members visited all residential properties and spoke with most of the landowners or tenants during June and July 2016. Business landowners were contacted by phone prior to letters being sent (if their information was available to the Project team).

Landowners were informed of the Preferred Alignment (the alignment developed at the time of this consultation) and how it may potentially affect their property and the potential scale of property requirement (whether it is likely a boundary impact, partial or full land requirement). Discussion also included the potential noise, visual and access effects during construction and operation, and in general the Public Works Act 1981 (PWA) process. Residents were provided with plans of the Preferred Alignment, the process for giving feedback and the Project team's contact details for any further questions. All landowners were informed that there would be land requirement plans issued in September - October.

In November 2016, landowners further impacted by the grade separated EWL/Great South Road/Sylvia Park Road intersection were informed of the revised design and how it may affect their properties.

9.8.5 Other key stakeholder engagement

During the consultations phases, meetings and presentations have been held with representative stakeholder groups, including the business and community groups listed in *Section 9.6* of this AEE. These meetings have included one-on-one discussions to receive information from these groups on their issues, interests and aspirations and collective presentation meetings to update groups on response to these issues and on the development and consideration of alignment options.

9.8.6 Public engagement

The community includes those living or working within suburbs directly affected by the Project as well those from wider Auckland who potentially use the area from time to time. Community input assisted in

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[54] Particular attention was given to ensuring property owners were engaged and informed prior to property tenants, by addressing all correspondence and initial contact to these parties. The exception to this was if commercial tenants had registered leases in which case they were treated the same as property owners.

[55] The outcome of this process is that the 'directly affected' landowners at this stage included approximately 55 residential properties and just over 60 business/commercial/other landowners (the largest being Auckland Council whose landholding includes business, commercial and open space).

understanding the Project area, how it is used by the community, the value of its various components and their aspirations for its future. Engagement with the community has included meetings and engagement with a range of representative groups with various interests including The Onehunga Enhancement Society, Bike Auckland and Manukau Harbour Restoration Society.

In addition, public consultation was undertaken between 24 June – 15 July 2016 which included website information, open days, open office sessions, distribution of newsletters to community facilities and media announcements. During this period, the public had multiple channels for providing feedback to the Project including:

- Verbally at open days (which were attended by over 150 people in the community);
- Written feedback via email or hardcopy feedback form (which tended to be from representative agencies or businesses – over 50 respondents provided this form of feedback, noting this does not include the recording meeting minutes from landowner/tenant meetings);
- Online feedback form (with receipt of over 100 individual pieces of feedback); or
- Phone through the 0508 number.

9.9 Summary of issues and engagement outcomes from pre-lodgement engagement

Partner, stakeholder and community feedback received throughout the engagement process has helped the Project team understand issues and opportunities associated with the Project area, allowing feedback to inform and refine the design. Feedback has also been used to better characterise the existing environment of the Project area and identify potential sensitive locations allowing potential adverse effects to be assessed and if necessary avoided and minimised.

The following sections provide a summary of the issues raised in consultation and references how this has assisted in development of the Project or in consideration of specific measures to avoid, remedy or mitigate adverse effects.

9.9.1 Feedback summary

Feedback on the Project has been received from a range of key stakeholders and partner stakeholders, local landowners (site-specific landowner feedback is not cited in this report) and the general public. The key feedback themes received from these groups are discussed in the sections below, focusing on engagement on the Preferred Alignment.

9.9.1.1 Importance of the Project

Most key stakeholders and Project partners recognised the importance of the Project. Auckland Council emphasised that the Project will need to be completed in a way that minimises adverse effects, and benefits more than just freight movements (particularly in recognition of the importance of the Onehunga Town Centre area, the sensitive coastal environment, and heritage areas).

Other stakeholders highlighted that the Project needs to meet freight movements for the next 30 years and be built earlier than was currently programmed. In particular, they raised issues related to the ability of the Project to provide sustained transport benefits in the area (capacity and efficiency of transport movements).

9.9.1.2 Cultural

Mana Whenua as Project partners have noted that they need to consider the economic and other impacts of the options, not just their impacts on cultural sites. In other words ‘cultural effects’ need to be considered holistically. As such, Mana Whenua have emphasised that the impacts on cultural values are not limited to just impacts on ‘culturally significant sites’ but also to the systems and functions of the wider environment (both natural and social). Mana Whenua have identified that the physical linkages and connections provided by the Project (e.g. transport connectivity and support for land uses of trade and commerce) are a reflection of traditional portages and economic activities of the historic cultural landscape. In their view, these elements are relevant in considering the effects of the Project on Mana Whenua.

It is a priority for Mana Whenua that the principles of both partnership / collaboration (founded on Te Tiriti o Waitangi) and recognition of the relationship of Mana Whenua to the environment are recognised in the planning, design and delivery of the Project.

There is a need to recognise and provide for the relationship of Mana Whenua to key sites and areas of value, including but not limited to Mutukāroa, Te Hōpua ā Rangi and other areas. Mana Whenua clarified they prefer the proposal of new structures over reclamation on the Onehunga Foreshore (where there are lava flow remnants) and building over rather than cutting into these important sites and areas of value such as Te Hōpua ā Rangi.

Mana Whenua consider that the cultural significance of Mutukāroa and the Ōtāhuhu Portage in particular should be recognised. The opportunity to enhance the Ōtāhuhu Portage should be explored (with the current culvert on SH1 constraining this). This latter comment in particular was noted in the confirmation of the construction of a bridge at Ōtāhuhu Creek (rather than retaining the existing culvert features).

Mana Whenua noted the potential of finding cultural remains during construction and the need for management of this and recognition of these sites. In particular the area at SH1 / Mt Wellington, including significant and sensitive sites already identified and other significant features / elements that might not yet be identified. While design responses in this area are limited, specific management protocols are proposed in reflection of the sensitivity of this area.

9.9.1.3 Cost

A number of people have expressed concern over the Project's estimated cost of $1.25 – $1.8 billion which they consider to be "too expensive". This feedback also suggested that the Benefit to Cost Ratio is 'very low' and does not justify the Project. These respondents tended to indicate that a less expensive option should be progressed. Additionally, many of these respondents have requested that the money be spent on other modes of transport, such as public and active modes, as opposed to building another road to cater for motor vehicles. Response to this feedback is provided in the information presented in this AEE, particularly regarding this assessment of traffic and economic outcomes of the Project.

9.9.1.4 Alternative design features

A number of alternative design features were suggested by those stakeholders who gave feedback. In particular, some queried whether the speed environment along the Project was appropriate (specifically, the stop-start implications of traffic signals were raised as a concern and the potential need for higher speed limits on the route in the future). Alternative design elements suggested by stakeholders in response to these issues included:

- Making the EWL three lanes instead of two and provide a slip lane on the outside lane so that traffic flow could be continuous;
- Ensuring that appropriate truck turning circles are provided at the local road access points; and
- Removing signals and replace with either grade-separated interchanges or roundabouts (with a mix of design options from different stakeholders).

In regards to the Neilson Street Interchange proposal, a number of respondents were concerned with its complexity and wanted assurance that it is safe and efficient for all modes of transport. Emergency services providers sought confirmation on the design standards for movements at the interchange (this matter has been clarified and the design standards have been appropriately addressed). There was also concern around the amount/size of the structures required and the negative visual impact this would have on the surrounding community. A common alternative design suggested was to bury or tunnel the EWL at the interchange to avoid the need for structures.

An alternative design for the Neilson Street Interchange was put forward by some community representatives (led by the Onehunga Business Association). This design option included a number of wider transport and land development components (including an alternative light rail connection over the Manukau Harbour, new local road connections and expansion of the Taumanu Reserve coastal reclamation extending through to Onehunga Wharf). Those elements of the design option relevant to the EWL have been discussed in *Part D: Consideration of Alternatives* of this AEE. Consultation is continuing with the Onehunga Business Association and others in relation to this alternative and/or aspects of it.

A major design variant identified by key stakeholders (particularly Auckland Council) was that a section of the road going past the Onehunga Wharf area be trenched to maintain local road connectivity between the Onehunga Wharf and township. This design option has been incorporated into the Preferred Alignment forming part of this application.

Many respondents have voiced their opposition to the proposed four lane road along the northern edge of the Māngere Inlet and say that Neilson Street should be upgraded instead. Conversely, a number of those who supported the Project suggested that there should be fewer traffic lights, a faster speed limit and a free flow corridor to support business and economic activity. Upgrading Neilson Street as an alternative to the current EWL proposal has been considered in *Part D: Consideration of Alternatives* of this AEE.

There was general support for the additional lanes proposed along SH1, however it was suggested that the additional lanes be extended northward, including provision of north-facing ramps between the EWL and SH1. This also involves adding another lane at the Mt Wellington bottleneck.

The above design elements and issues have been provided to technical teams in their evaluation of the options and where relevant, design changes have been made to respond to issues (e.g. intersection designs to reduce the number of traffic signals along the Project). The layout at intersections (and other design features) will continue to be assessed in further Project development.

9.9.1.5 Onehunga Town Centre

Key stakeholders and Auckland Council expressed concern about the potential impacts of EWL on the Onehunga Town Centre and in particular through traffic flows (seeking these be reduced) and visual impacts between the centre and the foreshore and Onehunga Wharf. Areas of concern included noise and air pollution, the visual impact that the proposed Neilson Street Interchange structures will have and continued accessibility to Gloucester Park. It has been recommended that any structures be visually sympathetic to the future port uses proposed and that adequate local access points are provided. This feedback has informed both the specific assessments that have been undertaken in respect of the Project (e.g. noise, air quality and visual assessments) and in the design response (e.g. the urban design plans).

Some stakeholders also raised concerns regarding the extent of land impact associated with EWL, seeking both that tunnelling options be considered and that further reclamation and/or structures in the CMA be considered as alternatives to minimise these impacts. The land impacts identified included loss of potential land that might be suitable for residential activities (e.g. around Gloucester Park) and important business land (e.g. around the MetroPort). This feedback has been considered alongside the assessed potential impacts of these options.

9.9.1.6 Māngere Inlet

Overall, there was support from many key stakeholders (including a number of staff representatives within Auckland Council) regarding the proposed works along the Māngere Inlet. In particular, the capturing of contaminants in the proposed stormwater ponds and improving water quality outcomes for this area of the Manukau Harbour.

In principle, Mana Whenua reiterated that reclamation should be generally avoided, however noted conditional support for reclamation along the foreshore contingent on the contamination containment bund achieving environmental outcomes of stormwater treatment, containment and detention of discharges going into the Māngere Inlet. They also recognised that reclamation provides the opportunity to naturalise the edge of the Inlet. It was noted there should be avoidance of the remnant lava flows along the coastline of the Māngere Inlet (this related to options for both the Neilson Street Interchange and the foreshore sector). They have consistently expressed the importance of the extent of reclamation being minimised or carefully justified in respect of the outcomes of the contamination containment bund being delivered.

Concerns from some Auckland Council staff included the capacity (and therefore ability) of these stormwater ponds to capture all the contaminants entering the Māngere Inlet from this area.

Many others also noted the importance of the design response to also provide for the re-naturalisation of the coastline and provide an inviting space for pedestrians and cyclists. Again, this feedback has both informed the design response and the technical assessments prepared for this AEE. There are ongoing discussions with Auckland Council as potential future asset owners on the operational outcomes of the foreshore (stormwater and leachate management) design.

9.9.1.7 Cycling and walking

There was support for the proposed walking and cycling route along the coastal edge of the Māngere Inlet. Specific issues raised in stakeholder engagement included:

- The need for more access points to the coastal pathway from the local community (in response pedestrian and cycle connections are provided at Onehunga Wharf/Onehunga Harbour Road, Alfred Street, Captain Springs Road, and Hugo Johnston Drive). It was noted that there should also be safe crossing points, especially over Neilson Street, for cyclists and pedestrians. The traffic and transport assessment contained in *Section 12.2: Traffic and Transport* of this AEE provides further specific consideration of the traffic safety outcomes for the cycling and walking proposals;
- The provision for dedicated cycle facilities to support commuter cycle facilities in a safe and efficient manner. In response to feedback from Auckland Transport, Auckland Council and Bike Auckland, the design provides for footpaths on both sides of the EWL, but with the majority of space provided on the southern side of the alignment (allowing for a 3.0m cycle lane and 1.8m path) and a 1.8m path on the northern side;
- Many respondents were happy that the proposed shared path would be on the coastal side of the Project. A common suggestion from respondents was that the shared path should be well separated from the Project and that the path be accessible via multiple crossing points across the Project. Instead of having a shared path, many respondents would like the shared path to be separated in to two paths; one for cycling; and the other for walking (for user safety);
- The opportunity for the shared paths to connect to other open spaces and walkways in and around the area, e.g. Mutukāroa-Hamlins Hill and Taumanu Reserve. These matters are addressed further in the Project description; and
- Appropriate features need to be provided along the coastal pathway such as seating, toilets and viewpoints to make this space more attractive for users, particularly for that section of the Project between Onehunga and Captain Springs Road (being the Panuku 'Onehunga Transformation' area). These issues have informed the scheme design and ULDF for the Project.

9.9.1.8 Local access

Many respondents were concerned about local access to the Onehunga Wharf and the foreshore of the Māngere Inlet being cut off by the Project. Some stated that the Neilson Street Interchange will restrict local residents from accessing the Onehunga Wharf area which Panuku is looking to rejuvenate. Many said that the access points proposed are unappealing and that the new roads will make the Onehunga Wharf an unattractive space. In regards to the Māngere Inlet, many respondents said the Project will cut local residents off from the foreshore and that there are not enough crossing points proposed for adequate access.

9.9.1.9 Physical environment and amenity values

Mana Whenua stated it was important to acknowledge that all the proposed options considered will have adverse effects on the environment, but that some of the options or aspects of the options included significant positive impacts. They noted that emphasis needs to be put on opportunities to restore the natural state of the environment as far as practicable, including changes to physical infrastructure and improved landscaping, biodiversity and riparian planting enhancement across the whole alignment.

Key stakeholders generally identified the need for best practice methods being implemented to avoid polluted stormwater runoff from the proposed roads entering the local waterbodies. Mana Whenua noted the Project should seek to maximise stormwater and water quality outcomes for receiving environments (not limiting design solutions to 'meeting' standards such as the level for total suspended solids removal, and instead focusing on the outcomes that can be achieved). A suggestion made was that greenways should be incorporated throughout the design to mitigate any environmental impacts and provide for better amenity.

In regards to the Anns Creek area, stakeholders including Auckland Council and DOC have said they would prefer for the structures to be optimised in size to minimise the adverse ecological impacts on this sensitive environment. This feedback has assisted the specialists in their assessments (particularly ecological and geological heritage) and the design response (e.g. identification of areas within Anns Creek where structures are to be excluded). Mana Whenua have expressed preference for options that avoid impacts on significant ecological areas, such as those at Anns Creek, which is considered to contain remnant features which represent those lost in the urbanisation of the wider Project environment.

The Auckland Council Project Reference Group has also provided specific input to the technical assessments for the Project (e.g. heritage and archaeology).

In terms of amenity, respondents expressed a preference for the Māngere Inlet to be "beautified". Strong support was shown for the naturalisation of the coastline with the proposed stormwater ponds and the capturing of contaminants in these ponds. A number of respondents expressed concerns over the potential destruction of the ecological and heritage features within the Anns Creek area and the lava flows located within the Māngere Inlet. Many respondents also requested that the Aotea Sea Scouts Hall be retained in its current location along Orpheus Drive. In contrast, others (including the Aotea Sea Scouts) expressed concern that retaining the hall in its current location would render the building and activities at the building 'invisible' and disconnected from the town centre. This matter is discussed further in the social impact and heritage assessments contained in *Sections 12.14 and 12.6* of this AEE respectively.

Many respondents have expressed both support for the Project and concern around air and noise pollution along the Project. The former support was largely around the existing SH1 alignment, where new noise walls are proposed, while concerns generally focused along the Māngere Inlet. It was suggested that the air and noise pollution emitted from trucks on the new road will negatively impact users of the proposed coastal shared path. Numerous respondents have requested that noise walls be built along the length of the Project to mitigate noise impacts on pedestrians/cyclists as well as nearby properties.

9.9.1.10 Integration of Projects

Another theme identified by key stakeholders was the importance and opportunity to integrate the Project with wider infrastructure and development proposals in the area (being delivered by other agencies). In particular, these included: mass transit to the Airport (Auckland Transport), rail improvements at Southdown / NIMT (KiwiRail), relocation of electricity transmission (Transpower), upgrading of sports fields (Auckland Council – Parks), development of the Onehunga Town Centre and future of Onehunga Wharf (Auckland Council, including Panuku). Numerous respondents have also requested that the Project be future proofed to connect with the AMETI and South Eastern Arterial extension projects to improve the efficiency of Auckland roads. This matter is discussed further in *Section 6.0: Description of the Project* and *Technical Report 1: Traffic and Transportation Assessment* contained in *Volume 3*.

Many respondents are concerned that the Project will restrict a number of other projects currently underway or proposed for the future. There has been ongoing discussion with these agencies and where considered practicable, provision or enabling of these elements has been provided in the Project design.

9.9.1.11 Engagement and Communication

Many respondents have stated that effective engagement needs to be upheld throughout the duration of the Project. In particular, communication with Mana Whenua, affected property owners and the local communities. A number of respondents were unhappy with the public engagement carried out by the Project team for several reasons. Some respondents believed that the public should have been informed at the same time as key stakeholders and some said that the Project has not been adequately advertised as some respondents have mentioned that they were unaware of the open days.

Others said that the information provided at the open days was insufficient and that more detailed design drawings should have been provided so that the true scale of the Project could be visualised. In particular, respondents were interested in seeing 3D modelling of the Neilson Street Interchange. This feedback has assisted the team in confirming the scope and presentation of information for the latter part of 2016 by making more of this information available.

9.9.2 Feedback from surveys

As noted in *Technical Report 11: Social Impact Assessment*, a series of community surveys were undertaken in Onehunga Town Centre, Māngere Bridge, Taumanu and the Manukau Foreshore West Walkway. Some of the key findings from the surveys revolved around local residents' feedback on access to recreational areas and spaces in and around Onehunga, the importance of the Onehunga Foreshore, the proposed extension of the Manukau Foreshore West and East Walkway travelling along the northern shoreline of the Māngere Inlet, the level of support for the possible extension of the Manukau Foreshore Walkway to Sylvia Park Shopping Centre as well as the proposal to connect the Walkway to Neilson Street via a shared path along Alfred Street.

While half of participants were happy with existing recreational areas and spaces in and around Onehunga, some made the following suggestions:

- Create better linkages between certain areas such as Favona, Māngere Bridge, Queenstown Road bridge and Hillsborough Road;
- Create better connections and access to Onehunga and the Onehunga Foreshore; and
- Need to improve Māngere Bridge area.

The Onehunga Foreshore was perceived to be an important asset to the Onehunga community, primarily for providing a recreational space. Participants would predominantly use the Manukau Foreshore Walkway travelling along the northern shoreline of the Māngere Inlet as a cycleway or walkway. Some also made some suggestions around the proposed initiative:

- Enhance the natural surroundings of the proposed extension;
- Extend and connect it to other areas such as Māngere Bridge, Stonefields and Ambury Farm; and
- Ensure it is well lit and safe for everyone to use.

There was strong support for the possible extension of the Manukau Foreshore West and East Walkway to the Sylvia Park Shopping Centre for the following reasons:

- Keeps cyclists off busy roads and making it safer for them;
- Encourages more people to cycle; and
- Connects to other areas such as Pakuranga, Mt Wellington and eastern suburbs.

There was a positive response towards the proposal to connect the Waikaraka Shared Path to Neilson Street for similar reasons:

- Encourages more people to cycle;
- Creates more opportunities to engage in recreation and training; and
- Provides a suitable area for walking and dog walking.

On the other hand, those who indicated they would not use this connection predominantly mentioned that Neilson Street was already too busy and it may be quite dangerous for cyclists to use this extended cycleway.

The majority of participants indicated they would use this proposed extension for recreational rather than commuting purposes.

9.10 Ongoing and future consultation

Ongoing communication will be undertaken post-lodgement of the resource consent applications and notices of requirement. This will include sharing Project information and providing updates via the Project website and local media. Consultation with key stakeholders will also be an integral part of the detailed design process.

The Transport Agency and the construction contractor will implement a comprehensive communication plan prior to and for the duration of construction works. The types of communication that the public could reasonably expect will be outlined in the CEMP prepared by the contractor(s) (refer to *Section 7.0: Construction of the Project* and *Part H: Management of effects on the environment* in this AEE respectively). The experience of the Transport Agency with other major construction projects around the country is that communication and information is one of the best ways to manage the effects of construction on people and communities.

PART F

DESCRIPTION OF THE ENVIRONMENT

10.0 History of the Area

10.1 Introduction

This section provides an overview of the Project area's history. It includes descriptions of Māori occupation and European settlement within Onehunga, Penrose and Ōtāhuhu, and provides regional context where necessary. Further detailed information relating to the area's history can be found in *Section 12.7: Archaeology and built heritage*. Cultural information relating to the area is discussed in *Section 12.6: Effects on values of importance to Mana Whenua.*

10.2 Māori occupation

Prior to Pākehā arrival in the late 18th and early 19th centuries, extensive Māori settlements existed throughout the Manukau Harbour, Tāmaki River and Hauraki Gulf. Evidence of these settlements is seen in the many archaeological sites found along shorelines and the slopes of surrounding volcanic cones. Onehunga, Penrose and Ōtāhuhu in particular were important areas due to their close proximity to the Manukau and Waitematā Harbours, strategic defensive locations and fertile volcanic soils.

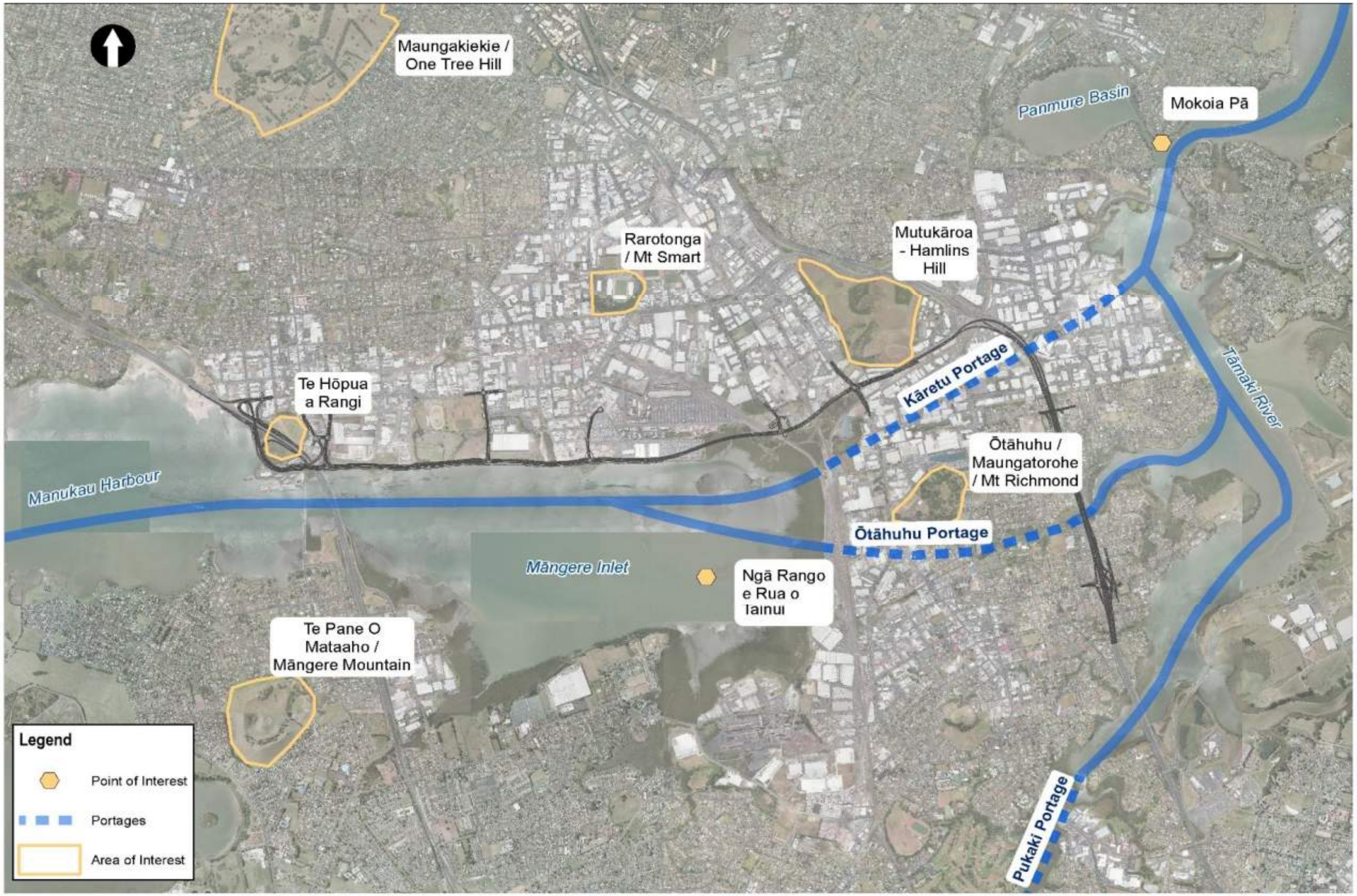
The Auckland isthmus between the Māngere Inlet and Ōtāhuhu Creek is only several hundred metres wide between the east and west coast and represents the narrowest part of New Zealand. Its low elevation and short distance was utilised by Māori for overland portage of canoes and boats. Three key portages were used for overland access and the movement of people and goods between the Waitematā and the Manukau Harbour. The portages were Ōtāhuhu, Kāretu and Pukaki. Their locations are shown in Figure 10-1. Evidence suggests that the Ōtāhuhu portage linking the Māngere Inlet and Tāmaki River was in use as far back as 1100AD. The small island Nga Rango Erua o Tainui (also known as Ngarango e rua o Tainui), located in the upper reaches of the Māngere Inlet is said to be the final resting place of the skids used to haul the great waka Tainui across the Ōtāhuhu portage.

The Māngere Inlet is of significant cultural importance to Mana Whenua not only because it provided access to the Ōtāhuhu and Kāretu Portages but also because the coastline, riverbanks, intertidal areas and freshwater streams were an important source of resources.

Other sites within the Project area with evidence of Māori occupation are shown on Figure 10-1 and include:

- Te Hōpua a Rangi - the basin of Rangihuamoa (the wife of the first Waiohua paramount chief Huakaiwaka);
- Mutukāroa-Hamlins Hill - a settlement site with at least three areas of occupation and of strategic importance to the Kāretu Portage;
- Rarotonga/Mt Smart - a cultural site that stretches across Onehunga;
- Ōtāhuhu/Maungatorohe/Mt Richmond – a site closely associated with the Ōtāhuhu Portage;
- Mauinaina and Mokoia - two fortified pā at the mouth of the Panmure Basin and positioned to control movement on the Tāmaki River;
- Ihumatao - associated with the volcanic cones of Te Ihu o Mataaoho/the nose of Mataaoho and Te Pane o Mataaoho/Māngere Mountain; and
- Maungakiekie/One Tree Hill - dominating the centre of the Auckland isthmus and one of the largest and most significant pā sites in the area.

Figure 10-1: Sites of cultural importance



10.3 19th century

From the mid-1840s, Europeans progressively settled around the upper reaches of the Manukau Harbour. Defence settlements were established in Onehunga and Ōtāhuhu due to their ability to provide strategic military and navel defence points. These settlements rapidly expanded and Onehunga Town Centre was established in 1847. Ōtāhuhu was developed as a European town in 1848. Housing, churches and shops followed as the population grew rapidly over the next 20 years.

Industrial development began with a flour mill constructed on Princes Street in 1854 and Onehunga Port (at the location of the current Onehunga Wharf) in 1862. Timber trading flourished during the 1860s with kauri and kahikatea brought down the Manukau Harbour to local sawmills on the Onehunga Foreshore. Infrastructure expanded with the construction of wharves (1858 and 1865), railway connections to Auckland (1873), and the first Māngere Bridge in 1875 (replaced by what is now known as the Old Māngere Bridge in 1915). The area's first water reservoir was established at Captain Springs in 1878.

New commercial, industrial and residential buildings were constructed during the 1870s and 1880s. By 1891, Onehunga's population was nearly 3,000 and various industries, transportation infrastructure, utilities, churches, schools and public amenities continued to be established or further developed.

Waikaraka Park (at 175-243 Neilson Street) was set aside in 1881 for public use as a recreation ground, rifle range and public cemetery. Waikaraka Cemetery opened in 1890 along the southern portion of the reserve and continues to function as a cemetery today. The War Veterans Memorial dedicated to soldiers and servicemen was built in April 1917. Stone walls surrounding Waikaraka Park were built during the Depression years of the early 1930s (and partly relocated in the early 2000s as part of the Neilson Street widening). These built heritage features are still present in the north-western corner of the site and a stone caretaker's cottage is located in the north-eastern corner of the Park. The Landing Restaurant and Bar at 2 Onehunga Harbour Road, constructed in 1879, is the oldest hotel remaining in operation in Auckland.

Figure 10-2 shows the location of heritage items and places within the Project area.

10.4 20th century

In the early 1900s, cheap flat land and easy access to ports, roads and railways made Onehunga and Ōtāhuhu ideal areas for heavy industry. Southdown freezing works opened in 1905, followed by Westfield and Hellaby's freezing works, new railway workshops, rubber, chemical and fertiliser companies. The Southdown and Westfield freezing works continued to operate until the 1980s.

By 1911, the Onehunga area was subdivided, with a local road network and urban land uses starting to establish. The area continued to grow following World War 1 and World War 2 with development of housing, streets and suburbs increasing. This growth resulted in the construction and development of better road infrastructure and the first section of SH1 opened in July 1953 between the Ellerslie-Panmure Highway and Mt Wellington. The Old Māngere Bridge was supplemented with the existing new crossing in the 1980s, which was later duplicated in the 2000s (Manukau Harbour Crossing).

Upon the completion of the NIMT in 1909, coastal shipping subsequently declined at Onehunga Port. In recent years the port has mainly serviced fishing boats, occasional coastal freighters and the Holcim cement carrier. The Onehunga Branch Line was extended from the Penrose Railway Station to Onehunga Wharf and included the Onehunga Railway Station (corner of Princes Street and Onehunga Mall) and Te Papapa Station (Captain Springs Road).

Figure 10-2: Built heritage items and places of importance

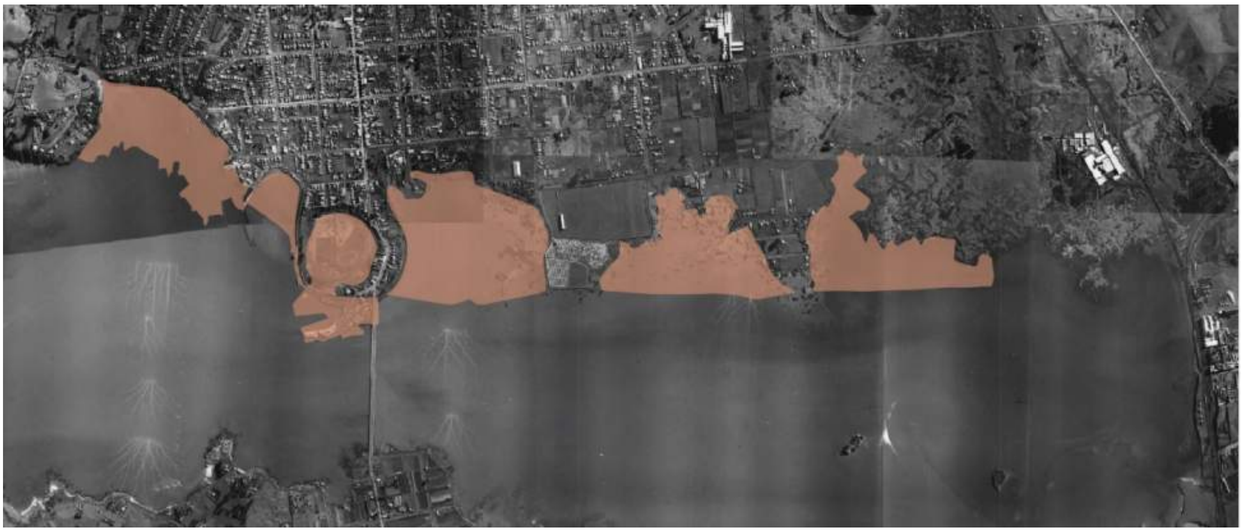
Te Hōpua tidal lagoon was used in the early 20th century for boating and a yacht and boating club (now the Aotea Sea Scouts Hall) built on the tuff between the lagoon and harbour in 1911. The Aotea Sea Scouts Hall at 1 Orpheus Drive is the second-oldest boating club in Auckland. The lagoon was reclaimed in the 1930s to create playing fields, now known as Gloucester Reserve. Figure 10-3 shows Onehunga and the lagoon prior to reclamation in the 1930s.

The almost circular shape of Gloucester Park was divided by construction of Hugh Watt Drive in the 1970s which connected Queenstown Road, Hillsborough to Neilson Street, Onehunga. The motorway connection was completed in 1983 with the construction of the new Māngere Bridge to Coronation Road in Māngere.

Figure 10-3: Onehunga from the air (circa 1930s)

The coastal edge of Māngere Inlet was highly modified by reclamation throughout the 20th century. It is estimated approximately 1.8km^2 (24%) of the CMA has been reclaimed, with the majority occurring after 1940. A number of locations were also used as landfills for municipal waste. Figure 10-4 shows the extent of reclamation undertaken, illustrating the approximate shoreline in 1940 and current day.

Figure 10-4: Approximate extent of reclamation on the northern side of Māngere Inlet 1940-2010



11.0 Description of the Existing Environment

11.1 Introduction

This chapter provides an overview of the natural, built and social environment in which the Project is located. It focuses on local features and communities that have the potential to be impacted by the Project however regional context is provided where relevant.

The existing environment is described in more detail in the relevant sections of *Part G: Assessment of Effects on the Environment* of this AEE and the associated technical reports contained in *Volume 3: Plan Set*.

11.2 Regional context

The Project is located within the Auckland suburbs of Onehunga, Penrose, Mt Wellington, Te Papapa and Ōtāhuhu, approximately 10-15km south of Auckland's CBD. The area is regionally important due to its road and rail transport connections and close proximity to Auckland International Airport and the Port of Auckland (Refer Figure 2-3 in *Section 2.0* of this AEE). Ports of Auckland and Port of Tauranga (MetroPort) both have inland distribution centres located in the Project area. In the Auckland Plan the area is identified as part of the 'regional economic corridor' due to its established commercial, industrial and residential land uses. Transport links between central Auckland, the North Shore, west and south Auckland that cross through the Project area are also regionally important for commuter traffic as well as public and private transport.

The natural environment of the Project area, while discrete and distinct, forms part of a wider environmental and ecological system that stretches across Auckland. This includes groundwater systems, ecological habitats, air and marine environments. A network of community open spaces also exists across the Project area including recreational sports reserves, informal recreation reserves, cemeteries and shared paths.

Regionally important utilities crossing the Project area include high pressure gas mains, water supply, stormwater and wastewater networks, power lines and telecommunications towers (refer to *Section 6.4.7* of this AEE).

11.3 Natural environment

11.3.1 Topography and catchments

The Project traverses two major hydrological catchments, being the Manukau Harbour Catchment and the Tāmaki River Catchment (refer Figure 11-1). Within these catchments there are six Auckland Council Drainage Management Areas which discharge stormwater runoff to either the Manukau Harbour (including the Māngere Inlet) or to tributaries of the Tāmaki River (including Ōtāhuhu Creek).

Both catchments are characterised by well-established urban development with a large proportion of impervious surfaces (roads, roofs and concrete areas). Stormwater from impervious areas drains into the piped stormwater network which eventually discharges to coastal areas at the bottom of catchments. Rain that falls on open ground typically soaks through topsoil layers to groundwater. The stormwater reticulation network (piped network) outside of SH20 and SH1 (which is operated by the Transport Agency) are managed and operated by Auckland Council.

The topography of the catchments is generally flat to undulating with a slight gradient from the upper, inland areas to coastal margins. The topographical feature of Mutukāroa-Hamlins Hill is the exception with substantial elevation above the surrounding area.

11.3.2 Surface water

Permanent streams within the Project area include Southdown Stream, Miami Stream, Anns Creek and a tributary of Tāmaki River near Clemow Drive (Clemow Stream). Wetlands are present within Te Hōpua and Anns Creek Reserve. These streams and wetlands are shown on Figure 11-1.

Southdown Stream crosses beneath Hugo Johnston Drive via twin culverts. The catchment upstream of Hugo Johnston Drive is piped and predominantly industrial. The lower reaches of the stream in Southdown Reserve are estuarine and discharge to the north-east corner of Māngere Inlet through an 80m long culvert. Southdown Reserve is a stormwater treatment wetland managed by Auckland Council.

Clemow Stream is located within an industrial catchment between the rail corridor and Clemow Drive. It drains northeast to the Tamaki Estuary. It is bounded by SH1 infrastructure to the north east, the Turners & Growers property to the south east and Mt Wellington Highway to the west. Stormwater inputs from SH1 and industrial properties to the south enter the stream via a culvert on the southern side. It is piped upstream and downstream.

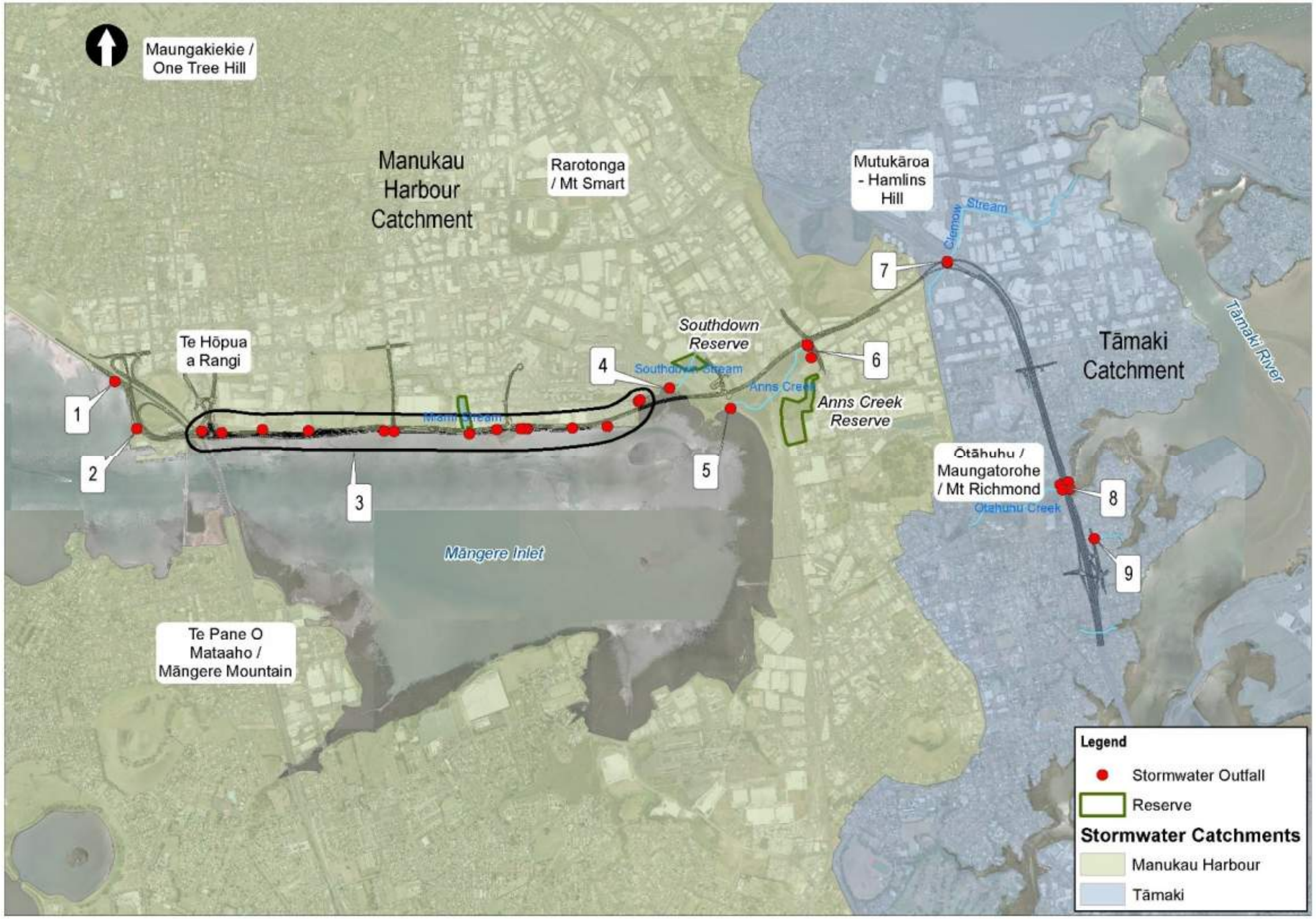
Miami Stream is a small, brackish stream located adjacent to Miami Parade. It is piped for the majority of the upstream catchment however open stream habitat in the heavily industrial catchment may exist. Miami Stream has a short freshwater reach (approximately 20m) that transitions into mangrove-dominated estuarine and then marine habitats in the Māngere Inlet.

Stormwater outfall points

The major existing stormwater outfall points within the Project are described below. Figure 11-1 indicates their location and the features are shown in *Plan Set 9: Stormwater* of *Volume 2*:

1. A large culvert discharging to the CMA beneath SH20 at the Neilson Street Interchange;
2. A stormwater treatment pond treats stormwater from SH20 in this location;
3. Approximately 11 small outfalls along the Māngere Inlet foreshore which discharge into the Māngere Inlet;
4. Three pipes from Southdown Reserve discharging to Māngere Inlet;
5. Two culverts discharge from Anns Creek into the Māngere Inlet;
6. Two culverts discharge to Anns Creek from underneath Great South Road. Three gross pollutant traps on Sylvia Park Road and Great South Road trap gross pollutants and litter from the catchment prior to discharging to Anns Creek;
7. Stormwater from SH1 between Mt Wellington and Panama Road discharges through an underground piped network to Clemow Stream. An existing stormwater pump station lifts stormwater from a low point in this location;
8. Stormwater from SH1 between Panama Road and Princes Street discharges mostly untreated into Ōtāhuhu Creek on both the eastern and western sides of SH1 via four stormwater outfalls. A Transport Agency owned and operated sand filter treats one of these outfalls; and
9. Stormwater from the Princes Street Interchange discharges into a Transport Agency owned and operated stormwater treatment pond within the interchange.

Figure 11-1: Catchments, streams and stormwater outfalls



Flood prone areas

Auckland Council flood hazard studies and Flood Hazard Mapping indicate that a number of locations within the Project area are subject to potential flooding and ponding (see *Technical Report 12: Stormwater Assessment* for further details). These include commercial sites in Wharangi Street, Hill Street, Neilson Street, Hugo Johnston Drive, Great South Road, Sylvia Park Road, Luke Street, Frank Grey Place and Pacific Rise. Limitations in pipe capacity, lack of secondary overland flow paths and the influence of the tide in southern areas of catchments are thought to contribute to flooding of these low lying commercial areas.

Locations on SH1 that are currently prone to flooding include:

- The northbound Mt Wellington Road off-ramp;
- Beneath the Panama Road overbridge; and
- The northbound on-ramp and southbound off-ramp at Princes Street.

The lowest ground level of industrial property in the Project area is estimated to be at 2.8m RL (Auckland Chart Vertical Datum), on Miami Parade. Mean High Water Springs level is 2.05m RL and the highest recorded tide is 3.04m RL.

Stormwater quality

Stormwater quality within the Project area is considered typical of industrial and commercial land use in the Auckland context (refer to *Section 12.21: Stormwater* for further discussion). Particles from car exhausts, tyres and brakes, silt, oils and litter collect on road surfaces and are washed from impervious surfaces into the stormwater system during rain events. The area is identified by Auckland Council as likely to be contributing significant quantities of pollutants to the Māngere Inlet[56].

There are few stormwater treatment systems installed within the Project area however, new developments in the catchment are required by the Auckland Council to provide source control. These controls include treatment for quality and quantity.

It is estimated that approximately 850 tonnes of suspended sediment is generated from 675ha of the Onehunga-Penrose catchment each year. In addition to suspended solids, there are expected to be many other pollutants typically carried in stormwater such as metals, hydrocarbons, nutrients and coliforms.

The results of stormwater quality monitoring undertaken for the Project (as detailed in *Technical Report 12: Stormwater Assessment*) indicate that contaminants including zinc, copper, total suspended solids, and to a lesser extent lead are common in stormwater in this area. The results showed spikes in faecal coliforms and ammoniacal nitrogen levels suggesting local wastewater cross connections and overflows within the stormwater network as well as leachate ingress.

There is also anecdotal evidence from site visits undertaken between January and June 2016 that regular spills and illegal discharges occur within the catchment affecting stormwater quality.

The Māngere Inlet catchment contains some of the most heavily industrialised parts of Auckland. There is a widespread legacy of contamination, including several coastal reclamation sites that were historically used for landfills and uncontrolled filling. It is likely that legacy landfills along the foreshore are leaking

[56] Integrated Catchment Study Area 4: Onehunga – Medium Level Options Analysis Report, 2004, Auckland City and Metrowater.

leachate into stormwater and groundwater before being discharged into the coastal receiving environment.

11.3.3 Geology

The Project is located within the Waitematā basin, a sedimentary basin which formed some 20 million years ago. Sediments from erosion of the surrounding land and volcanic activity have over time accumulated in the basin. Thickening of these sediments resulted in consolidation, forming the sandstones and siltstones of the Waitematā Group. From about six million years ago, a new phase of deposition occurred in the Auckland area leading to the Tauranga Group which overlies the Waitematā Group across most of the Project area.

The Auckland volcanic field developed between 250,000 and 600 years ago, generating regional tuff (compacted, often stratified volcanic ash and debris) and basalt lava flows. The Project area is underlain by lava flows from Maungakiekie-One Tree Hill and Rarotonga-Mt Smart volcanoes as well as Maungarei-Mt Wellington in the east. There are a number of known / visible volcanic features in the vicinity of the Project. These include:

- Te Hōpua. This is a small, volcanic feature of the Auckland volcanic field that has been extensively modified by previous human development. Parts of Te Hōpua are identified as an Outstanding Natural Feature in the AUP (OP) (ID 46 - Hōpua explosion crater and tuff exposure - Site type – B). Over time, the tuff ring was naturally breached by sea level rise and marine and organic muds were deposited within. The breach was closed some 70 years ago and the tuff ring reclaimed with urban refuse and fill;
- Remnant basalt outcrops along the Onehunga Foreshore. Much of the foreshore along the northern margin of the Māngere Inlet consists of outcrops of the distal ends of lava flows which originated from Maungakiekie-One Tree Hill, Rarotonga-Mt Smart and Maungarei-Mt Wellington volcanoes; and
- Lava flows within and around the Anns Creek area. In the north eastern corner of Māngere Inlet and within Anns Creek itself, lava flows from Rarotonga-Mt Smart and Maungarei-Mt Wellington volcanoes are juxtaposed and there are some significant outcrops. Several of these outcrops have been identified as Outstanding Natural Features (AUP (OP) ID 192 Southdown pahoehoe lave flows including Anns Creek, Site type – B).

The Onehunga Bay and Māngere Inlet foreshore have been progressively reclaimed with landfill and engineered fill extending some 500m inland from the present foreshore. The most significant areas of reclamation and landfill include:

- Gloucester Reserve reclamation in Te Hōpua;
- Galway Street Landfill; and
- Pikes Point East and Pikes Point West reclamation and landfills.

Due to the many and varied historic activities and land uses, there are widespread and extensive Hazardous Activities and Industries List (HAIL) sites across the Project area. This includes Gloucester Reserve (uncontrolled fill), Galway Landfill, Pikes Point West and East Landfills, asbestos fill at Hugo Johnston Drive and uncontrolled fill at Anns Creek and Ōtāhuhu Creek.

11.3.4 Groundwater

Groundwater in the Project area flows from elevated ground in the north to the coastal areas of Māngere Inlet and Anns Creek. Flow paths are highly variable due to the variable nature and hydraulic characteristics of the underlying geology and basalt lava flows. Groundwater levels in Onehunga are typically 1.2 to 5.5m below ground level. Groundwater recharge is rainfall infiltration, directly as rainfall and through stormwater soakage pits.

The Project crosses two major groundwater aquifers: the Onehunga Aquifer and the Mt Wellington Aquifer. The Onehunga Aquifer is utilised by Watercare to supplement their public water supply network through a groundwater take of approximately 22,000m^3/day.

Seawater ingress from Māngere Inlet to the basalt and landfill areas along the Onehunga foreshore area is likely.

Key geological features in the Project area including landfills are provided in *Technical Report 13: Groundwater Assessment.*

11.3.5 Coastal environment

The Project area includes Māngere Inlet and Ōtāhuhu Creek. Māngere Inlet is located in the north-eastern corner of the Manukau Harbour while Ōtāhuhu Creek is an upper reach of the Tāmaki River which flows to the Waitematā Harbour.

Manukau Harbour/Māngere Inlet

The Manukau Harbour covers an area of approximately 350km^2, of which 226km^2 is intertidal. The Māngere Inlet has an area of 5.7km^2, with 5.37km^2 of the Inlet being intertidal mudflats.

The northern shore of the Māngere Inlet has been extensively modified through reclamation, port activities, creation of landfills and roads. These activities have resulted in the loss of natural embayments and establishment of a linear shoreline (refer Figure 11-2). The coastal edge is protected by a variety of coastal structures including tipped rock, rock revetments and vertical sea walls offering varying degrees of coastal erosion protection.

Figure 11-2: Northern coastal foreshore of Māngere Inlet (present day)

The Māngere Inlet has been subject to significant change since the mid-1800s and was the location of several large scale industrial developments that have resulted in a reduction of the Inlet's surface area. The original Inlet had a CMA of 7.5km^2 but this has been reduced to 5.7km^2 through reclamation, resulting in a loss of 1.8km^2 (24%).

Anns Creek, in the north-eastern corner of the Inlet, comprises a short section of open stream, extensive mangrove stands and some areas of saltmarsh.

The eastern shore of Māngere Inlet was reclaimed to establish the Westfield yards. The southern shore is less modified. The Harania and Tararata Creeks remain relatively intact. Nga Rango Erua o Tainui Island is located in the south-east end of the Inlet.

Historically, a number of industries located adjacent to the Māngere Inlet (e.g. meat works, abattoir, fertiliser works, wool scours, fellmongeries, tannery, woollen mill, wood-pulp works, battery works, soap and candle works and glue works) and discharged waste directly into the Inlet. In more recent times, runoff from railway workshops, a steel plant, Middlemore Hospital, and septic tank and landfill leachate was discharged to the Inlet. The Māngere Wastewater Treatment Plant upgrade, which occurred between 1998 and 2003, contributed significantly to improved water quality in the Manukau Harbour and Māngere Inlet.

The Māngere Bridge and Onehunga Wharf constrict water flows between the Māngere Inlet and the wider Manukau Harbour.

Sediments within the Inlet consist of mud and fine grained sand. Core sampling indicated that sediment texture has been muddy since pre-human times.

Māngere Inlet experiences a significant amount of sediment movement, particularly during windy conditions. Sediment is predominantly from redistribution around the Manukau Harbour and Māngere Inlet rather than from catchment sources.

The subtidal area adjacent to the Onehunga Wharf is dredged periodically, with the area affected being approximately 4,050m^2. The dredging is associated with maintaining ship accessibility to the wharf.

Tāmaki River – Ōtāhuhu Creek

Ōtāhuhu Creek is a tributary of the Tāmaki River which connects to the Hauraki Gulf. Tāmaki River is on the eastern side of Auckland and forms a long narrow channel about 17km long. Its shores are dominated by mangroves with muddy channels. The middle reaches are a mix of tidal mud flats, patchy marginal strips of mangroves, mud covered low-lying shore platforms, and sandy beaches.

Ōtāhuhu Creek is a shallow tidal creek with extensive mangrove covering and an urbanised catchment of 144ha. A combination of a small wind fetch length and large mangrove areas prevents any significant wave action. In the late 1950s triple culverts were installed under SH1 causing an upstream build-up of sediment. This corresponded with an increase in mangroves. The approximate CMA of the creek to the west of the SH1 is 5 ha, 95% of which is covered with mangroves. Figure 11-3 shows Ōtāhuhu Creek at SH1.

Figure 11-3: Ōtāhuhu Creek (present day)

11.3.6 Terrestrial Ecology

The Project is within the Tāmaki Ecological District, an area characterised by terrestrial vegetation that has been heavily modified by urban and industrial development. The Project alignment can be divided into several broad areas based on groupings of terrestrial habitats. At the western extent of the Project area, a small saltmarsh wetland is present within Gloucester Park South (AUP (OP) SEA-T-6103). The wetland is fed by saltwater intrusion and is dominated by indigenous saltmarsh species. It is surrounded by large groups of planted shrubs (a mix of native and exotic species) and rank grassland. There is a large pōhutukawa (*Metrosideros excelsa*) tree beside Onehunga Harbour Road on the edge of Gloucester Park South.

The coastal fringe surrounding Māngere Bridge and SH20 is mostly mangroves and saltmarsh dominated by glasswort. An area of mangroves has been cleared on the western edge of the bridge. Along the coastal walkway are groups of native plantings and a large embankment dominated by weed species.

The coastal foreshore of Māngere Inlet has several remnant basalt lava outcrops which extend from the coastal reclamation. These outcrops are dominated by mangrove forest with small pockets of lava shrubland. Within the mangroves at Pikes Point, lava shrublands are dominated by ngaio, karo, flax and saltmarsh species. The whole of the mangrove forest and lava outcrops at Pikes Point are identified as SEA in the Operative District Plan, while in the AUP (OP), five of the lava shrubland areas at Pikes Point are identified as SEA (AUP (OP) SEA-T-9022). Weed species such as gorse (*Ulex europeaus*) and pampas are common on the lava. In the vicinity of Waikaraka Park there are several small lava flows dominated by saltmarsh species, extending out from the rock wall.

The remainder of the coastal shoreline is characterised by mangroves scattered sporadically along the majority of the rocky shoreline. The rocky embankment has small pockets of shrubs such as taupata, karo, and pohuehue. Native plantings and mown grass line the edges of the coastal walkway. Weed species such as moth plant (*Araujia hortorum*) are common. At Waikaraka Cemetery, there is a grove of planted pōhutukawa either side of the Cemetery access road.

Anns Creek is characteristic of the early vegetation cover of the Auckland isthmus. It is the only remaining area in Auckland where native shrubs, herbs and ferns, including threatened species, remain growing together on lava. Three threatened Geranium species have been recorded in Anns Creek: *G. retrorsum* (‘nationally vulnerable’), *G. solanderi* (‘at risk – declining’), and *Pelargonium inodorum* (regionally ‘sparse’). A threatened volcanic fern, *Pellaea falcata* (‘at risk-declining’) has also been recorded on the lava. The lava field at Anns Creek is the type locality for the shrub *Coprosma crassifolia* collected there by William Colenso in 1846.

The mouth of Anns Creek at Māngere Inlet contains an extensive area of mangroves with basalt lava flows extending into Manukau Harbour (refer Figure 11-4). Native shrub and saltmarsh species occur on the basalt lava flows together with a mix of exotic weed species including blackberry (*Rubus fruiticosus agg*.) and gorse. On the landward eastern half of the Inlet, exotic trees such as brush wattle are dominant together with exotic weeds and grasses including moth plant, blue morning glory and cape ivy (*Senecio angulatus*).

Southdown Reserve is dominated by a mix of 20 year or older native and exotic plantings and an area of mahoe (*Melicytus ramiflorus*) forest. The stream flowing through the reserve has an area of raupo and flax at the freshwater end which grades into mangroves, and into a small area of saltmarsh at the southern end, with oioi, salt marsh ribbonwood and *Carex flagellifera*. Weed species are common. The abandoned lot adjacent to Southdown Reserve at 213 Hugo Johnston Drive contains rank grass and weeds.

Vegetation on the banks of Ōtāhuhu Creek on the eastern side of the motorway is dominated by exotic species including bamboo (*Phyllostachys sp*.) and brush wattle. On the western side of the motorway there is a mix of native and exotic trees and shrubs including tutu (*Coriaria arborea*). North and south of Ōtāhuhu Creek, there are planted trees beside SH1 in a number of locations. The Princes Street area is characterised by planted trees and shrubs beside the motorway.

Figure 11-4: Anns Creek estuary area (present day)

A range of potential lizard habitat is present throughout the Project area including replanted native vegetation around Miami Creek, vegetated reserve margins with refugia including piled basalt rocks and wood debris (Manukau Foreshore Walkway) and grasslands that provide basking habitat and refugia (Captain Springs Road). The majority of potential lizard habitat is considered ‘poor’ quality, but small areas of ‘moderate’ and ‘high’ quality habitat were observed. No native lizards were detected during lizard surveys undertaken for the Project.

11.3.7 Avifauna

Manukau Harbour is an important site for a number of Threatened and At Risk national and international migratory wading and shorebirds. The mangroves, saltmarsh and wading bird habitat at the mouth of Anns Creek in Māngere Inlet is identified in the AUP (OP) as SEA-M1 and is contiguous with wading bird habitat. The SEA-M2 wading bird area in the wider Māngere Inlet extends to Pikes Point. Banded rail (At Risk) and Australasian bittern (Threatened) have historically been reported in the Anns Creek salt marsh, mangroves and wetlands but have not been observed during Project surveys.

A diverse range of shore birds are known to forage on the Māngere Inlet intertidal mudflats and include NZ pied oystercatcher (At Risk), bar-tailed godwit (At Risk), pied stilt (At Risk), lesser knot (Threatened), wrybill (Threatened), northern NZ dotterel (Threatened), royal spoonbill (At Risk), white-faced heron, red-billed gull (Threatened) and black-backed gull. A number of tern and shag species forage in low numbers in the channels and subtidal area of the Māngere Inlet.

High tide roosts within the Māngere Inlet are currently limited but include Pikes Point reef and a large macrocarpa tree on Nga Rango Erua o Tainui Island which are both utilised by royal spoonbill. Other shorebirds do not appear to roost along the northern shoreline of Māngere Inlet in significant numbers. Other important high tide roosts within the wider area include the roofs of several industrial buildings as well as Ambury Park and Kiwi Esplanade to the south.

Unlike elsewhere in the Tāmaki Estuary, Ōtāhuhu Creek does not provide habitat for wading or shorebirds.

The northern shore of Māngere Inlet and surrounding Ōtāhuhu Creek has been highly modified due to urbanisation and commercial activities resulting in terrestrial avifauna assemblages in the area being dominated by exotic species. No Threatened or At Risk land bird species were recorded in this area during Project surveys.

11.3.8 Freshwater ecology

Freshwater streams within the Project area are within the Auckland Council Maungakiekie-Tāmaki State of the Environment reporting area. The freshwater grade given to the area in 2014 (the most recent available report) was F, the lowest possible grade (Auckland Council 2014). Freshwater quality indicators used to derive this grade include water quality (grade E), flow patterns (grade D), nutrient cycling (grade F), habitat quality (grade F) and biodiversity (grade F). In general, in stream health in Maungakiekie-Tāmaki is considered impaired due to urban development. Development effects include elevated water temperatures, reduced biodiversity value, changes to the natural flow patterns and increased pollution from contaminated stormwater.

The four permanent streams in the Project area are generally consistent with other waterways in Maungakiekie-Tāmaki in terms of in stream health. Miami Stream, Southdown Stream and Clemow Stream having low ecological values based on poor habitat diversity and condition, low invertebrate and fish diversity and abundance, and high (untreated) stormwater input. Anns Creek has the most evenly spread distribution of aquatic macroinvertebrates (indicating a healthy balance of different types and function), whereas the streams were dominated by one or two taxa which typically indicates a highly modified ecosystem.

Further, all of the streams surveyed were short stream reaches in predominantly piped catchments, so the opportunity for migratory species to move upstream is low.

Anns Creek represents a low lying coastal estuarine sequence with nationally ‘At Risk’ inanga. The presence of large shoals of juvenile and adult inanga means that the freshwater component at Anns Creek has value as a waterway that supports the potential for spawning and juvenile rearing.

11.3.9 Marine Ecology

The Project area includes Māngere Inlet (primarily the northern shore and Anns Creek) and Ōtāhuhu Creek at SH1.

Māngere Inlet

Māngere Inlet is a tidal mudflat that almost entirely empties at low tide. The benthos is dominated by silt and clay sediment. The benthic invertebrate community comprises moderate richness, diversity and abundance. Asian date mussels are present sub-tidally. Sediment contaminants are moderately elevated along the northern shore.

Anns Creek comprises a short section of open stream, extensive mangrove stands and some areas of saltmarsh. The marine habitats within Anns Creek are severed in a number of locations by rail corridors, with remnant mangrove stands physically isolated from the main mangrove area.

The eastern shore of Māngere Inlet is reclaimed whereas the southern shore is less modified. Dense mangroves fringe the eastern and southern shores, whereas the northern shore comprises less dense and patchy areas of mangroves.

There are three AUP (OP) SEA-M1 areas in the Māngere Inlet: Anns Creek (21), Ambury (23 - located in the south-west of the Inlet) and a small area in the south-east of the Inlet (22). A large AUP (OP) SEA-M2 (22) area covers most of the remaining CMA within the Inlet, excluding the north-west shore and central areas.

Anns Creek SEA-M1 comprises an ecological sequence and mosaic of vegetation types, including basalt lava shrubland, freshwater wetland, saltmarsh and mangroves. Inanga are known to spawn in this area. Anns Creek is also recognised as a Coastal Protection Area 1 in Auckland Council's Operative Coastal Plan (CPA1 21).

Ambury SEA-M1 comprises an important high tide roost area and foraging area for a wide range of international migratory and New Zealand endemic wading birds. The small SEA-M1 located in the south-east corner of the Inlet comprises a complex of saltmarsh species.

SEA-M2 covers much of the south-east of the Inlet (22a) and is recognised for saline vegetation on the coastal margins and extensive intertidal mudflats containing benthic invertebrate communities that are diverse and dense. The benthic invertebrate assemblages provide important foraging for international and endemic wading birds, some of which are threatened. The Auckland Council Operative Coastal Plan recognised a smaller area as CPA2 (22a) as important foraging habitat for coastal birds.

The entire Manukau Harbour is recognised by DOC as an Area of Significant Conservation Value (7), with intertidal mudflats, mangrove and saltmarsh of importance. The harbour is recognised as an internationally important feeding, roosting and breeding area for wading birds.

The Māngere Inlet contains large mangrove stands and therefore likely provides habitat for fish species when inundated at high tide. Morrisey et al. (2007) found that the typical fish species that use mangrove habitats include sand and yellow-belly flounder (*Rhombosolea plebeia* and *R. leporina*) and snapper (*Pagrus auratus*). Recreational fishers on the Old Māngere Bridge commonly catch kahawai (*Arripis trutta*) and Jack mackeral (*Trachurus novaezelandiae*) (Kelly & Sim-Smith, 2015).

While pilot whales, killer whales, dolphins and seals have been seen in the Manukau Harbour, it is highly unlikely that whales or dolphin would venture into the upper reaches of the Māngere Inlet. Seals have been seen near the Māngere Wastewater Treatment Plant and other places around the Manukau Harbour however it is highly unlikely they would swim into the Māngere Inlet for any length of time due to the habitat being primarily intertidal, the shallow depth of water at high tide and the barrier presented by the Old Māngere Bridge.

In 2006, the area within Māngere Inlet covered by mangroves was estimated at 110ha. Saltmarsh is currently present in small areas including 0.25ha area of bachelor's button in the south-east corner.

Ōtāhuhu Creek

Ōtāhuhu Creek, where it is crossed by SH1, comprises a narrow channel fringed by dense mangroves. While the groupings of benthic invertebrates comprise moderate species diversity, richness and abundance, the invasive Asian date mussel is abundant within the channel. Benthic sediment comprises silt and clay and generally has moderate contaminant concentrations. Mangroves dominate the mudflats (occupying approximately 95% of the CMA west of the existing SH1 alignment), with negligible saltmarsh present between mangroves and land around the SH1 crossing (Kelly, 2008).

The intertidal areas within the Ōtāhuhu Creek are recognised in the AUP (OP) as a significant ecological area as they provide extensive areas of foraging habitat for wading birds (SEA-M2, 45c).

Fish present in the Tāmaki Estuary, particularly near Ōtāhuhu Creek are likely to be speckled sole (*Peltorhamphus novaezeelandiae*), sand flounder (*Rhombosolea plebeia*), grey mullet and short-fin eel.

11.3.10 Air quality

Because the Project is located within a regional hub for transport and distribution activities, the air quality environment is heavily influenced by the many arterial roads which have a high volume of truck and heavy vehicle movements. Motor vehicles discharge a wide range of contaminants however nitrogen dioxide and fine particles are the main pollutants of concern due to their potential adverse health effects. Existing air quality data from Auckland Council's Penrose monitoring site and a NIWA research study carried out in Ōtāhuhu East indicates background levels in the Project area currently comply with the Resource Management (National Environmental Standards for Air Quality) Regulations 2004 (AQNES).

11.4 Built environment

11.4.1 Land use

A large portion of the Project is located in one of Auckland's main commercial, industrial and manufacturing areas. It is a regional hub for the transport and distribution of goods, with Ports of Auckland, MetroPort (which services Port of Tauranga), KiwiRail and Toll Freight all operating in the area. A large number of other freight distribution and logistics firms also take advantage of the area's proximity to key markets and the well-established road and rail network. The sections of the Project along SH1 are predominantly surrounded by residential areas such as Ōtāhuhu.

Land use around Neilson Street Interchange and Galway Street is primarily transport, network utilities, open space (informal and formal) and commercial/industrial. Residential areas are located further to the north (Onehunga), west (Hillsborough) and south (Māngere Bridge). The Onehunga Town Centre is also located immediately to the north and the recently constructed Taumanu is to the north-west.

Along the northern shore of Māngere Inlet, land use is primarily industrial and open spaces. Open spaces include the Manukau Foreshore Walkway for walking, cycling and recreation, Waikaraka Cemetery, Waikaraka Park and the Māngere Inlet foreshore.

The north eastern end of Māngere Inlet becomes Anns Creek. The NIMT bisects Anns Creek and connects to the Southdown Freight Terminal located immediately to the north. Land use in this area is dominated by freight loading activities for road and rail. The KiwiRail designation for Southdown Freight Terminal includes a spur through Anns Creek which is designated for rail purposes but has not been constructed.

Anns Creek East is subject to a designation for railway purposes, held by KiwiRail, that traverses the south west corner of the area and authorises activities for railway purposes. Appendix C to *Report 2:*

Statutory Analysis Report contains a map showing the location of the designation. The designation has recently been confirmed in the AUP (OP). The designation does not authorise the alteration or removal of vegetation, given that such an activity requires regional consents under the AUP (OP). In addition, one of the current landowners of Anns Creek East, TR Group Ltd, has resource consents for reclamation and development of the eastern part of the area. The consents authorise two stages of works in different parts of Anns Creek East, subject to a comprehensive suite of conditions. Site visits by the Project team have indicated that only the first stage of works has been given effect to. Works related to stage 2, being the filling of an eastern part of Anns Creek adjacent to Great South Road has yet to be undertaken.

Between Great South Road and SH1, land use is predominantly industrial, including major storage and distribution activities. A regionally significant gas storage facility is located on the corner of Vestey Drive and Mt Wellington Highway. Sylvia Park Shopping Centre is located on the eastern side of SH1. A high pressure gas pipeline and transmission lines cross through this area and generally follow the alignment of Sylvia Park Road. Mutukāroa-Hamlins Hill Regional Park is located to the north.

The Project area from Mt Wellington to Princes Street is dominated by SH1. Around Mt Wellington, land uses are predominantly commercial and light industrial while the Princes Street area is dominated by the residential areas of Ōtāhuhu. The residential areas are predominantly low density single houses on large sites.

The AUP (OP) identifies Onehunga Town Centre as a growth area for both residential and commercial activity, and Sylvia Park Town Centre as a growth area for commercial and retail activities. Ōtāhuhu has been identified as one of the ten priority areas for development in the Auckland Plan. More recently the area has been up-zoned significantly under the AUP (OP) to Mixed Housing, Terraced Housing and Apartment Zoning. The area is also a pilot Spatial Priority Area for Auckland Council which means there is a focus from Auckland Council on job creation, more housing, improved recreation, better transport and a higher quality environment overall.

Existing designations within the Project area include the following:

- ID 6305 – Southdown Freight Terminal (New Zealand Railways Corporation (Kiwi Rail))
- ID 6718 – State highway 20 from Hillsborough Road to Manukau Harbour Crossing, Onehunga (NZ Transport Agency)
- ID 9102 – Gas Transmission Pipeline (First Gas Ltd)
- ID 9947 – Water Supply Purposes – Hunua No. 4 Watermain (Watercare services Ltd)
- ID 1102 – Protection of aeronautical functions (Auckland International Airport Ltd)
- ID 9102 – Gas Transmission Pipeline (First Gas Ltd)
- ID 1677 – Road Widening Great South Road (Auckland Transport)
- ID 6300 – North Auckland Railway Line (New Zealand Railways Corporation (Kiwi Rail))
- ID 6302 – North Island Main Trunk Railway Line (New Zealand Railways Corporation (Kiwi Rail))
- ID 6734 – State highway 1 (NZ Transport Agency)
- ID 8502 – Electricity transmission – overhead electricity transmission lines in a corridor between Penrose Substation on Gavin Street and the Tāmaki River (Transpower New Zealand Ltd)
- ID 8509 – Electricity transmission – overhead tower site and associated overhead transmission lines of the Māngere-Mt Roskill A 110kV transmission line (Transpower New Zealand Ltd ID 551 – Captain Springs Road Local and Sports Park (Auckland Council)
- ID 553 – Pikes Point Transfer Station (Auckland Council)
- ID 1695 – Road Widening – Neilson Street (Auckland Transport)
- ID 1699 – New Road – Pukemiro Street (Auckland Transport)
- ID 1700 – New Road – Captain Springs Road (Auckland Transport)
- ID 1701 – New Road – Manukau Esplanade (Auckland Transport)
- ID 1703 – Road Widening – Church Street (Auckland Transport)

The land use zones for the Project area, as identified within the AUP (OP) are in summary:

- Public Open Space – Sport and Active Recreation
- Public Open Space – Informal Recreation
- Business Mixed Use
- Light Industry
- Heavy Industry
- Strategic Transport Corridor
- Minor Port
- Coastal Transition
- General Coastal Marine
- Public Open Space - Conservation
- General business
- Single House
- Mixed Housing Suburban
- Terrace Housing and Apartment Buildings
- Mixed Use
- Cemetery

11.4.2 Transport network and facilities

The transport network within the Project area is characterised by a wide range of existing infrastructure and facilities including local roads, State highways, passenger and freight rail lines, pedestrian paths, cycle ways and bus services. SH20 and the Neilson Street Interchange mark the western edge of the Project area. SH1 between Mt Wellington Highway and Princes Street marks the eastern edge of the Project area. Great South Road and Mt Wellington Highway bisect the Project area north to south.

Large volumes of traffic flow through the Project area with many road networks and intersections functioning at an unsatisfactory level of service resulting in inconsistent travel times and delays. Traffic volumes in the Project area are anticipated to grow substantially in the future, adding to the traffic congestion already experienced by road users. Traffic growth within the Project area for 2036 is anticipated to be:

- Onehunga (vehicles): 16% increase;
- Onehunga (bus): 230% increase;
- Mt Wellington / Ōtāhuhu (vehicles): 16% increase; and
- Mt Wellington / Ōtāhuhu (bus): 95% increase.

The location of key transport infrastructure within the Project area is discussed in further detail in *Technical Report 1: Traffic and Transport Assessment.*

State highways

There are two State highways within the Project area: SH1 and SH20. SH1 is the main north-south route through Auckland and one of the most heavily-used pieces of road infrastructure in New Zealand, carrying more than 150,000 vehicles per day. The Project area includes the section of SH1 between Mt Wellington Highway and Princes Street. SH1 at Mt Wellington consists of three lanes in the northbound direction, which then reduces to two lanes after the Mt Wellington northbound off-ramp (three lanes merge to two lanes). In the southbound direction SH1 consists of two lanes at the interchange becoming three lanes after the southbound on-ramp. Mt Wellington Interchange provides all direction access to SH1 via on/off-ramps. The posted speed limit on SH1 is 100km/h.

SH20 passes through the suburb of Hillsborough to the west of the Project area and Māngere Bridge to the south. SH20 is the main transport connection to Auckland Airport and eventually joins SH1 to the south of Manukau City Centre. Neilson Street Interchange provides all direction connections to SH20. In this location SH20 has three lanes in each direction and a posted speed limit of 100km/hr. Manukau Harbour Crossing immediately to the south of Neilson Street Interchange has four lanes in each direction.

Onehunga Harbour Road and Neilson Street are the main arterials connecting SH20 to Onehunga. SH20 in the vicinity of the Project is shown in Figure 11-5.

Figure 11-5: Looking south on SH20 with Māngere Inlet in the distance (present day)

Local roads

The main arterial roads within the Project area include Neilson Street, Church Street, Mt Wellington Highway, Great South Road, Sylvia Park Road and Onehunga Harbour Road. Secondary arterials include Panama Road, Princes Street and Frank Grey Place. Local and arterial roads generally have posted speed limits of 50km/h and range from two to four lanes. The intersection at Great South Road/Sylvia Park Road is a signalised intersection consisting of three approaches. The south approach has 1200 vehicles per day travelling in the morning, the north approach peaks at 700 vehicles per day, while the Sylvia Park Road approach shows no hourly peaks in traffic demand.

The total traffic volume at the Sylvia Park Road / Mt Wellington Highway Intersection peaks at 3,400 vehicles per hour at 8am and again between midday and 4pm.

Other key local roads within the Project area include:

- Orpheus Drive - provides a connection between Seacliffe Road and Onehunga Harbour Road and provides access to the Onehunga Foreshore area as well as Onehunga Wharf. The road width is generally narrow, particularly south of the Manukau Cruising Club.
- Alfred Street - a short cul-de-sac, approximately 500m long. It primarily serves adjacent industrial business properties on one side and traffic mainly consists of heavy commercial vehicles.
- Captain Springs Road (south) - a cul-de-sac accessed from Neilson Street. It is approximately 500m long and enables access to adjacent industrial businesses and Waikaraka Park. The average daily traffic is 2500 vehicles per day in both directions.
- Hugo Johnston Drive – a cul-de-sac extends from the Neilson Street signalised intersection and continues south where it ends at the Manukau Foreshore Walkway entrance. The five-day average daily traffic was recorded to be 9088 vehicles per day in both directions.

There are also many smaller local roads in and around the Project area in the suburbs of Onehunga, Te Papapa, Penrose, Mt Wellington and Ōtāhuhu. These small local roads are typically two-lanes with a posted speed limit of 50km/h.

For east-west vehicle movements within the Project area, road users are likely to use Neilson Street, Church Street and Sylvia Park Road.

The Panama Road and Princes Street overbridges offer the only east-west connection across SH1 within the Project area. The Panama Road bridge is two lanes with a narrow footpath on both sides and no dedicated cycling provision (refer Figure 11-6). It has a morning peak of 450 vehicles per hour in each direction and then an evening peak of 500 vehicles per hour between 4-5pm.

Figure 11-6: Panama Road Bridge (present day)

The Princes Street overbridge is one lane in each direction with a narrow footpath on either side (refer Figure 11-7). The bridge is a key connection over SH1 for residents of Ōtāhuhu and offers access on and off SH1.

Figure 11-7: Princes Street overbridge (present day)

Bus network

The public bus network within the Project area includes up to 18 different buses routes connecting Onehunga Town Centre with other locations across Auckland as well as important bus routes along Great South Road and Mt Wellington Highway, connecting Ōtāhuhu and beyond. There are also a large number of bus connections and bus stops throughout the local streets of Ōtāhuhu and Onehunga.

Reliability is the biggest challenge for public transport within the area, particularly for buses. Buses are subject to regular congestion and accessing Onehunga from SH20 has significant travel time variability of 6-8 minutes over a 2.5km distance.

Auckland Transport is proposing to restructure the bus network which is to be implemented in 2017. This will mean more frequent services travelling between key locations (e.g. Sylvia Park, Ōtāhuhu and Māngere). These will be supplemented by less frequent collector and local routes which connect suburban areas with the main centres.

Rail network

The Onehunga, NIMT and the North Auckland rail lines all traverse the Project area. There are three train stations within or in close proximity to the Project area: Onehunga and Te Papapa train stations are on the Onehunga Line which travels between Britomart and Onehunga station, and Sylvia Park Station is on the Eastern Line which travels between Britomart through Mt Wellington and terminates at Manukau.

To the north of Anns Creek is the Southdown Rail Yard, which is the main freight loading yard for Auckland. This joins to the NIMT enabling connections across the North Island.

Pedestrian and cycleways

Within the vicinity of the Project there is approximately 5.1km of off-road shared paths and 0.7km of segregated on-road cycleways. The quality of these existing pedestrian and cycleways is highly variable with many suffering from poor physical connectivity, severance, low visual amenity and safety issues. The exceptions are the Manukau Foreshore Walkway and Taumanu which have high levels of amenity.

Existing pedestrian and cycle connections within the Project area are illustrated in *Technical Report 1: Traffic and Transport* in Volume 3.

In general, the pedestrian and cycleways within the Project area are as follows:

- Taumanu/Orpheus Drive: A high-quality recreational trail and commuter route separated from general traffic. Connections are provided north to the suburb of Highbury, south to Old Māngere Bridge and east across SH20 via a pedestrian bridge to Onehunga. Old Māngere Bridge (see Figure 11-8) is a key north-south movement for pedestrians and cyclists primarily from Māngere Bridge suburb accessing Onehunga Town Centre and other services/facilities. The walking and cycling link contains an underpass which passes under the Manukau Harbour Crossing and through to Onehunga Mall.
- Onehunga Harbour Road and Manukau Foreshore Walkway: A high-quality separated shared path (see Figure 11-9), although it has a somewhat isolated character, hidden behind industrial sites. Connections are provided to the south across Māngere Inlet via Old Māngere Bridge, to the north via local road connections and east to west between Onehunga Wharf and Hugo Johnston Drive. Connections to local roads are generally on narrow footpaths with limited safe crossing points at signalised intersections. At Anns Creek, a pedestrian/cycle bridge provides access across the Kiwi Rail Corridor. The shared path provides links to Waikaraka Park and Anns Creek and extends for approximately 4km from SH20 at Onehunga and ends at Hugo Johnston Drive. It is used by both recreational and commuter cyclists and pedestrians. The highest usage of the path is recorded in the weekend.
- Great South Road to SH1: There are no dedicated cycleways or lanes between Great South Road and the Mt Wellington Interchange at SH1 and Sylvia Park Town Centre. There are pedestrian paths along main roads but limited safe crossing points, e.g. there are no pedestrian crossing facilities at Great South Road-Mt Wellington Highway intersection.
- SH1: Pedestrian connections across SH1 at Princes Street and Panama Road overbridges are narrow with no dedicated cycleways or lanes. Safe connections to adjacent local roads are inadequate.

Figure 11-8: View of Old Māngere Bridge looking north towards Onehunga

Figure 11-9: Manukau Foreshore Walkway

Ports

The Port of Onehunga (and Onehunga Wharf) is located south of Gloucester Park, accessed from Onehunga Harbour Road. The site comprises an area of reclaimed land and wharf structures. It is currently used for distribution of bulk materials (cement) and commercial fishing activities. However, Holcim has indicated it will cease its cement operations on the site, with commercial operations closing in 2017. An aerial photo of Onehunga Wharf is shown in Figure 11-10.

Panuku has identified the wharf site as a potential key for its wider Onehunga Transformation programme. Both Panuku and the community have explicit aspirations to transform this area into a mixed use development (e.g. a mix of public space, residential and commercial activities). There is no current programme for the implementation of this development.

Figure 11-10: Onehunga Wharf

11.4.3 Network Utilities

A number of regionally significant utilities are located within the Project area including transmission and distribution networks for gas, electricity, water supply, wastewater, stormwater and telecommunications. These include:

- Two high pressure gas pipelines owned and operated by First Gas, the Westfield-Hillsborough pipeline between Neilson Street Interchange and Anns Creek, and the Oaonui-Southdown pipeline between Anns Creek and Mt Wellington Highway;
- The 220kV and 110kV transmission lines owned and operated by Transpower;
- The Southdown Co-generation Plant on Hugo Johnston Drive which connects to the overhead transmission network. This site is currently under care and maintenance;
- Cellular communication masts at Great South Road intersection and Frank Grey Place; and
- Three bulk supply watermains owned and operated by Watercare. This includes Hunua 4 at Neilson Street Interchange, Hunua 1 along Great South Road and Hunua 3 within Sylvia Park Road.

An Auckland Council leachate interception system is located on the inside of the seawall at Pikes Point West and East landfills. Typical volumes of leachate discharged to Watercare's trade waste from the leachate interception system at Pikes Point landfill is approximately 50,000 m^3 per year.

The locations of major utilities within the Project area are shown in *Plan Set 12: Utilities Relocation* in Volume 2.

11.4.4 Social and community facilities

The Project area contains many social and community facilities including educational facilities, reserves and recreational areas, community centres, business areas and shopping centres. These facilities include (amongst others):

- St Joseph's School
- Taumanu (Onehunga Foreshore)
- Te Tauranga (Onehunga Bay Reserve)
- Gloucester Park
- Waikaraka Park and Cemetery
- Bedingfield Memorial Park
- Onehunga Town Centre (including Onehunga Countdown)
- Sylvia Park Town Centre
- Panama Road School
- Ōtāhuhu Intermediate School
- McAuley High School
- Mutukāroa-Hamlins Hill Regional Park
- Southdown Reserve (closed due to public health concerns)
- Onehunga Community Centre and Library
- Aotea Sea Scouts Hall

Recreational areas at the western extent of the Project area include Gloucester Park, Te Tauranga (Onehunga Bay Reserve) and Taumanu (Onehunga Foreshore). Gloucester Park (see Figure 11-11) is located within Te Hōpua and is bisected by SH20 resulting in a North and South Gloucester Park. Gloucester Park North contains sports fields. To the west of Gloucester Park is Te Tauranga and Taumanu (see Figure 11-12) which is accessed from Beachcroft Avenue and includes a car park, toilets, children's playground and a lagoon. Taumanu and Onehunga Bay Reserve are linked via a recently constructed pedestrian footbridge over SH20. Taumanu is also accessible from Orpheus Drive. Taumanu was opened in 2015 following a three-year construction period creating 6.8ha of new parkland on reclaimed land.

Figure 11-11: Gloucester Park North

Figure 11-12: Taumanu (Onehunga Foreshore)

Further to the east, the key reserves and recreational areas are Waikaraka Park (including the Waikaraka Speedway), Mt Smart Stadium, the Manukau Foreshore Walkway and Mutukāroa-Hamlins Hill Regional Park. There are also smaller reserves including Captain Springs Reserve, Simson Reserve (accessed from Hugo Johnston Drive) and Southdown Reserve (currently closed to public access). Waikaraka Park and the Waikaraka Speedway are accessed via Captain Springs Road, Neilson Street and Alfred Street. Waikaraka Park is primarily used as sports fields for a number of clubs including the Onehunga Sports Football Club.

Mutukāroa-Hamlins Hill is a 48ha regional park that is accessed from Great South Road. There is a car park open at all times but only walking tracks to the top. The park offers views over the industrial area of Penrose and Mt Wellington, Anns Creek and the Māngere Inlet (see Figure 11-13) and has historical and cultural significance.

Figure 11-13: Mutukāroa-Hamlins Hill (from Great South Road)

Bedingfield Memorial Park is located on Princes Street East, near the Princes Street overbridge. The park contains a children's playground and bike/skate park (refer Figure 11-14). There is no dedicated parking area.

Figure 11-14: Bedingfield Memorial Park, Ōtāhuhu

11.5 Social and economic context

The Project area is rich in Māori history with many cultural values and issues of significance to Mana Whenua. The Mana Whenua groups associated with the Project area as well as Mataawaka are outlined in *Chapter 13.3.1: Effects on values of importance to Mana Whenua*.

The Project area also represents one of the most significant industrial locations within Auckland. It contributes $4.7 billion in GDP annually to the New Zealand economy and is therefore both regionally and nationally significant. It supports the employment of over 68,000 people, second only to Auckland's CBD. Industrial businesses in this area are three times the average size for Auckland indicating the regional and national market that many of these industrial businesses service.

The area has experienced significant change over the past 15 years, beyond that experienced by the Auckland market. Retail, commercial and servicing businesses have seen disproportionate growth. Due to residential demand and increased amenity in the area, land prices and the ability for the area to retain large site sizes has been a primary concern to businesses and their growth aspirations.

A key restriction experienced by businesses in this area is the lack of reliable and constrained transportation routes, along with limited Port access. These restrictions limit business efficiencies and productivity in terms of moving produced goods and inputs (as well as labour movements).

Anticipated future growth for the area is expected to see a continued rise in higher value outputs while still providing for land extensive activities that require ease of access to both the road and rail networks.

Onehunga

Onehunga is a light industrial and residential suburb located 10km from Auckland's CBD. The majority of residential dwellings in Onehunga are located north of the Onehunga Town Centre. The main street has cafes, convenience stores, a police station and fire station.

Population growth for Onehunga South West and Onehunga South East between 2006 and 2013 was approximately 7%. The 2013 Census indicates that the majority of residents travel to work by private vehicle. Only 11% of residents in Onehunga South West and 18% of residents in Onehunga South East travel to work via active/public transport.

Figure 11-15: Onehunga Town Centre (looking north up Onehunga Mall)

Te Papapa, Penrose and Mt Wellington

Te Papapa contains a mix of residential and industrial land uses. Penrose is predominantly commercial and light and heavy industry, and has a relatively small resident population compared to the rest of the Project area. The industrial and residential properties in the area are primarily accessed via Neilson Street and Church Street, which provide the existing east-west movements between SH1 and SH20.

Mt Wellington is primarily commercial and industrial, with some large lot sizes with light industrial/commercial use or large format retail including Sylvia Park Town Centre. The 2013 Census data indicates the usual resident population is approximately 4,077 people. Population growth in Te Papapa and Penrose between 2006 and 2013 was 6%. A high percentage of residents travel to work by private vehicle (81% in Te Papapa, 76% in Penrose, 86% in Mt Wellington). On average, only 12% of the community travel to work via public or active transport.

Ōtāhuhu North and Ōtāhuhu East

Ōtāhuhu is a mix of industrial and commercial uses to the west and primarily residential dwellings to the east. The suburb is accessed via SH1, through the existing Princes Street Interchange.

The 2013 Census indicates that of those people in employment, 11% travelled to work via public transport or walked/jogged. 69% of the area went to work via a private vehicle or as a passenger in a private vehicle. 10% of the households in the area were recorded to have no access to a motor vehicle with 37% having access to at least one motor vehicle.

PART G

ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

12.1 Introduction and summary of effects on the environment

12.1.1 Overview

Overview

The assessment of effects on the environment for the Project has identified a wide range of actual and potential positive and adverse effects on the environment.

The most significant positive effects of the Project relate to travel, transport and economics during operations. These effects include reduced congestion, improved journey times for vehicles, freight and public transport, improved connectivity for pedestrians and cyclists, and enabling improved economic efficiencies as a result of transport improvements. Other significant positive effects include an improved noise environment for residents adjacent to SH1, rehabilitation of the coastal edge and improved quality of stormwater discharges into the Māngere Inlet.

During construction there will be temporary adverse effects, including loss of habitat, potential sedimentation of waterways and the Māngere Inlet, noise and traffic from construction activities, business disruption and human health risks from working on contaminated land.

The Project will have some permanent adverse effects. Most notably these impacts are on outstanding natural features, loss of intertidal habitat and impacts on rare flora.

12.1.1.1 Introduction

This section provides a summary of the actual and potential effects of the construction, operation and maintenance of the Project, as assessed in the remainder of the sections in this Part. The summary provides an overview of the effects associated with the Project and identifies whether they are positive or adverse and the scale they are likely to occur at (i.e. local, regional or national).

Active avoidance of adverse effects has been the first principle for the design of the structures and road alignment. Where avoidance has not been possible, mitigation measures have been proposed. Details of mitigation still required is addressed in more detail in subsequent sections and will be reflected in the conditions for the project.

12.1.1.2 Structure of the assessment

The remainder of the sections in Part G describe the assessment undertaken in the key topic areas. For convenience, each assessment topic is described in a separate section. The topic sections, and the relevant supporting technical reports, are set out in Table 12-1.

Table 12-1: Effects on the environment assessment topics

AEE Section	Topic	Relevant technical report/supporting information
12.2	Traffic and transport effects	TR 1: Traffic and Transportation Assessment
12.3	Economic effects	Report 3: Economic Assessment
12.4	Property, land use and business disruption	-
12.5	Network Utilities	-

AEE Section	Topic	Relevant technical report/supporting information
12.6	Values of importance to Tangata Whenua/Mana Whenua	-
12.7	Heritage – Built	TR 2: Built Heritage Assessment
12.7	Heritage - Archaeology	TR 3: Archaeological Assessment
12.8	Heritage – Geological	TR 4: Geological Heritage Assessment
12.9	Trees	TR 5: Arboricultural Assessment TR 5: Archaeological Supplementary Assessment
12.10	Landscape and Visual	TR 6: Landscape and Visual Impact Assessment TR 6: Landscape and Visual Impact Supplementary Assessment Supporting information: Urban and Landscape Design Framework
12.11	Noise and vibration	TR 7: Traffic Noise and Vibration Assessment TR 8: Construction Noise and Vibration Assessment TR 8: Construction Noise and Vibration Supplementary Assessment
12.12	Air quality	TR 9: Air Quality Assessment
12.13	Construction traffic	TR 10: Construction Traffic Impact Assessment TR 10: Construction Traffic Impact Supplementary Assessment
12.14	Social Impact	TR 11: Social Impact Assessment TR 11: Social Impact Supplementary Assessment
12.15	Earthworks and vegetation removal	TR 12: Stormwater Assessment TR 15: Ecological Impact
12.16	Groundwater	TR 13: Groundwater Assessment
12.17	Ground settlement	TR 14: Assessment of Settlement Effects
12.18	Contaminated land	TR 17: Contaminated Land Assessment
12.19	Coastal Processes	TR 15: Coastal Processes Assessment
12.20	Ecology	TR 16: Ecological Impact Assessment TR 16: Ecological Impact Supplementary Assessment
12.21	Stormwater	TR 12: Stormwater Assessment TR 12: Stormwater Supplementary Assessment

The technical reports supporting the assessments are contained in *Volume 3: Supporting Technical and Assessment Reports*.

12.1.2 Summary of Effects

The actual and potential effects of the construction, operation and maintenance of the Project are summarised in Table 12-2. This table provides a summary of the positive and adverse actual and potential effects of the Project, and in many cases there are opportunities or measures that can be taken to minimise or mitigate the adverse effects identified.

Table 12-2: Summary of effects relating to the NoRs

Table Key:	Construction / Temporary Effects	Operational / Permanent Effects

Actual or potential effect	Positive	Adverse	Local, regional or national level effect(s)
Traffic and Transport Effects			
Increased construction traffic movements from both staff vehicles and heavier vehicles are likely to have adverse amenity and safety effects on local roads – including for pedestrians and cyclists – and may cause damage to road surfaces.		ü	Local, regional
Disruption on the local road and state highway network.		ü	Local, regional
Changes of intersections, road alignments and bus stop locations.		ü	Local
Closure of walking and cycling routes.		ü	Local
Property access closure or restrictions		ü	Local
Significant travel time reductions for vehicles, freight and buses.	ü		Local, regional
Increased average speeds.	ü		Local, regional
Improved travel time reliability for vehicles, freight and buses.	ü		Local, regional
Generally reduced traffic on local roads.	ü		Local, regional
Higher quality and more facilities for walking and cycling – including safety for cyclists.	ü		Local
Providing separate ‘commuter’ and recreational cycle/walk routes.	ü		Local
Steady growth in use of pedestrian and cyclist facilities.	ü		Local, regional
Connecting existing shared paths to proposed paths and key destinations.	ü		Local, regional
Access to properties generally improved by reduced traffic and reduced flows.	ü		Local
Ability to accommodate on street parking demand with reduced parking spaces in local roads.	ü		Local
Economic effects			
Increased spend during construction.	ü		Local, regional
Business disruption in addition to property access changes.		ü	Local, regional
Increased flexibility for businesses to maintain and enhance productivity through improved accessibility.	ü		Local, regional
Improvements in travel time and journey time reliability will reduce delivery costs, attract new businesses and enhance business efficiency.	ü		Local, regional
Land Use, business disruption and property effects			
Temporary occupation of property for construction purposes, including construction site compounds.		ü	Local
Integration with known local projects.	ü		Local
Changed access to some properties.	ü	ü	Local

Table Key:	Construction / Temporary Effects	Operational / Permanent Effects

Actual or potential effect	Positive	Adverse	Local, regional or national level effect(s)
Permanent acquisition of private residential and business property for the construction and operation of the Project – some full sites and some part sites. This affects both land owners and lessees.		ü	Local
Occupation of Southdown Freight Terminal.		ü	
Network Utilities			
Potential to cause unplanned physical damage or disruption to network utility assets or other transport infrastructure.		ü	Local, regional, national
Some utilities need to be relocated.		ü	
Improved accessibility to port land.	ü		
Cultural / Tangata Whenua			
Potential discovery or destruction of artefacts of importance to Mana Whenua.	ü	ü	Local
Effects on traditional mahinga kai, including terrestrial vegetation and, potentially, marine species.		ü	Local, regional
Reinforcement of two of the historic portages in the area.	ü		Local, regional
Improved quality of discharges from the Onehunga catchment into the Māngere Inlet in the long term, assisting to enhance the mauri of the Manukau Harbour and enabling kaitiaki role.	ü		Local, regional
Responds to key cultural interests through ongoing partnership with the Mana Whenua of the area.	ü		Local, regional, national
Works on sites of value to Mana Whenua.		ü	Local
Replacement of Ōtāhuhu culvert with a bridge structure	ü		Local
Heritage – Built			
Improved access including for walking and cycling to the Aotea Sea Scouts Hall.	ü		Local
Reduced historic context of Aotea Sea Scouts Hall.		ü	Local
Reduced historic context of Waikaraka Park and weakened relationship with Māngere Inlet.		ü	Local
Heritage – Archaeology			
Discovery of artefacts during construction.	ü	ü	Local
Potential destruction of artefacts during construction.		ü	Local
Heritage – Geological			
Enhanced legibility of volcanic features, including interpretive signage and material.	ü		Regional
Changes to the valued features of ONF(s) and volcanic features.		ü	Regional
Trees			
Works in the dripline of trees		ü	Local
Planting of new trees.	ü		Local

Table Key:	Construction / Temporary Effects	Operational / Permanent Effects

Actual or potential effect	Positive	Adverse	Local, regional or national level effect(s)
Landscape and Visual			
Visible construction works and construction yards.		ü	Local
Improved amenity of the coastal edge with open space for informal recreation purposes including new wetland planting, new public walking and cycling shared paths.	ü		Local, regional
Enriched amenity for Anns Creek through weed clearance and replanting.	ü		Local
Natural character of the coastal edge will be rehabilitated, including through reflecting the historic landforms.	ü		Local, regional
Noticeable changes to the outlook from some properties and public areas.	ü	ü	Local
Noise walls.	ü	ü	Local
Reduced legibility and natural character of Te Hōpua.		ü	Local
Loss of sea views from the Waikaraka Cemetery.		ü	Local
Noise and Vibration			
Nuisance and disturbance to close neighbours.		ü	Local
Changed noise environment for residential properties due to replaced / installed barriers on SH1.	ü	ü	Local
Air quality			
Localised dust impact.		ü	Local
Potential odour or hazardous air pollutants release from working in landfills.		ü	Local
Discharges from concrete batching.		ü	
Emissions from construction machinery.		ü	Local
Reduced congestion and therefore improved air quality.	ü		Local
Social Impact			
Disruption to recreational users of walking and cycling facilities, including at and along the foreshore.		ü	Local
General disruption to local communities (residents, businesses, visitors) as a result of construction activities including diversions, change in access, noise, and large numbers of construction workers.		ü	Local
Exposure to disturbed contaminated soils therefore risk to human health (predominantly for workers).		ü	Local
Temporary occupation of Waikaraka Park.		ü	Local
Disruption to emergency service routes.		ü	Local
Closure / diversion of important walking and cycling routes for commuters and recreational users.		ü	Local, regional
Loss of passing trade from local road diversions.		ü	Local

Table Key:	Construction / Temporary Effects	Operational / Permanent Effects

Actual or potential effect	Positive	Adverse	Local, regional or national level effect(s)
Loss of passing trade from diversions and changes to access.		ü	Local
Potential reduction in crime resulting from more people in the area and passive surveillance.	ü		Local
Increase in trade for local businesses from in-flow of construction workers.	ü		Local
Enhanced public accessibility to the coastal environment and coastal edge.	ü		Local, regional
Improved amenity and impacts for businesses from reduced traffic volumes on Neilson Street.	ü		Local, regional
Improved Princes Street Interchange.	ü		Local, regional
Reduced traffic and improved connections to Onehunga Town Centre. Improved amenity in Onehunga Town Centre as a result.	ü		Local, regional
Integration with local projects such as Greenways in Ōtāhuhu.	ü		Local
Reinstatement of Waikaraka Park south occupied during contributing to the development by Auckland Council of recreational facilities.	ü		Local
Loss of amenity and tranquillity in the Waikaraka Cemetery.		ü	Local
Reduction in amenity for residents and activities where land is partially taken.		ü	Local
Loss of community services from full land requirement (e.g. businesses on Sylvia Park Road).		ü	Local
Reduction in passing trade on Onehunga Harbour Road due to separation of through and local traffic.		ü	Local
Loss of affordable residential houses in Mt Wellington / Ōtāhuhu area and limited choice for relocation due to wider housing pressures.		ü	Local
Loss of social housing and perceived lack of alternatives.		ü	Local

Table 12-3: Summary of effects relating primarily to the resource consents

Table key:	Construction / Temporary Effects	Operational / Permanent Effects

Actual or potential effect	Positive	Adverse	Local, regional or national level effect(s)
Earthworks and vegetation removal			
Discharge of sediment into the surrounding environment.		ü	Local, regional
Groundwater and settlement effects			
Raised groundwater levels		ü	Local
Improved long term quality of groundwater through management of leachate in some cases.	ü		Local, regional
Ground settlement			
Settlement effects on buildings, utilities and transport networks		ü	Local , regional
Works in contaminated land			
Discharge of contaminants from historic landfills to the receiving environment.		ü	Local, regional
Increased risk to human health and terrestrial / aquatic life from disturbance of contaminated land.		ü	Local
Risk to human health (largely for workers) from disturbance of asbestos, methane gas and other contaminants.		ü	Local
Remediation of contaminated sites directly within the Project footprint.	ü		Local
Improved long term management of contamination and reduced exposure for humans and ecology along the foreshore through containment.	ü		Local
Coastal Processes			
Changes to coastal environment during construction from temporary works, including dredging.		ü	Local, regional
Changes to access to the coastal environment – may require exclusion of the public.		ü	Local
Minor changes to coastal processes within the Māngere Inlet resulting from the loss of tidal prism.		ü	Local
Enhanced resilience, protection from stormwater inundation and provision of protection from sea level rise, enhancing the usability of many properties in the Onehunga area.	ü		Local, regional
Ecology – Marine Environment			
Loss of intertidal habitat by occupation of CMA.		ü	Local, regional, national
Fragmentation of habitats.		ü	Local, regional
Removal of vegetation.		ü	Local, regional
Disturbance of habitats.		ü	Local, regional
Increased habitat diversity.	ü		Local, regional
Reduced contaminant load discharged to the CMA.	ü		Local, regional

Table key:	Construction / Temporary Effects	Operational / Permanent Effects

Actual or potential effect	Positive	Adverse	Local, regional or national level effect(s)
Ecology – Avifauna			
Removal of intertidal habitat which is foraging ground for sea and shore bird species.		ü	Local, regional, national
Increased habitat diversity.	ü		Local, regional
Reduced contaminant load discharged into the CMA.	ü		Local, regional
Cumulative loss of habitat		ü	Local, regional
Ecology – Terrestrial			
Removal of vegetation.		ü	National
Fragmentation of habitats.		ü	Local, regional
Increased weeds.		ü	Local, regional
Ecology – Freshwater			
Reduced habitat due to reclamation of streambeds.		ü	
Increased habitat diversity through creation of new habitats in the form of stormwater wetlands.	ü		Local, regional
Reduced contaminant load discharged to streams.	ü		Local, regional
Loss of habitat.		ü	Local, regional
Stormwater and impermeable surfaces			
Increased risk of sediment and contaminant discharges to the Māngere Inlet.		ü	Local
Increased stormwater discharge to the CMA.		ü	Local
Potential mobilization of sediments in coastal waters.		ü	Local
Improved quality of stormwater discharges to Māngere Inlet from the local Onehunga and Penrose Catchment.	ü		Local, regional, national
Reduced contaminant levels in run off entering the Māngere Inlet from roads and the surrounding urban area as a result of treatment being provided in some areas where none is currently present.	ü		Local, regional, national
Improved stormwater quality from new treatment for parts of SH1 that currently have no treatment.	ü		Local, regional
Potential opportunity to provide for some treatment of contaminated discharges.	ü		Local, regional

12.2 Traffic and transport

Overview

The Project will deliver significant positive traffic and transport effects (i.e. benefits) for Auckland, namely:

- Significant improvements in consistency and reliability of travel times for trips accessing the strategic network (i.e. SH1 and SH20) from Onehunga-Penrose business area. The access times become much more consistent and reliable across the day which will allow improved and more flexible journey and logistics planning for businesses;
- Improvements to journey times to key locations over a wider area (e.g. to/from the airport and Highbrook);
- Improved accessibility to businesses in the Onehunga-Penrose area by the provision of new access roads;
- Reduced traffic flows using local roads which improves amenity for residents. Resilience in the local road network by taking pressure off the Neilson Street corridor, having alternative access points and providing a link between the two State highways in case of an emergency event or closure;
- Improved accessibility for pedestrians and cyclists between Māngere, Onehunga and Sylvia Park Town Centrevia high –quality, direct and dedicated facilities. Improved access to Ōtāhuhu East by safer walking and cycling facilities, reduced impact of motorway queues and new accessibility to the adjacent Panama community;
- Safer walking and cycling facilities; and
- Improved travel time reliability for buses accessing Onehunga Town Centre from SH20 and on other local bus routes.

These benefits are important for local business activities, the movement of road-based freight and for local communities who will experience improved and more reliable journey times. Less traffic on local roads means safer, quieter streets for the people who live there.

There will be a reduction in community severance in the Ōtāhuhu area as a result of a safer and shorter routes for pedestrians and cyclists.

These benefits would not be achieved without the Project.

12.2.1 Introduction

This section presents the findings of the assessment undertaken to determine the actual and potential effects of the Project on operational traffic and transport following construction. This includes predicted changes in travel times, traffic flows, active transport (pedestrian and cycling), public transport (bus and train), property access and parking. Details of the existing environment, methods and findings of transport investigations are contained in *Technical Report 1: Traffic and Transport Assessment* contained in Volume 3.

12.2.2 Existing traffic and transport environment

The description of existing traffic and transport environment is included in *Technical Report 1: Traffic and Transport* in Volume 3.

In summary, the five key existing transport issues currently affecting the Project area were identified as:

1. Unreliable and inconsistent journey times, including significant variability in travel times between businesses in the Onehunga-Penrose area and SH1 and SH20;
2. Unreliable and inconsistent bus journey times between SH20 and Onehunga Town Centre;
3. Conflict between through and local access traffic on Neilson Street, Church Street and Great South Road;
4. Use of residential streets to access the industrial hub due to congested strategic connections; and
5. Walking and cycling routes with connectivity, severance and amenity problems.

12.2.3 Methodology for assessing effects

The Traffic and Transport Assessment (refer to *Technical Report 1: Traffic and Transport Assessment*) was developed in accordance with Auckland Transport's *Integrated Transport Assessment Guidelines* (2015) and the Transport Agency's *Integrated Transport Assessment Guidelines* (2010).

The methodology for assessing the operational effects of the Project on the transport environment included modelling, qualitative assessment, data collection and future forecasting, observations and surveys (car parking, trips, walking and cycling). An integral part of the methodology has been altering or incorporating changes to the design of the Project to avoid or reduce any adverse transport impacts and considering feedback from stakeholders. Wherever possible the design of the Project has sought to minimise land requirements, impacts on parking and access and ensuring the Project does not preclude future transport projects.

Modelling is one of the techniques used and the following three models were used for assessing effects on travel times, travel reliability and traffic flows:

6. A Strategic Demand model (referred to as ART3)[57] that relates land use (such as population and employment) to travel patterns at a strategic, region-wide level;
7. A Project model (SATURN) which considered a smaller geographical area to the strategic model. The extent of the model was from Mt Albert Road in the north to Manukau City Centre in the south. This model loads vehicle trip patterns onto the road network to investigate traffic effects at a more detailed level; and
8. Design / operational models which use micro-simulation and intersection packages to look at traffic operation in even greater detail within the Project area.

The models have been appropriately calibrated, validated and peer reviewed.

The transport environment is constantly changing as a result of new transport initiatives coming on-line, land use changes and changes in network performance. Assessment of the Project against the existing (2016) environment is therefore not considered appropriate. Instead, key parts of the assessment have used transport models to simulate the following future scenarios for comparison purposes:

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[57] The ART3 model is owned and operated by the Joint Modelling Application Centre which is a collaboration between Auckland Council, Auckland Transport and the Transport Agency.

- Future network with and without the Project in 2026; and
- Future network with and without the Project in 2036.

The modelling year 2026 has been used as it is shortly after the EWL is anticipated to open and aligns with the Regional models. The year 2036 is used as longer term forecast and is approximately 10 years after the Project is expected to open.

The assessment has been based on travel modes and issues, rather than the geographical Project sectors used in other assessments. This is because transport movements generally traverse multiple sectors with interactions between them, depending on the activities and travel conditions.

12.2.3.1 Without Project scenario

The Without Project modelled scenario represents a future scenario for 2026 without the Project in place. This has been developed to provide a baseline against which the effects of the Project can then be assessed. This scenario recognises that a number of other transportation projects are likely to be progressed, and development will continue to occur in the period to 2026, irrespective of the Project.

The Without Project scenario includes the land use changes forecast by Auckland Council (including from the AUP (OP)[58]). Transport projects that have not yet been constructed (and have not been consented), but are expected to be completed by 2026 regardless of whether the Project goes ahead are included in the Without Project scenario. These include:

- The Waterview Connection Project, including the upgrades to SH20 south of the Waterview tunnel;
- Auckland accelerated projects (Southern Corridor Improvements, Northern Corridor Improvements, AMETI and SH20A to Airport (Kirkbride Road grade separation));
- Auckland City Rail Link; and
- Upgrades to SH20 (Queenstown Road to Neilson Street), local widening of Neilson Street currently under construction as separate works (see *Section 6.7.6.2: EWL SH20 Capacity Improvements: Neilson Street to Queenstown Road* for further discussion).

12.2.3.2 With Project scenario

The With Project modelled scenario is the same as the Without Project scenario detailed above but also includes the Project.

Modelling results are set out in *Technical Report 1: Traffic and Transport Assessment* contained in Volume 3.

12.2.3.3 Effects based assessment methods

To assist in assessing effects, the models have been used to provide quantitative forecasts of the four scenarios. The key assumptions that have been used in the modelling include:

- Medium level population forecasts consistent with those developed for the Auckland Plan;
- Committed or likely regional projects;

[58] Forecasts based on the Proposed Auckland Unitary Plan, dated 30 September 2013. The results of the zoning in the Decisions Version (released 19 August 2016) are similar.

- Behavioural responses to non-price travel demand management measures that reduce car usage and increase public transport, walking and cycling; and
- Committed local projects such as the widening of SH20 south of Maioro Street and between Queenstown Road and Neilson Street, and four laning of Neilson Street between Alfred Street and MetroPort.

The full modelling results are contained in *Technical Report 1: Traffic and Transport Assessment* in *Volume 3: Technical Reports*.

In summary, the results indicate that in the Without Project scenario, the already-congested conditions experienced when accessing the Onehunga-Penrose area from both SH20 and SH1 are expected to get significantly worse due to regional and local traffic growth. This additional congestion causes time delays and significant variability in travel times, affecting vehicles both commuter and commercial (including buses) and freight.

12.2.4 Assessment of operational traffic and transport effects

There will be significant positive operational traffic and transport effects as a result of the Project. Reduced congestion on local roads will be achieved, resulting in faster and more reliable travel times for vehicles, freight and public transport. The Project improves accessibility to SH20 and SH1 from the Onehunga-Penrose area for vehicles, provides improvements to cycling and walking facilities and improves journey time reliability for buses between SH20 and Onehunga Town Centre. These predicted effects and effects on parking, access and safety performance are set out below.

12.2.4.1 Travel times, travel time reliability and traffic flows

a. **Predicted travel times**

Significant travel time savings are anticipated for freight (and other vehicles) from the Onehunga-Penrose industrial area accessing the State highway network. From the intersection of Captain Springs Road and Neilson Street (being a representative location in the industrial area) the following travel time savings are predicted in 2036 with the Project:

- Reductions accessing SH20 north of up to 4.1 minutes (43%[59]);
- Reductions accessing SH20 south of up to 6.5 minutes (48 %);
- Reductions accessing SH1 north of up to 6.3 minutes (37%); and
- Reductions accessing SH1 south of up to 18 minutes (68 %).

The time savings vary for each movement and time period. These values are the maximum savings identified and reference should be made to *Technical Report 1: Traffic and Transport Assessment* for the detailed assessment.

The most significant savings are those to and from SH1 south, due to the new link and access ramps. The works include extra lanes on SH1 south to Ōtāhuhu meaning this improvement will be able to accommodate the additional traffic that is generated on SH1 as a result of the Project. Substantial travel time savings are predicted to and from SH20 heading south and will significantly reduce congestion at Onehunga, specifically along Onehunga Mall, Onehunga Harbour Road and Neilson Street. The travel time savings to and from SH20 north are lower as this movement typically is not as highly congested.

[59] The changes are taken from comparing the Without Project scenario to the With Project scenario.

Similarly, the savings to SH1 north are lower, as the access points are directly into the Church Street corridor and this corridor remains influenced by congestion on SH1 north.

When expressed in changes in average speed, these improvements include:

- Increases from 25kph to 60kphto/from SH1 south; and
- Increases from 36kph to 52kph to/from SH20 south.

The travel time savings vary across the day with peak periods experiencing the greatest improvements. The local traffic expected to benefit from these access movements is estimated to include:

- Some 32,000 vehicles per day accessing SH20 north;
- Some 40,000 vehicles per day accessing SH20 south;
- Some 45,000 vehicles per day benefiting from improvements on Church Street, including those accessing SH1 north; and
- Some 20,000 vehicles per day accessing SH1 south.

In addition to local benefits, wider travel time savings as a result of the Project have been identified. The Project is expected to improve journeys between the wider Auckland isthmus and Manukau areas. The travel time implications on the wider area include:

- Up to nine minutes between SH20 and Highbrook;
- Up to four minutes between Onehunga and Auckland Airport;
- Some three minutes between Royal Oak and Auckland Airport;
- Over three minutes between SH1 and Auckland Airport;
- 14 minutes between MetroPort and Highbrook; and
- Over three minutes between Pakuranga and Onehunga.

Almost all of the representative movements have savings, which range up to 14 minutes. The movements with the biggest savings relate to those to or from MetroPort and Highbrook. A good level of savings is also predicted to other locations, including to or from Royal Oak, Pakuranga and Ōtāhuhu. The few forecast increases in travel time are predicted to be small (up to 2.5 minutes, <11%[60]). There is a slight increase in travel times predicted from Highbrook to the airport (12% in the PM peak). This is due to the increase in southbound traffic on SH1 and downstream constraints elsewhere on the network.

Overall, this indicates that the Project is expected to improve journeys over a much wider area than just the Onehunga-Penrose area.

b. **Travel time consistency**

Consistency of travel times across the day has been used as a measure of journey time reliability to reflect the manufacturing and logistics activity in the Onehunga-Penrose area. In addition to reductions in average travel times, there will be a significant reduction in the range of travel times experienced across the day and by direction of travel. This is most notable for trips accessing SH1 south where the range reduces from over 12 minutes to under two minutes. Whilst there will still be variability in travel times through peak periods it is expected to be significantly improved with much greater consistency across the time of day and direction of travel.

[60] Percentage reduction is compared to the Without Project scenario.

The significantly improved consistency across the movements, directions and times of day are expected to allow improved and more flexible journey and logistics planning for businesses in this area. This is expected to assist increased freight and economic efficiency for this area.

When the Project is in place, modelling predicts that travel times on SH1 and SH20, for vehicles not accessing the Onehunga-Penrose area, stay the same or experience marginal improvements. This shows that the extra capacity provided on SH1 (as part of the Project) and on SH20 (as separate works), means that the extra EWL flows can be accommodated without a detrimental impact on the travel along SH1 and SH20.

c. **Changes in daily traffic flow – local network**

The general pattern of changes in daily flow suggest that traffic will move from the adjacent corridor to the EWL, with large reductions in flow, and therefore reduction in congestion, seen on Neilson Street and Church Street. There is a decrease in flows on other routes, including residential areas, therefore improving conditions and accessibility for residents.

Flows expected on the Main Alignment range from 33, 700-48, 500 vehicles per day which is similar to the flows in the existing Neilson Street/Church Street corridor. This level of flow requires a general configuration of four lanes.

Changes in daily flows on EWL and in the adjacent corridors are illustrated on Figure 12-1 to Figure 12-3. Where there has been a decrease in the daily flow, the figure illustrates this in green; an increase in flow is illustrated in red. The line thickness denotes the relative change in flow where a wider line is a greater change and a thinner line is a smaller change. The changes are discussed in more detail in the paragraphs that follow.

Figure 12-1: Changes in daily flow in the adjacent corridor (west)

Notable from the figure above is a significant diversion of traffic to EWL and the on/off-ramps connecting to EWL. The new extension of Galway Street results in more traffic on Galway Street, south of Neilson Street. Generally the remaining roads in the area have lower daily flows, with Onehunga Mall (south of Neilson Street), Onehunga Harbour Road and Neilson Street having the biggest change. The traffic on Onehunga Mall (south of Neilson Street) is expected to reduce significantly (81-84 %) with the flows on Onehunga Harbour Road predicted to reduce by nearly 100% (only a few hundred per day) without the wharf redevelopment. The traffic flows on Neilson Street (Selwyn Street to Onehunga Mall) are also expected to reduce substantially (38-40 %).

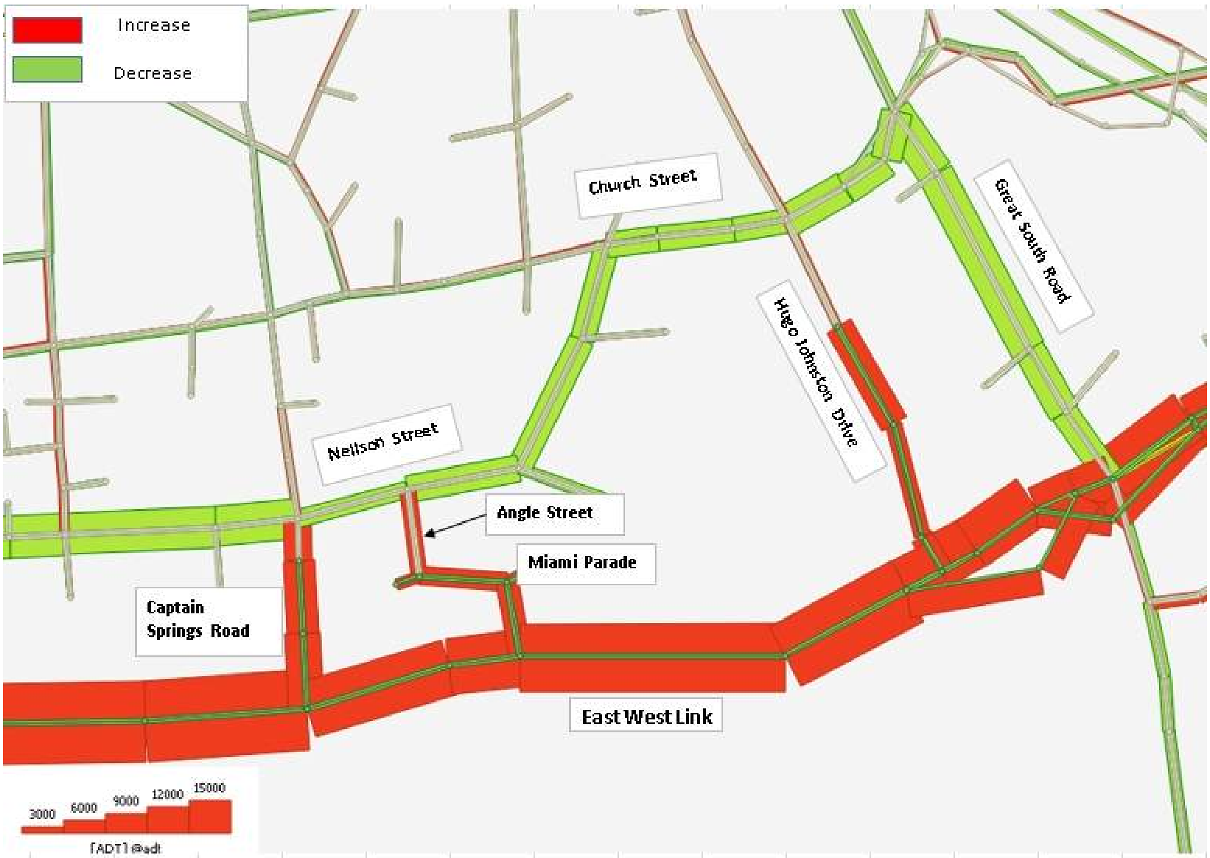
Some 55% of the total current traffic and 64% of the existing freight movements are expected to be removed from the Neilson Street/Onehunga Mall intersection. This reduction in flow allows improved pedestrian and cycling facilities, improved amenity, and reduced traffic severance between Onehunga, the foreshore and Old Māngere Bridge.

There will also be a significant reduction on Gloucester Park Road (south) due to the provision of the new on ramp to SH20 from the EWL.

There will be increases in traffic on Selwyn Street due to the closure of Gloucester Park Road (north). However, Selwyn Street is a 4-lane road which can accommodate the predicted level of traffic flows.

An increase in traffic is expected on Victoria Street (north of Neilson Street). However, the increase of 2,000 vpd should not create a material adverse impact. Further, the presence of the rail crossing on Victoria Street and the predicted increase in traffic flows will only result in a minor increase to queue lengths during a train crossing and these are not expected to queue back to the Neilson Street intersection.

Figure 12-2: Changes in daily flow in the adjacent corridor (central) 2026



Notable from Figure 12.2 is a significant diversion of traffic to EWL and along the connecting roads (Captain Springs Road and Hugo Johnston Drive) between EWL and Neilson Street. This figure also shows Neilson Street, Church Street and Great South Road have much lower traffic flows.

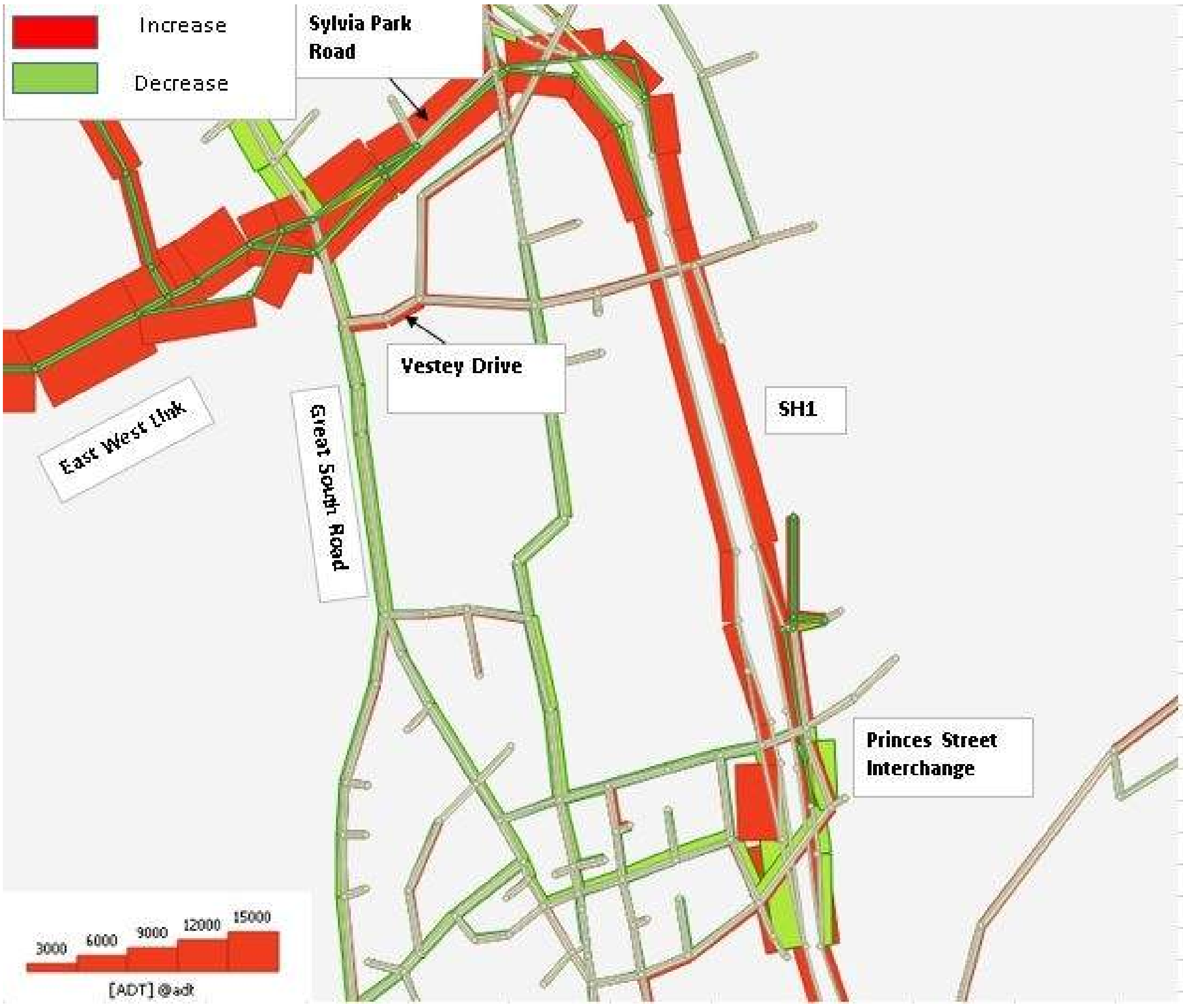
There will be a significant increase in traffic (a 371% increase) on Captain Springs Road south of Neilson Street. This is because it becomes the major connection between the EWL and Neilson Street, taking on an arterial road function. It will be widened to four lanes to accommodate this change in function and traffic flow.

There is an increase in traffic flow predicted at the northern end of Hugo Johnston Drive, as it provides an additional connection between the EWL and Church Street and O'Rorke Road. The extra through traffic attracted to the route is partially mitigated by a proportion of traffic from activities on Hugo Johnston Drive now being able to exit south to the EWL rather than having to exit to the north. This means that there will be a small increase at the northern end, but the southern end will get noticeably busier with the introduction of through traffic. Hugo Johnston Drive will retain its current two lane and tree-lined form.

The flows on Neilson Street (near MetroPort) are expected to reduce significantly which will ease the ability to access Neilson Street from properties and side roads. An increase in flows is expected on Miami Parade and Angle Street and these flows can be accommodated. The flows on Great South Road are expected to reduce, including a 36-37% reduction at Southdown Lane.

Combining the flows on EWL Main Alignment and Neilson Street (east of Galway Street) there are predicted to be some 60,000 vpd travelling along the corridor; increasing towards 80,000 vpd when combined with the Church Street corridor.

Figure 12-3: Changes in daily flow in the adjacent corridor (east) 2026



Notable in Figure 12.3 is a large increase in traffic on Sylvia Park Road (west of the new motorway ramps), and an increase along SH1. Local roads around Princes Street benefit from reduced traffic.

The flows on Sylvia Park Road are expected to increase significantly (29-34%) west of the new motorway ramps, but only marginally at the eastern end (1-5%). Sylvia Park Road is proposed to be widened to four lanes to accommodate the increased flow and to integrate with the new ramps.

There will be an increase in daily flow on SH1 by approximately 10-11% with the new ramps and increased capacity on SH1. The additional lanes on SH1 avoid potential adverse effects on the travel times along SH1.

The flows on the western end of Vestey Drive are expected to increase significantly (41%) by approximately 3,000 vehicles per day in 2026. Vestey Drive will be able to accommodate the predicted increase in vehicles and will not need to be upgraded. However, it is recommended that the destination of Māngere is included on any existing or future road signage located on Mount Wellington Highway which directs motorists to perform a right turn into Sylvia Park Road, rather than using Vestey Drive. Reductions are expected on the arterial north-south routes of Great South Road (8-11% reduction) and Mount Wellington Highway (7-11% reduction), as traffic is diverted to SH1 (a 10-11% increase).

In Ōtāhuhu, the improved capacity and access to SH1 is expected to reduce vehicles currently diverting through the local network. Therefore significant reductions in traffic on Avenue Road (46-47%) and Princes Street (9-11%) are predicted. Together over 4,700 vehicles per day are expected to be removed from these two roads.

d. **Changes in daily traffic flow - Wider Network**

Key changes including improved network capacity and connectivity is predicted to reduce through traffic on residential streets north and west of Onehunga. Reductions in east-west traffic in Penrose including a 12-21% reduction in traffic on Mt Smart Road and other reductions in streets within Penrose. The flows on SH1 north of the South Eastern Arterial are not expected to materially change. Flows south on SH1 south of EWL are expected to increase, however SH1 is being widened between the EWL ramps and Princes Street to accommodate these changes. An increase on SH20 is expected north of Neilson Street however the flows on Manukau Harbour Crossing are not expected to materially change.

e. **Effects on Residential Amenity**

Reductions in traffic are predicted in residential areas in both 2026 and 2036, thus improving network conditions for residents on streets such as:

- Campbell Road;
- Mt Albert Road;
- Mt Smart Road;
- Avenue Road;
- Trenwith Street; and
- Frank Grey Place (north of Trenwith Street).

f. **Community and Business Accessibility**

The significant reduction in traffic around Neilson Street and Onehunga Mall will provide amenity benefits and improve the environment of the road, allowing a high quality pedestrian and cycling facility to be provided. This will significantly improve accessibility to Onehunga Town Centre from the south.

Current high volumes of traffic on Neilson Street can mean it is difficult to turn into or out of local driveways and side roads resulting in people taking ‘chances’ pulling into small gaps and in some cases leading to crashes. Without the Project, traffic demands will increase, potentially further exacerbating the problem of motorists pulling into very small gaps. The reduction in traffic on Neilson Street with the Project will significantly reduce the wait times from local roads and driveways improving accessibility to local businesses.

g. **Corridor Operational Analysis**

Level of service is a consistent measure used across transport projects to understand how a road is currently performing and how it is predicted to perform. Level of service assesses the waiting time at intersections and the speed of flowing traffic which helps to inform design. The level of service for intersections is defined by the seconds of delay experienced. For vehicles (including freight) on the EWL all intersections perform at or better than the Project design target of Level of Service D (33-55 seconds delay at intersections). For pedestrians at signalised intersections the majority of crossing points will be Level of Service D or better (30-40 seconds delay).

For traffic travelling along EWL the average speed will meet or better the recommended targets of Level of Service B during interpeak periods and C at peak periods.

h. **Impact on State Highway Network**

When the Project is in place the travel times on SH1 and SH20 routes will be similar to the Without Project scenario, or in some cases experience some improvement. The improvements are due to the proposed motorway widening on SH1 (to be undertaken as part of the Project) and the EWL Main Alignment allowing some diversion of traffic away from the southern parts of SH20. This demonstrates that the widening on SH1 will allow the proposed ramps and associated traffic increases to be accommodated without significantly impacting on through traffic on SH1. Similarly on SH20, the auxiliary lanes proposed between Neilson Street and Queenstown Road (a separate project being implemented by the Transport Agency in late 2016), will mean that the extra flows from the improved Neilson Street Interchange can be accommodated without adverse impact on SH20.

12.2.4.2 Effects on parking, access and roads with increased traffic

a. **Access**

Access to some properties and streets are likely to change as a result of the Project.

There are some properties on Gloucester Park Road, Onehunga Mall, Onehunga Harbour Road and Sylvia Park Road that will require a longer route to gain access to them. However, potential adverse effects are all mitigated by the reduced congestion and significantly improved access to SH1, SH20 (and the local roads) due to the Project.

Access to Orpheus Drive will be via a low volume local road rather than the current high volume motorway access road. This will be more compatible with its recreational function.

Access to businesses on Galway Street (north of Neilson Street), will have reduced accessibility due to the banned turns proposed from Neilson Street at Galway Street. The proposed reinstatement of the right turn into Onehunga Mall will mitigate the impact on accessibility.

Access to 781 Great South Road is currently restricted to left-in and left-out only, however these constraints can be removed due to the significant reduction in traffic flows at that location. This will significantly enhance access to and from the site, especially for access to the EWL.

Vehicles exiting Pacific Rise onto Sylvia Park Road are anticipated to become easier with the widened intersection form. The staggered movement allows traffic lanes to be crossed in succession rather than all at once.

Access to Sylvia Park Town Centre for Hillside Road residents will be significantly improved by reinstating the right turn from Hillside Road into Panama Road. The route will be shorter and quicker and has a positive connectivity impact for this community.

The upgraded interchange at Princes Street is expected to better manage motorway queuing, and allow non-motorway traffic to move around any residual queues. This is expected to significantly improve the quality and resilience of access to this community.

b. **Parking**

The removal of approximately 15 parking spaces on the southern side of Onehunga Harbour Road cul-de-sac (opposite The Landing) can be mitigated by replacing these spaces in the redundant portion of Onehunga Harbour Road to the west of the Airport Harbour View Motel. There is also opportunity for these car parking spaces to be replaced on the newly realigned Onehunga Harbour Road which will be lightly trafficked with the Project in place.

On Galway Street (south of Neilson Street) approximately 30 on-street parking spaces will be removed. It is anticipated that the demand for the spaces can be provided off-street as the businesses on Galway

Street were observed during surveys to have extensive off-street parking. A clearway on one side of Galway Street will be considered to mitigate the loss of on-street parking.

With the Project in place there will be an overall net gain of 10 on-street parking spaces on Captain Springs Road due to the conversion of the current private road portion into public road. There will be a temporary loss of 38 on-street parking spaces for short periods of time in the morning and evening peaks with the implementation of a clearway. Demand during these periods will exceed supply, however parking for 42 cars on the western (Waikaraka Park) side of the road will be available at all times during the day and should adequately remedy the temporary shortfall.

The Project will involve the removal of approximately 40 car parking spaces on Hugo Johnston Drive but there will still be sufficient on-street parking capacity for existing users. The on-street parking spaces available will be towards the southern end of Hugo Johnston Drive which may mean some people have to walk further. To mitigate this potential personal safety impact, upgrades to existing street lighting will be considered during detailed design if required in consultation with Auckland Transport. However, the through traffic and enhanced recreational cycling facilities is expected to increase parking demand. Therefore additional parking is proposed at the southern end.

On Sylvia Park Road, 150 existing on-street parking spaces will be removed but will not have a significant impact on parking as the spaces are currently significantly under-utilised with only a 6% occupancy rate. The removal of the majority of the businesses on the southern side will mean that the associated demand will also be removed as all observed cars during surveys were parked on the southern side.

At 1016 Great South Road, approximately eight car parking spaces are likely to be removed. It was assessed that the demand for on-site parking for this site can still be accommodated with the reduced number of spaces.

There will be a loss of approximately 40 car parking spaces associated with the rear units at 20 Sylvia Park Road. An appropriate number of parking spaces, as determined by the AUP (OP) parking provisions or relevant resource consents, will be provided for the remaining rear units.

There are other locations where a small amount of on-street parking will be lost, however this can be absorbed into existing nearby streets. A full discussion of these locations is contained in *Technical Report 1: Traffic and Transport Assessment* in Volume 3.

12.2.4.3 Walking and Cycling Effects

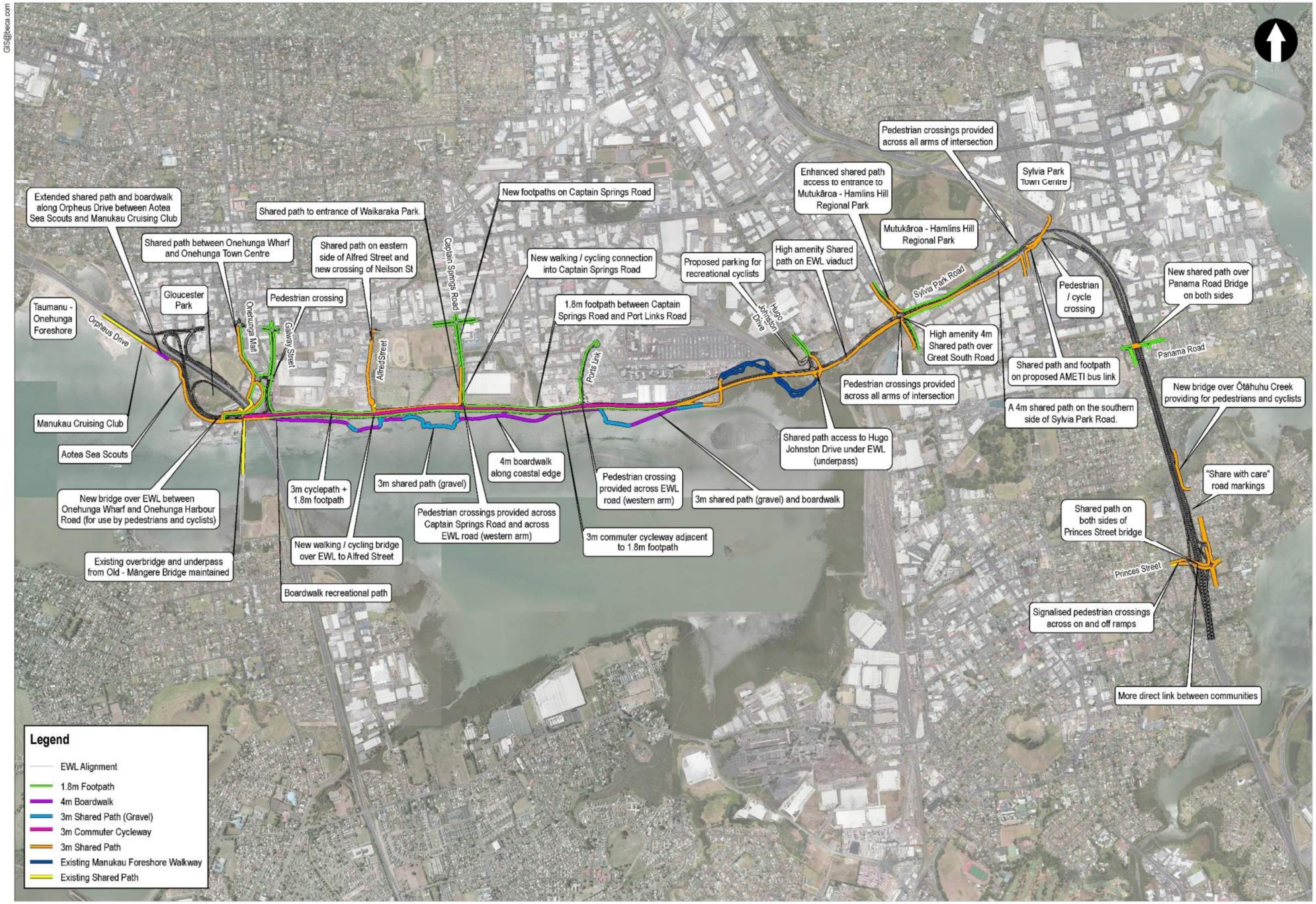
The Project will have significant positive impacts on pedestrians and cyclists and will provide approximately 24km of new cycling and walking facilities.

The Project will improve safety and accessibility for cycling and walking between Māngere Bridge, Onehunga Town Centre and Sylvia Park Town Centre by providing a direct continuous link and connecting key destinations. The proposed direct route between Māngere Bridge and Sylvia Park Town Centre will be approximately 1.6km shorter than the current route. This includes a high amenity elevated shared path over Great South Road removing the need for pedestrians and cyclists to make three separate at-grade crossing movements. One new connection on Captain Springs Road and one enhanced connection on Alfred Street will also improve accessibility and connectivity between the Māngere foreshore and Onehunga. A new pedestrian and cyclist connection across Ōtāhuhu Creek between Princes Street and Panama Road communities and will improve local connections between the two currently segregated communities.

Auckland Transport has identified roads that are intended to accommodate cycleways in the future. A number of these roads are predicted to have reductions in flow of traffic with the Project in place in 2026 (e.g. Onehunga Mall, Church Street and Princes Street in Onehunga). This will have a positive impact on cyclists. All facilities have been designed to safely accommodate the number of cyclists and pedestrians that are predicted to use the facilities, particularly on weekends.

Overall, the Project will have significant benefits for pedestrians and cyclists. The proposed improvements are illustrated on Figure 12-4 and described in Sections (a) to (d) that follow.

Figure 12-4: Overview of proposed walking and cycling facilities as part of the Project



a. **Sector 1**

Between the Aotea Sea Scouts Hall and the Manukau Cruising Club on Orpheus Drive there will be improvements to connectivity and accessibility from the new 3m off-road shared path which connects between the existing Manukau Foreshore Walkway and the Old Māngere Bridge.

There will be significantly improved connectivity for pedestrians and cyclists between Old Māngere Bridge, Onehunga Wharf and key destinations such as Onehunga Town Centre and Onehunga train station. A new link will close the existing network gap between the cul-de-sac at the end of Onehunga Mall and the Onehunga Town Centre and Onehunga train station.

The shared path will be high amenity, separated from traffic by a kerb and adjacent to a low trafficked environment, particularly on Onehunga Harbour Road and Onehunga Mall where traffic volumes will reduce significantly (up to 84 %) with the Project in place.

b. **Sectors 2 and 6**

From Old Māngere Bridge along the foreshore there will be significant connectivity and accessibility improvements through the provision of new high amenity pedestrian and cycling facilities on both sides of the new road. This includes shared paths, boardwalks, commuter cycle lanes and footpaths.

There will be new and enhanced connections between the foreshore and the Onehunga community via a new link at Captain Springs Road and enhanced connections along Alfred Street and with recreational spaces (e.g. Waikaraka Park). Proposed overbridges, underpasses (new and existing) and new at grade signalised intersections will allow pedestrians to cross the new road safely, contributing to high amenity and improved connectivity.

The high amenity facilities provide opportunities for the natural surroundings of the Māngere Inlet to be enjoyed by pedestrians and cyclists. Recreational users and high speed commuters will be separated. Passive surveillance from the new road will improve personal safety. Frequent connections between the boardwalk and the facilities adjacent to the road are provided.

c. **Sectors 3 and 4**

There will be a significant improvement in connectivity for pedestrians and cyclists in Sectors 3 and 4 due to the proposed off-road high amenity route between the end of the existing Manukau Foreshore Walkway at Hugo Johnston Drive and Sylvia Park Town Centre. This will link key destinations of Mutukāroa-Hamlins Hill Regional Park and Sylvia Park Town Centre and close this significant network gap. This sector completes the route between Māngere Bridge and Sylvia Park Town Centre.

This sector includes a 4m high amenity elevated shared path adjacent to the road structure, a proportion of which passes over Great South Road, and continues on the southern side of Sylvia Park Road to approximately 13 Sylvia Park Road. From this point the shared path will remain slightly above the road grade of Mount Wellington Highway until connecting with Sylvia Park Town Centre. The elevated portion over Great South Road will have considerable benefits for pedestrians and cyclists (east-west movements) as they will not have to use the three at grade crossings on the southern arm of Great South Road.

The severance between Anns Creek and Sylvia Park Town Centre will be significantly reduced with a new, high amenity and very direct shared path which is approximately 1.6km shorter than the existing indirect, mainly on-road route. A significant proportion of the shared path will be elevated.

d. **Sector 5**

At Panama Road the shared path on both sides of the replacement Panama Road bridge and a short length of Hillside Road will improve connectivity for cyclists as there are currently no facilities for these road users. The 3m shared path will be off-road, separated from traffic which is a significant improvement from the existing narrow footpath on the bridge catering only for pedestrians.

The new pedestrian and cycling connection over Ōtāhuhu Creek removes the severance for the local communities on either side of the Creek. This will significantly improve connectivity as it will link the Princes Street and Panama Road communities. This will address an existing potential safety risk of children walking along SH1.

At Princes Street, a reconfigured interchange will provide a controlled crossing point across SH1 Princes Street off-ramp and the provision of a large refuge for waiting pedestrians across the SH1 Princes Street on-ramps which will improve safety significantly. A high amenity 3m shared path will significantly improve connectivity and safety for cyclists as there are currently no facilities. More direct and shorter routes across SH1, along with a significantly wider footpath on the bridge, will improve connectivity between the two communities.

e. **Estimate of usage**

Growth predictions have only been undertaken for the main Manukau Foreshore Walkway. Predictions are highly challenging to develop due to the significant variability in usage and because many people would currently be dissuaded from walking and cycling due to the limited infrastructure, high traffic and limited passive surveillance. The key features of the existing use of the walkway include low commuter usage and very high recreational use, including people with families.

Notwithstanding the challenges in predicting likely usage, steady growth across the network for the five years after opening is anticipated. It is estimated that with the Project, the usage would be similar to the upper Dominion Road cycleway or the North West cycleway near Te Atatu. Significant growth in commuter travel in this part of Auckland does not seem feasible without the increased connectivity offered by this Project.

12.2.4.4 Public transport effects

There will be significant improvements to journey time reliability and time savings for buses in the Project area as a result of reduced congestion on local roads. Faster travel times are predicted for the key public transport route of northbound buses accessing Onehunga Town Centre from SH20 with savings of up to five minutes compared to the Without Project scenario. The travel time savings will benefit between 2,400 and 6,300 passengers per day in the future (2036). The main changes to the road network impact bus routes 380, 313 and 309 (on the new bus network) travelling between Māngere and Onehunga Town Centre via SH20. These impacts are:

- Northbound Buses: A revised route via a realigned SH20 Neilson Street off-ramp, EWL off-ramp, Galway Street and Galway Link Road to connect with Onehunga Mall. Buses will no longer use Onehunga Harbour Road to access the Town Centre; and
- Southbound Buses: Existing southbound on-ramps to be slightly realigned. The existing T2 lane at Gloucester Park Road and SH20 on-ramp will be converted to bus-only and will connect directly into the existing bus lanes on SH20.

Without the Project, congestion will cause bus travel times to increase between now and 2036, but with the Project in place, travel times entering Onehunga are shown to be lower (by up to 5 minutes), and remain consistent throughout the day. This results in more resilient and reliable bus services. The travel times for buses during peak times are predicted to be consistent with those for the inter peak, thus indicating a higher level of reliability not impacted by congestion.

The improvements for travel time reliability will also benefit passengers by making it easier to make onward rail and bus connections. It is anticipated that passengers accessing the Onehunga train station via bus services will experience an increase in reliability to the overall journey into the CBD or other rail station.

Reduced travel times will result in significant cumulative time savings for public transport users. Given more reliable journeys are predicted with the Project, efficient service scheduling and timetables can be developed.

In addition to the positive impacts for bus passengers accessing Onehunga Town Centre, the Project will provide benefits for other bus routes. Significant journey time savings on eight other bus routes are predicted in 2026 with the Project in place. This includes a predicted seven minute saving on southbound Crosstown 8 bus in the morning peak in 2026 with the Project in place compared to without the Project.

School bus routes are expected to gain potential travel time and safety benefits where they travel through roads with predicted reductions in traffic flows and congestion.

The Project will not impact any existing bus stops. The two future bus stops planned by Auckland Transport for Great South Road can be accommodated by the Project design.

The Project does not preclude a future mass transit connection to the Auckland Airport. Auckland Transport has advised that the current preference is for an elevated route over Neilson Street and the EWL as it crosses the Manukau Harbour. The design of EWL and its connection to Galway Street has sought to provide flexibility for future decisions on the mass transit link. This has included provision of an at grade intersection of Galway Street and the EWL.

The Project also integrates with Auckland Transport's proposed AMETI bus link at Sylvia Park.

Overall, the Project will have a highly positive impact on public transport in the local area particularly for buses travelling northbound between SH20 and the Onehunga Town Centre with significant (5 minute) journey time savings for between 4,500 and 6,300 passengers in the future. The Project will also have a positive impact on eight bus routes in the wider area with significant travel time saving benefits. The Project does not preclude further future bus or the rail plans to the airport.

12.2.4.5 Effects on safety performance

A high crash rate was not identified as a major problem in this area. However, the predicted reductions in traffic flow on the wider network are expected to result in some reduction in road crashes in those areas. Significant reductions would be expected on adjacent roads such as Neilson Street, Church Street, Great South Road, Onehunga Mall and Princes Street in Onehunga. Smaller-scale reductions would be expected in the wider network, such as on Favona Road, Campbell Road, Mt Smart Road and Mt Albert Road.

In relation to the new roads, consideration of safety has been a critical part of the design process. This has included use of design standards, Safety in Design workshops and independent Safety Audits at various stages of the design development. Issues raised in the Safety Audit have been considered and the design revised or confirmed as appropriate. Overall, it is considered that the new facilities are expected to appropriately address safety issues in their design, with crash rates likely to be lower than those on existing local roads. This is due to the specific design features, including limited direct property access, appropriate lane and shoulder widths, raised median islands and an appropriate arterial road environment.

The analysis of recent recorded crashes described earlier showed few recorded crashes for cyclists and pedestrians, except on Neilson Street where a serious and fatal cyclist crash was recorded.

The proposed pedestrian and cyclist facilities and connections were informed by a desire-line analysis that identified the routes and movements that were considered critical to incorporate.

Generally, the Project is considered to enhance pedestrian and cyclist safety in a range of ways:

- Providing an extensive network of off-road/separated facilities connecting key communities and destinations;

- Safe crossing facilities of the route and at existing roads;
- Reductions of truck and traffic flows on a range of local streets which could be used by cyclists; and
- Providing a strong east-west link along the foreshore (connecting with north-south access routes), that would reduce the need or desire for cyclists to use Neilson Street, which would continue to have high levels of truck movements.

12.2.5 Measures to avoid, remedy or mitigate potential adverse effects on traffic and transport

12.2.5.1 Approach to mitigation

The general approach to potential adverse operational traffic effects has been to design the Project to avoid or remedy adverse effects where practicable. Residual effects that have not been mitigated by the initial design phase are outlined below. It is anticipated all the operational traffic effects can be mitigated through the detailed design phases of the Project such that there will be minimal adverse effects.

12.2.5.2 Particular areas for mitigation

Specific areas for mitigation to be included either in the design or subsequent agreements with stakeholders are as follows:

- Replace car parking that is removed outside The Landing;
- Provision of clearways on Captain Springs Road and consideration on Galway Street to allow for off-peak parking;
- Removal of some parking on Hugo Johnston Drive along with the consideration of upgraded street lighting (if required);
- Provision of a u-turn facility and additional parking at the southern end of Hugo Johnston Drive;
- Explore the potential to allow internal access arrangements to 8 Sylvia Park via 1 Pacific Rise;
- Reinstatement of right turn onto Onehunga Mall from Neilson Street;
- Inclusion of Māngere as a destination into any existing or any future highway signage on Mount Wellington Highway directing motorists to perform a right turn into Sylvia Park Road rather than using Vestey Drive;
- Ongoing engagement with Auckland Transport to enable delivery of the shared path at the eastern end of the EWL main alignment in conjunction with Auckland Transport and extends through to the Sylvia Park Town Centre boundary;
- Ongoing engagement with Auckland Transport during detailed design development of the type of walking and cycling infrastructure, including both the form and connections; and
- Implementation of deign objectives and ongoing engagement with Auckland Transport for the design of specific locations where the Project interfaces with the existing local road network. This includes the design of Hugo Johnston Drive, Captain Springs Road, Pacific Rise intersection to accommodate u-turns and the re-instatement of the right turn from Hillside Road and at 781 Great South Road.

12.3 Economic effects

Overview

The Project will deliver significant benefits to the local and regional economies. During construction, these include employment opportunities for local contractors and the supply of construction materials. Once the Project is completed, it will enable faster and more reliable travel times and reduced congestion, resulting in economic efficiencies that support businesses for growth and less congestion for motorists.

12.3.1 Introduction

This section presents the findings of investigations undertaken to determine the high level actual and potential economic effects from the construction and operation of the Project. The economic assessment is based on census data and interviews with businesses in the Project area.

Effects on individual properties and businesses are assessed in *Section 12.4: Assessment of property, land use and business disruption effects* of this AEE.

12.3.2 Existing Economic Environment

The existing economic environment for the Project is discussed in *Section 2.0: Background*, *Section 11.0: Description of the existing environment* and also in *Report 3: Economic Assessment* in *Volume 3*.

The assessment shows the biggest changes to the current economic issues are likely to result from:

- Increasing growth in transport, warehousing and distribution which will lead to an increase in freight trips to, from and within the Project area;
- Increasing employment within the Project area, which will lead to increased pressure on the transport system at peak hours as commuting trips increase;
- Specific pressures on the transport network as a result of local economic growth, e.g. the consequences of greater movements of heavy vehicles in and around Penrose and Onehunga; and
- Freight volumes, which are strongly driven by regional population growth rather than local employment growth and are expected to increase as a consequence of regional population and economic growth.

12.3.3 Assessment of economic effects during construction

The period of construction will have a positive impact on the local and regional economy. The Project is anticipated to take approximately five to seven years to build and at its peak would employ 300 to 500 people. The presence of construction teams will likely increase spending at some local businesses including local food outlets. In addition some local suppliers will benefit from the manufacture and provision of construction materials. There will be adverse impacts on specific businesses and properties, which are discussed in further detail in *Section 12.4: Assessment of property, land use and business disruption effects* of this AEE.

12.3.4 Assessment of economic effects from operation

There will be positive economic effects from the ongoing operation of the Project. These effects are of local, regional and national significance and are set out in further detail in *Section 3.4: The outcomes to be delivered by the Project* of this AEE.

In summary the benefits will facilitate economic growth in the area through:

- Lower delivery costs from improved travel times;
- Increased accessibility both locally and regionally for vehicles, pedestrians and cyclists;
- Attracting new businesses due to increased local amenity, safety and reduced congestion;
- Improved accessibility from better travel times and reliability for buses;
- Increased land values; and
- Greater propensity for higher value-added industrial activities.

Overall, travel demand within and through the area will increase as Auckland's population and transport pressures increase. The Project will help enable growth in the area and absorb the impacts of growth in travel demand by providing capacity to keep pace with growth and deliver economic benefits for Auckland.

The significance of the Southdown Freight Terminal as a key link between regional supply chains will grow. Northland, Auckland, Waikato and the Bay of Plenty together produce more than 50% of New Zealand's GDP today. Increased economic interaction between these regions through the establishment and strengthening of supply chains will continue to drive economic growth in the upper North Island and throughout the country. Based on engagement during the Project, it is understood that there is likely to be an increase in the volume of freight going through MetroPort and the rail associated facility, with longer trains and additional services needed to service increased demand for goods.

More rail freight[61] will lead to an increase in short distance road freight trips in the Project area. Without increased road capacity, this will result in congestion and travel time delays, compromising economic efficiency. The Project will enable improved road capacity by reducing congestion on local roads and thereby improving rail freight accessibility within and beyond the area. This will contribute to increased economic efficiency and growth.

The State highway networks are the backbone of the regional and freight economy. The Project will add a new strategic road to the State highway network, helping to manage anticipated growth.

For local businesses, economic advantages of the area include the central location to the main industrial area, proximity to customers and suppliers and proximity to good transport links. For businesses, the comparative advantages of the location have increased with business growth. However, this growth has resulted in increased congestion on the road network. By addressing congestion, the Project will continue to support the principal economic function of the Onehunga-Penrose industrial hub. The zoning of the area has recently been confirmed in the AUP (OP) for industrial purposes, providing industrial and commercial land to support Auckland's growth.

In response to existing congestion, local businesses have identified three operational adaptations that they currently consider necessary:

- Adjusting patterns of operation to avoid the worst peak periods;
- Undertaking longer deliveries in the early morning when congestion is lower and doing shorter local movements in the middle of the day; and
- Increasing resources (vehicles and staff) to meet transport needs.

These necessary adaptations affect business efficiency. The Project will reduce congestion, deliver more reliable travel times and higher quality freight routes, which will have direct economic benefits on the businesses currently experiencing these issues. Improved freight times are likely to reduce handling

[61] This is anticipated from growth, not as a direct result of the Project.

costs. The Project will also assist business to meet customer expectations, especially for businesses relying on time-critical deliveries.

12.4 Assessment of property, land use and business disruption effects

Overview

The Project traverses business and commercial areas around the Onehunga Town Centre in the west; through industrial and business areas of Penrose, Mt Wellington and Te Papapa and through dominantly residential areas in Ōtāhuhu and parts of Mt Wellington. This section provides an assessment of the effects of the Project on land uses, property and business activity during both construction and operation of the Project.

<u>Construction effects</u>

The Project is a significant construction project. The Project design has minimised and/or avoided a number of potential business disruption effects, however there are potentially significant impacts to businesses and existing land uses arising from construction activities. Measures will need to be implemented during construction to minimise or mitigate these potential impacts.

Construction activities will require establishment of construction yards, haul routes, temporary road works (including closures) and traffic management through construction. Key disruption effects include:

- Restrictions in access to businesses during construction, disrupting the ability for businesses to undertake operations. These potential adverse effects can be appropriately managed by involving potentially affected businesses in the preparation of construction traffic management plans and construction management.
- Changes to accessways and loss of visibility for businesses reliant on 'passing trade' and pedestrian access for their operation. These potential effects can be appropriately managed through consideration of temporary signage and other information to direct and inform those business users of access arrangements, and to consult with businesses on specific access requirements.
- Disruptions to business operations sensitive to noise and vibration, for construction works generating these impacts. Given the industrial nature of many areas of the Project, this impact is considered minor and can be appropriately managed through liaison with key businesses.

Some businesses are likely to experience positive effects during construction due to increased economic activity from the influx of construction workers to the area. This benefit is likely to be experienced by service industries and construction businesses.

In addition to effects on business land, the Project will affect open spaces and residential properties. Open spaces will be adversely affected during construction but will be appropriately reinstated or replaced such that the long term effects will be positive.

<u>Operational (permanent) effects</u>

The improved accessibility and travel time reliability will provide significant positive business operation effects, improving efficiency for business operations notably supply chain and distribution activities. These infrastructure improvements provided by the Project are identified in the Auckland Plan as a key enabler to improving GDP per capita in Auckland.

Reduced traffic volumes and the separation of local business traffic from 'through traffic' will provide significant benefits for the commercial, residential and retail activities existing and proposed in the Onehunga Town Centre. This will facilitate opportunities for the planned growth of this centre to be realised. This is considered a positive effect of the Project.

Direct land requirements will impact a number of businesses within the overall Project area. The alignment design has specifically sought to minimise or avoid adverse business effects.

Notwithstanding this, the following potential business disruption effects have been identified:

- Closure (temporary or permanent) or relocation of businesses. PWA processes are available to address these matters. Mitigation measures proposed to address the residual business disruption impacts include early engagement with these businesses to enable business relocation (as appropriate) and
- Reconfiguration of business operations on sites where partial land acquisition is required, to enable business continuity where land requirement will either impact on specific business operations or on site manoeuvring. PWA processes are available to address this. Mitigation measures to address residual potential adverse 'business disruption' effects include early engagement to enable effective planning and implementation of these works.

12.4.1 Introduction

There is a general pattern of land use change along the Project, as described in *Section 11.0: Description of the existing environment* of this AEE. The alignment traverses business and commercial areas around the Onehunga Town Centre in the west; through industrial and business areas of Penrose, Mt Wellington and Te Papapa, and through predominantly residential areas along the Project in Ōtāhuhu (adjacent to SH1). This section provides an assessment of the effects of the Project on land uses, property and business activity during both construction and operation of the Project. This section should be read in conjunction with *Section 12.14: Social Effects* of this AEE which addresses impacts on recreation, community and residential resources.

For those properties where land is required either permanently or for construction, the acquisition or lease of land will be undertaken by the Crown through the PWA process. The PWA establishes acquisition and compensation processes for this required land and as such, this specific matter is not considered further in this AEE.

This section assesses the effects of direct property impact, land use change and business disruption. Social effects of land use acquisition on residential properties and reserves, are addressed in *Section 12.14: Social Effects* of this AEE and contained in *Technical Report 11: Social Impact Assessment* in *Volume 3: Technical Reports*.

12.4.2 Overview of property effects and business disruption

Impacts on land use and property arise from three broad categories of physical impact. Each of these physical impacts give rise to different business disruption and land use effects during construction and operation activities. The categories of impact include the following:

- Effects arising from the direct physical impact of land. Key variables which influence the significance of the land use or business disruption effects include whether:
  - The whole site or only part of a site is required;
  - Building or service removal / relocation is required;
  - The required land is from the front or rear of the site (frontage land is often of greater significance); and
  - The land includes accessways or other services / utilities integral to the site.

- Effects on a property or land use arising from direct physical impact on adjoining land where this impacts on an easement or other property right (such as a right of way). The land use and business disruption impacts derive from loss or changes to accessways or site servicing. This category of impact also considers impacts to the operation of utilities over existing land uses (e.g. if a designation across land is affected this may have consequential impacts on the land uses and activities on a site); and
- Properties within proximity to the Project. In these cases, adjoining activities and land uses are impacted by effects resulting from the Project. This includes construction and operation effects. A number of these effects are considered elsewhere in this report (e.g. noise and vibration effects) and changes to the use (e.g. traffic volume), or operation of existing roads (e.g. accesses) or other network utilities. This section specifically considers the impact of these changes on the operation/activities of those properties/land uses, in particular impacts on the operation of businesses.

The Project footprint is shown on *Plan Set 3: Road Alignment* in *Volume 2* and a schedule of all the land required by the Project is attached to the NoRs.

12.4.3 Project context of property impacts and business disruption

The Project is located within the commercial and industrial suburbs of Onehunga, Penrose and Mt Wellington and then follows SH1 through the residential areas of Mt Wellington and Ōtāhuhu. Typical business activities can be broadly defined over these suburbs as:

- In the Onehunga area, businesses include a range of service and retail operations, including automotive servicing, building and business supplies and retail and food service businesses. A number of these businesses are small to medium sized enterprises with up to 10 full time employees.
- In the Southdown/Penrose area, there is a greater mix of heavy industrial activities and businesses, including construction, supply chain logistics, and manufacturing activities that involve discharges to air typical of a heavy industry zone. A number of these businesses are larger enterprises (e.g. Car Haulaways, Downer (parent company of Green Vision Recycling Ltd), and OI Glass).
- In the Mt Wellington area, there is a mix of industrial and business activities, including business park (e.g. at Hugo Johnston Drive), manufacturing (e.g. on Great South Road and Sylvia Park Road), service businesses and food processing and distribution. Throughout this area there are a range of small, medium and large businesses.

Open spaces in the Project area provide a mix of formal and informal recreation opportunities. Key open spaces of note are:

- Gloucester Park North;
- Gloucester Park South;
- Waikaraka Park;
- Waikaraka Cemetery;
- Manukau Foreshore Walkway (east and west);
- Ōtāhuhu Marginal Strip; and
- Bedingfield Memorial Park.

12.4.4 Design philosophy to minimising property, land use and business disruption impacts

The Project philosophy has been to avoid and minimise potential adverse impacts on businesses and business disruption through alignment and Project design, where this is practicable. This has included specific consideration of the potential business disruption impacts in the assessment of alternatives for alignment options as discussed in *Section 8.0: Consideration of Alternatives* of this AEE.

There are a number of examples where this process has enabled potential effects to be avoided or has minimised potential effects. For example:

- In early phases of the corridor options assessment (as discussed in *Section 8.0: Consideration of Alternatives* of this AEE), corridor selection considered routes that bisected industrial zoned areas and considered the potential for such severance to undermine the viability of residual land blocks.
- The assessment of alignment options considered the significance of land required and resulting business disruption, particularly where the Project could impact on the viability or operation of major / significant business activities in the area. This issue was considered in the development of alignment designs for the ramps to SH1 (e.g. impacts on business operations including Tip Top and the major activities at Turners & Growers).
- The development of the Preferred Alignment sought to avoid significant disruption impacts to land use and business activities where these issues were raised by landowners in engagement (see *Section 9.0: Engagement* of this AEE). For example, design was undertaken to reduce impacts on business manufacturing operations at Great South Road / Sylvia Park Road and for vehicle access and manoeuvring for distribution to businesses on Captain Springs Road.
- The use of open space or 'low utilised' land for construction yards. For example, the undeveloped areas of Onehunga Wharf, the southern Waikaraka Park area, Gloucester Park South and the vacant land at Hugo Johnston Drive and 'undeveloped' (vacant or low use) business land areas adjoining SH1.
- The investigating of alternative options for stormwater treatment such as proprietary devices where land requirement would have potentially adverse impacts on business operations.

12.4.5 Quantifying the land impacts for property and business disruption effects

The Project requires land from a number of existing land uses (broadly defined by zones). The total Project footprint is 128.9ha which includes approximately 104.5ha of land (including existing areas associated with SH1). The land includes the following zoned land for the AUP (OP):

- 17ha of existing road (excluding State highway);
- 2.7ha of residential land across 62 properties – these impacts are largely in Sector 5 (comprising purchase of 14 properties in full and predominantly impacts on the rear of sites adjoining the existing SH1). The resulting "impact" on owners, residents and the local community of this request for residential land is discussed in *Section 12.14: Social effects* of this AEE;
- 12.5ha of Open Space Zoned Land – the impacts on open space will be greater for construction (see comments in Section 12.4.4 above) than for the permanent physical works. Major areas of impact include Gloucester Park, the Manukau Foreshore Walkway, the undeveloped southern area of Waikaraka Park and some reserve areas where mitigation works are proposed. The resulting "impact" of these acquisitions are discussed in *Section 12.14: Social effects* of this AEE;
- 40.7ha of business and industrial land affecting approximately 40 businesses[62], of which:
  - Approximately 20 business sites are required to be purchased in full (such that the business operations on these sites will be required to relocate or be reconfigured). Two of these sites are undeveloped with one at Hugo Johnston Drive and one at Mt Wellington;
  - Land requirements will impact on the existing operation of a number of businesses, including:
    - On buildings and site operations on businesses;

[62] Some sites have multiple tenants and businesses operating on site.

- o On sites with specific locational requirements, including the Advanced Flight heliport operation which has specific Civil Aviation Authority requirements that prescribe operations;
- o On site accesses and site servicing which have the potential to impact on business operations (e.g. for remaining businesses on Gloucester Park Road, Captain Springs Road, and Sylvia Park Road); and
- o On amenity and open space areas of sites which have the potential to impact on either development plans for business operations or on the amenity use/enjoyment of these sites.

For those properties where land is required either permanently or for construction, the acquisition of land rights, including leases, will be undertaken by the Crown through the PWA process. The PWA addresses the issues of compensation for this required land, including business loss and relocation. As such, this specific matter is not considered further in this AEE, but rather the effects focus on the potential for the Project to disrupt business and land use activities.

While it has not been raised as a particular concern during consultation with affected landowners, actual and potential (including perceived) effects on property values is not a relevant consideration under the RMA.

12.4.6 Permanent full acquisition

All property owners whose land is directly affected have been informed and are aware of the potential for land or property rights to be required. Meetings with business owners and lessees, as well as group forums with representatives from the business community, were undertaken at several stages throughout Project development. An overview of this engagement is summarised in *Section 9.0: Engagement* and in *Section 12.14: Social Effects* of this AEE.

The full acquisition of operational business land required for the Project will result in business disruption impacts. These effects range from business closure to business relocation, and will depend on the circumstances of the business owner and the particular economic circumstances of the business impacted. As noted previously the PWA addresses issues of compensation for this required land.

The types of businesses that will be impacted by full acquisition can generally be categorised as follows:

- There are a number of small businesses, particularly on Sylvia Park Road. These businesses include a mix of retail, service and trade businesses. While relocation may be significant for some of these individual businesses, they are generally considered relatively ‘mobile’ or location flexible, and the relocation of these businesses is not considered to have an adverse impact on surrounding business activities (e.g. alternative businesses or relocation of the business will not significantly disrupt other activities);
- There are some medium sized business operations. The proximity of these businesses to transport networks, the CBD and residential areas (in the case of the storage business in Onehunga) are considered important factors to these businesses. Notwithstanding this, the businesses affected are not considered ‘location’ or resource dependent. As such, relocation of these businesses or reliance on alternative similar businesses in the wider area was considered probable for surrounding business activities (in the context of wider business disruption impacts); and
- A business operation that is location-specific. This is the Advanced Flight heliport at Southdown where specific Civil Aviation Authority requirements inform its operations. In particular, it is understood that flight paths over an operational State highway in this location are unlikely to be able meet specified requirements in this instance. Liaison with the owner and operator of this business is ongoing to seek to determine the best means to avoid this impact. Options considered to address the effects on the operation of the heliport have included locating the road alignment to the north of the heliport buildings, and relocating the heliport to a new location.

Mitigation measures proposed to address the residual business disruption impacts include early engagement with these businesses to enable best opportunities for business relocation where such mitigation is considered the best practicable option under the provisions of the PWA. This engagement process is discussed further in *Section 12.14: Social Effects* of this AEE.

The only open space that will be fully and permanently required for the works is the Manukau Foreshore Walkway. The land currently occupied by the walkway is required to enable the construction and permanent works of the Project along the Māngere Inlet foreshore. This will affect the community's ability to access the coast and use this recreational facility during construction as discussed in *Section 12.14: Social Effects* of this AEE. This loss of open space will be replaced by recreation walkways and boardwalks as part of the new foreshore.

12.4.7 Partial property acquisition and business disruption

In addition to full acquisition, there are a number of business sites where a portion of land is required. As noted above, the Project has sought to avoid business disruption to the greatest extent practicable.

The land acquisition process under the PWA compensates an affected landowner for the loss of the land required for the Project and any loss in value of the diminished balance of the land.

- Land requirements that will impact on buildings and site operations of businesses:
  - On the Turners & Growers site at Mt Wellington, two buildings are affected and this will have operational impacts for the wider fresh produce processing at the site. These impacts are considered potentially significant and specific mitigation measures are proposed to address these effects. These include ongoing liaison and site planning with the businesses operating on the Turners & Growers site.
  - The land required from the Southdown Co-generation Plant. Although this plant is being mothballed, the existing physical resources on this site are considered to be strategically significant and provide resilience for the Auckland electricity network. While the new road does not avoid this site, the design has sought to maintain opportunities for future use of the key physical assets on this site.
  - Land is required from 20 Sylvia Park Road which comprises two blocks of commercial units, one fronting Sylvia Park Road and the other located to the rear of the site. All of the front units and one rear unit will require removal. These businesses will require relocation. Discussions on mitigation options with the land owner are ongoing.
  - The land required from a business at George Bourke Drive may impact on truck circulation, where the building or access around part of the building which may require that part of the building be either acquired or modified. Discussions on mitigation options with this land owner are ongoing.
  - The acquisition of land from business sites (e.g. on Captain Springs Road, Gloucester Park Road, Great South Road and Miami Parade) where the land area itself is used for storage or stockpiling of materials or resources, which will mean that the reduction in site size will impact the operation of the site. Acknowledging that this impact has a PWA process in respect of the 'business loss' arising from this land requirement, there is considered to be minor or less than minor additional business disruption effects.
- Land requirements that will impact on site accesses and site servicing, which have the potential to impact business operations. These impacts include:
  - Requirements from sites that impact accessways, vehicle manoeuvring areas or works on roads that will impact accessways to adjoining businesses on Gloucester Park Road, Neilson Street, Captain Springs Road, Hugo Johnston Drive, Great South Road, Sylvia Park Road, Pacific Rise, and Monahan Road. Early engagement with landowners and businesses to plan for access and vehicle manoeuvring during detailed design and construction planning will appropriately manage these effects.

– Site accesses for both 19 and 20 Sylvia Park Road will be affected by limiting the range of movements, reducing and/or relocating the number of access points. 20 Sylvia Park Road will be limited to left turn movements. A number of on site parking spaces will be required and will be replaced for the remaining rear units. The main access point for 19 Sylvia Park Road will be removed and replaced via two separate driveways. Right turns into this site will be restricted; vehicles traveling form the east will be required to travel approximately an additional 1km to enter the site. Overall any inconvenience experienced by the altered access arrangements from the Project will be minimal when taking into account journey time savings and direct access onto the EWL. Engagement with landowners and businesses is ongoing.

– Land requirements that will impact on amenity and open space areas of sites, which have the potential to impact on either development plans for business operations or on the use or enjoyment of these sites.

– Land required temporarily for construction activities at Monahan Road and Carbine Road are considered to potentially impact on open space areas on these sites. No specific adverse effects have been identified for the businesses operating on these sites regarding these impacts. However, the proposal to reduce the final designation to the extent practicable following construction activities will enable any effects in this regard to be addressed.

– Specific consideration has been given to the legibility of the Tip Top building adjacent to SH1. While the Project will alter the experience of this building signage it is not considered to be an adverse effect as the building will remain visible to users of the road network.

In addition to business impacts, some open spaces require partial property acquisition. These include land at Gloucester Park North, Gloucester Park South, Bedingfield Memorial Park and South Waikaraka Park (a planned future park). Land is required to enable the construction and in some cases permanent works of the Project and for the health and safety of the community. The indicative construction methodology will be confirmed once a construction contractor is engaged, however indicative timeframes for construction have been provided in *Section 7.4: Anticipated construction programme* of this AEE. These range from approximately two years near Bedingfield Memorial Park to 3 years at Waikaraka Park.

The land required has been minimised as far as practicable to avoid effects on the active recreation areas and maintain public access where practicable. It is intended that the designation will be reduced in area as much as possible following construction. In addition, for Gloucester Park North and Waikaraka Park, a reinstatement plan is proposed to enable construction yard decommissioning to facilitate future recreational open space activities. Social effects of this land requirement are discussed in detail in *Section 12.14: Social Effects* of this AEE.

12.4.8 Temporary property and business disruption for construction

Some of the directly impacted land will only be required temporarily for construction of the Project and is not required in the long term for permanent works. Land areas that may not be required in the long term include:

- Construction yards and laydown areas; and
- Construction access routes.

Wherever practicable, these proposed activities have been sited on vacant or low developed land, (e.g. the currently undeveloped southern part of Waikaraka Park on Captain Springs Road, the undeveloped business land at Hugo Johnston Drive and similarly on Carbine Road). This approach has avoided potential business disruption impacts in other areas of the Project. *Section 12.14: Social Effects* of this AEE proposes mitigation in respect of the impacts on open space during construction.

On completion of construction, the Transport Agency will review the designation, and uplift those parts that are no longer required for roading purposes (see Section 5.1.6 of this AEE for further discussion). This will enable the future use and development of these sites.

During construction, changes to accessways and loss of visibility for businesses reliant on passing trade and pedestrian access for their operation is a potential adverse effect. This is considered particularly relevant for service businesses, (e.g. in the Onehunga Town Centre, Onehunga Harbour Road (hotel and restaurant) and on Sylvia Park Road), where construction of the Project is likely to require modifications and temporary closures on the existing road network. The scale of impact to businesses will depend on the nature of the business and the scale and duration of works, but is expected to range from minor to significant. These potential effects can be managed through use of temporary signage and other information to direct and inform of accesses, and consultation with businesses on specific access requirements for their business.

12.4.9 Planning approvals for businesses

The Project affects a number of sites operating under existing planning approvals, including existing designations and resource consents such as land use consents, air discharges, water takes and discharge consents. Implications on existing resource consents will be identified on a case-by-case basis with those existing consent holders.

Existing designations that are affected by the Project are addressed in *Section 11.0: Description of the existing environment* of this AEE.

12.4.10 Positive business and property effects

Some businesses are likely to experience positive effects during construction, as a result of increased economic activity from the influx of construction workers to the area. This benefit is likely to be experienced by service industries (e.g. restaurants, cafés and convenience retail outlets) and construction businesses (e.g. demolition processing, supplies etc.).

The improved accessibility and travel time reliability both for users of the EWL and for traffic using existing local roads in the Project area will provide significant positive business operation effects and improve efficiency for business operations (supply chain and distribution). This benefit will be particularly significant for the logistics and supply businesses (e.g. fresh produce and processing in Mt Wellington; logistics and distribution in Southdown). The infrastructure improvements provided by the Project (e.g. improving accessibility) are identified in the Auckland Plan as a key enabler to improving GDP per capita in Auckland. These effects are significantly positive for business operations.

Reduced traffic volumes and the separation of local business traffic from through traffic on Neilson Street and Great South Road will provide significant benefits for the commercial, residential and retail activities proposed in the Onehunga Town Centre and in the wider context of Great South Road. In particular, the increased capacity in the roads will facilitate opportunities for the planned growth (as provided for in the AUP (OP)) to be realised. This is considered a positive business and land use effect of the Project. Properties are likely to experience enhanced locational attributes as a result of improved connectivity to the road network.

12.4.11 Methodology to avoid or mitigate adverse effects

Meetings were held with all landowners whose land was initially identified as affected by the Project. The purpose of these meetings was twofold, first to inform the landowner about the Project and the potential land required and second, to gain an understanding of how the site is currently used (e.g. the nature of businesses operating on site), the operational needs of each site and the potential effects that could arise as a result of land requirement. This engagement has enabled understanding of the composition and function of residential sites and local businesses within the Project area.

Where engagement signalled there was likely to be a significant impact on the use of residential land, opportunities to amend the construction methodology or design to reduce effects were considered. For example, the construction methodology for noise walls along SH1 was altered from undertaking construction from the property side to the motorway side where practicable.

Where engagement signalled there was likely to be a significant impact on the ongoing viability of a business, the Project team sought to modify the design and extent of land required on those properties as far as possible. Changes made to the design in response to potential effects has included:

- Redesign (vertically or horizontally) of bridges, viaducts and ramps, including locations of piers;
- Alterations to existing property accesses (discussed in more detail in *Section 12.2: Traffic and transport* of this AEE);
- Creation of new access points; and
- Relocation (if required).

Mitigation measures for business disruption during construction include:

- To address impacts of construction works disrupting the ability for businesses to undertake operations, particularly for those businesses reliant on regular movement of goods to the sites, these businesses will be involved in the preparation of construction traffic management planning and construction management, relevant to the local works areas.
- To address impacts associated with changes to business access and the loss of visibility for businesses reliant on passing trade and pedestrian access during construction, consideration will be given to temporary signage and other information to direct and inform those business users of access, and to consult with businesses on specific access requirements.
- In addition to the specific measures proposed for managing noise and vibration during construction, it is proposed that business operations sensitive to noise and vibration be managed through liaison with key businesses (e.g. the glass bottle logistics business).

In numerous circumstances it has not been possible to avoid entire or partial land requirement from businesses or residential properties. In these situations the acquisition of land will be completed in accordance with the provisions of the PWA. Section 60 of the PWA provides for fair and reasonable compensation to be paid to the affected owners.

Where avoidance has not been possible, mitigation measures are proposed which will assist to alleviate effects during operations such as early engagement with these businesses to enable business planning in response to the works and where required to facilitate business relocation (as appropriate).

12.4.12 Summary

There will be moderate to significant site-specific adverse effects on some individual businesses across the Project. Overall, the Project provides greater accessibility and reliability to a market in which transportation cost is a large component. This will be a significant positive impact for business activity in the area. However, to deliver the Project, a number of specific businesses and sites require either full or partial land acquisition and others will experience disruption during construction.

Potentially significant adverse effects on business continuity have largely been avoided by Project design. In addition to this, the residual potential adverse effects arising from land acquisition and business disruption can be mitigated through ongoing liaison and involvement of business in construction management, construction traffic management and for affected service businesses, through specific planning for temporary signage and way-finding to support business continuity during the construction period.

12.5 Network utilities

Overview

There are a large number of existing infrastructure networks throughout the Project area ranging from local service connections to regionally significant rail, water, electricity and gas transmission infrastructure. Given the scale of the Project, effects on network utility infrastructure are anticipated and include impacts from temporarily or permanently relocating existing network utilities and from construction activities.

The Project team has engaged with network utility operators to identify the relocation and/or protection of network utilities and to develop appropriate measures to manage adverse effects on network utilities during the construction and operation of the Project. There are well-established procedures across the industry for the relocation and/or protection of network utilities arising from construction activities.

Potential operational adverse effects on network utilities have been avoided through design of the Project and any adverse effects during construction can be managed through appropriate measures.

12.5.1 Introduction

The Project is located in an urban area and therefore it contains a large number of existing infrastructure networks[63] including transmission lines, a high pressure gas pipeline and rail lines. The Project will have both direct and indirect impacts on existing infrastructure networks including:

- Effects associated with temporarily or permanently relocating existing network utilities for the construction and operation of the Project; and
- Effects on network utilities from construction of the Project including from dust, ground settlement, and the accidental striking of services.

The relocation and/or protection of network infrastructure is a normal part of construction for a project of this scale. There are well-established procedures across the industry associated with the relocation and/or protection of network utilities. The Project team has engaged with network utility operators to identify where relocation and/or protection is required during construction and operation of the Project. Any adverse effects can be appropriately managed either by providing protection or by relocating the utility. Where practicable, the necessary mitigation works will be undertaken as enabling works to the main Project construction works.

Some of the existing infrastructure networks in the Project area are designated. Further details about these existing designations are contained in *Section 11.0: Description of the Existing Environment* of this AEE.

12.5.2 Existing environment - network utilities

The existing network utilities along the Project are summarised in Table 12-4.

[63] This section of the AEE addresses Network Utilities with the exception of roads which are addressed in Section 12.2 of this AEE.

Table 12-4: Existing network utilities

Network utility	Operator	Details	Affected by the Project?
Transmission lines	Transpower NZ Limited	MNG-ROS A 110kV line PEN-ROS A 110kV line HEN-OTA A 220kV line	Yes No Yes
Electricity distribution lines – overhead and underground	Vector	Local lines throughout the Project.	Yes
High pressure gas transmission	First Gas	Westfield-Hillsborough high pressure gas pipeline between Neilson Street Interchange and Anns Creek. The Oaonui-Southdown high pressure gas pipeline (400 line) between Anns Creek and Mt Wellington Highway.	Yes No
Gas distribution lines	Vector	Local gas distribution lines throughout the Project.	Yes
Water supply mains	Watercare Services Limited	Hunua 4 bulk watermain under the Manukau Harbour Crossing, Onehunga Mall and Galway Street. Hunua 1 in Great South Road. Hunua 3 Sylvia Park bulk watermain within Sylvia Park Road.	No No No
Water distribution and wastewater	Watercare	Water supply and wastewater lines throughout the Project.	Yes
Telecommunications	Spark, Chorus, Vodafone, Vector Communications, FX Networks	Cables throughout the Project. Cellular communication masts at Great South Road Intersection and Frank Grey Place.	Yes No
Stormwater	Auckland Council	Stormwater lines and outfalls throughout the Project.	Yes
Landfill leachate interception system	Auckland Council	Pikes Point closed landfill interception system (see Figure 12-21).	Yes
Rail network	KiwiRail	Onehunga Branch Railway Line Southdown Freight terminal North Auckland Railway Line	Yes Yes Yes

These utilities are shown on the utilities relocation drawings in *Plan Set 12: Utilities Relocation* in *Volume 2*.

12.5.3 Assessment of effects on network utilities

12.5.3.1 Electricity transmission

There are three transmission lines within the Project area which are owned and operated by Transpower. These are:

- The Māngere - Mt Roskill A (MNG-ROS A) 110kv line located in Sector 1;

- The Penrose - Mt Roskill A (PEN-ROS A) 110kv line located in Sector 1; and
- The Henderson - Ōtāhuhu A (HEN-OTA A) 220kv line located in Sectors 1, 3, 4 and 5.

The HEN-OTA A line is one of only two transmission lines providing power transmission to Northland.

In Sector 1, the PEN-ROS A 110kV line passes close to the Neilson Street Interchange at Towers 20, 21 and 23 (refer to *Plan Set 3: Road Alignment* in Volume 2 for tower locations and extent of works). The road alignment will curve around the base of these towers to avoid relocation and/or modification of the towers. To avoid adverse effects during construction, Transpower has requested protection in the form of barriers and guardrails around the towers.

The HEN-OTA A 220kV line crosses SH20 just south of Neilson Street. Tower 31 is positioned between the EWL/SH20 southbound on-ramp and the EWL/Neilson Street overbridge. The foundation will be protected which means that the tower and lines can remain unmodified. The other towers of the HEN-OTA A are located clear of the alignment.

The MNG-ROS A 110kV line crosses SH20 just southeast of the Onehunga Bay Reserve footbridge and continues southbound through the Onehunga Bay Reserve and back across SH20 near the Manukau Cruising Club. The proposed alignment has been designed to achieve the Transpower 10m vertical clearance for roads carrying more than 30,000 vehicles a day at this location.

In Sector 3, the alignment will not cross under the HEN-OTA A 220kV line, however the new Hugo Johnston Road link will cross between Tower 20 and the gantry structure at the Southdown Co-generation Plant. This meets the Transpower clearance requirements and will not require modification. At the Great South Road intersection Tower 18 of the HEN-OTA A 220kV line, located at the eastern end of the properties at 20 to 24 Sylvia Park Road will require relocation and replacement. The tower may be replaced with one or two monopole structures.

In Sector 4, the HEN-OTA A 220kV line runs along the northern side of Sylvia Park Road. The northbound off-ramp will pass through the foundation edge of Tower 14 and therefore the tower will need to be relocated and replaced. The tower will be replaced by a monopole structure to minimise the footprint of the new structure and thereby reduce the physical impact on the adjacent property at 6-8 Monahan Road.

Tower 15 will remain within its current footprint however it will require raising to provide an 11m vertical clearance plus construction clearance over the northbound SH1 off-ramp. Towers 16, 17 and 18 along Sylvia Park Road are expected to be unaffected as the northern kerbline of Sylvia Park Road will remain in approximately the same position as currently. The remaining towers through this sector, Towers 12 and 13, will not meet the clearance requirement of Transpower. Dispensation is currently being sought to leave the towers in their current location provided the necessary foundation strengthening and/or temporary prop structures are installed to support these structures during construction of the Project.

In Sector 5, the HEN-OTA A 220kV line runs along the eastern side of SH1 to the southern extent of the Project at the Princes Street. Assessment of vertical clearances for the length of line shows that the vertical offset from the widened carriageway does not meet the minimum clearance requirements. Dispensation is currently being sought from Transpower for the clearances.

Construction in proximity to Transpower assets could give rise to the following potential effects on transmission lines if not appropriately managed:

- Blocking maintenance access to support structures;
- Dust from construction causing arcing of lines;
- Machinery working in proximity to lines increasing the risk of electrical hazard if lines are struck; and
- Earthworks undermining support structures.

These effects can be managed through the refinement of the design and construction methodology in consultation with Transpower, and the implementation of specific measures during construction as agreed with Transpower.

All adverse effects on existing electricity transmission infrastructure can be avoided through design or adequately mitigated through systematic construction sequencing and interim diversions where required to ensure security of supply through the construction of the Project.

12.5.3.2 Local electricity distribution

Throughout the Project area, there are a number of above and below ground local electricity distribution assets owned and operated by Vector.

Within Sector 1, there are low and medium voltage underground cables along both sides of Galway Street which terminate before the Project. There are low and medium voltage power lines running down the western side of Gloucester Park Road and passing under SH20. These lines will not be affected by the Project.

On the southern side of SH20, the lines go overhead and run along the northern berm of Onehunga Harbour Road servicing the Onehunga Wharf area before returning underground prior to tying in with the Māngere Bridge ground mounted substation. This section of Vector overhead line will need to be undergrounded. There are also a number of above and below ground connections along Onehunga Harbour Road and Onehunga Mall that will need to be relocated/undergrounded.

Within Sector 3, there is a series of sub-transmission oil filled cables in Great South Road as well as low and medium voltage underground cables. These can be maintained in their current location provided that acceptable cover is maintained or suitable concrete protection is provided.

Within Sector 4, there is a series of low and medium voltage underground cables along both the northern and southern sides of Sylvia Park Road. The overhead lines will be undergrounded into the northern berm, while the remaining underground electrical ducts along the southern berm will be abandoned as they will no longer be required.

Within Sector 5, there is a series of low and medium voltage underground ducts crossing the Panama Road Bridge. These will need to be relocated onto the new structure.

The relocation/undergrounding of the electricity distribution lines and cables will be undertaken in such a way (either before works commence or suitably scheduled during construction), to minimise effects on these services during construction.

Discussions have been held with Vector in regards to the relocation/undergrounding of electricity distribution lines and cables surrounding the Neilson Street Interchange and Vector has provided approval in principle.

12.5.3.3 Gas transmission

The First Gas Westfield-Hillsborough high pressure gas pipeline crosses SH20 near the Neilson Street Interchange and continues parallel to SH20 until it reaches the Manukau Harbour. From here it continues along the foreshore in Sector 2 and then onto the Southdown Co-generation Plant in Sector 3. From Sector 3 it continues eastbound, passing under the rail corridor and Great South Road, then runs parallel to Sylvia Park Road. First Gas has identified the continuity of gas supply to the region as critical. Any works requiring the relocation or realignment of the gas pipeline will be carefully co-ordinated with the Project works so an ongoing connection is maintained at all times.

Within Sector 1, the typical cover for the high pressure gas pipeline is 1m and therefore the pipeline can be retained in its current location. Where construction of the new Neilson Street Interchange ramps pass over the existing pipeline it will be suitably capped with concrete protection and relocated out of the carriageway where it runs parallel to SH20. This is expected to be completed in stages subject to the live connections required along this pipeline.

At the south eastern edge of the Neilson Street Interchange, the pipeline passes over the old Galway Street Landfill and some relatively soft existing ground. The construction of the new road embankment may result in ground settlement following construction which has the potential to affect the pipeline, and therefore this section of the gas pipeline (and the adjoining section within Sector 2) will be relocated to a new route within competent material on the northern side of the proposed embankment. The relocation of the line will minimise potential effects on the gas pipeline and enable ongoing unrestricted access for operations and maintenance.

Within Sector 2, the construction of the road embankment will require the relocation of high pressure gas pipeline line between the Neilson Street Interchange and the Southdown Co-Generation Plant. This will be relocated during construction to sit within the new embankment. Approximately 3-4 stages of relocation will be required to maintain operation of the existing pipeline. This will be managed to meet the requirements of First Gas for permanent and temporary construction loading.

Within Sector 3, the high pressure gas pipeline line will be crossed perpendicularly by the Anns Creek viaducts. The bridge piers of this viaduct will be spaced to meet the requirements of the existing First Gas protection easement are met, whilst avoid significant ecological and geological features (refer to Sections 12.8 and 16.23). Existing above ground gas infrastructure in this area (e.g. mainline valve) will need to be relocated because it cannot be placed under the new road structures.

Within Sector 4, the Project will pass over two existing eastbound gas pipelines along the northern side of Sylvia Park Road. The ramp piers have been spaced to provide the First Gas minimum clearance for the existing pipelines.

Within Sector 5, a bulk gas supply main has an existing concrete encased crossing of SH1 north of Panama Road. This will be extended to protect the supply main.

The proposed realignment and protection works have been discussed with First Gas and no issues are anticipated. The proposed Network Utilities Management Plan (NUMP) (as detailed in *Section 13.1: The Project Delivery Framework* of this AEE) will set out the process to be followed for First Gas and the Transport Agency to work together during the detailed design and construction phases of the Project to manage potential adverse effects on the gas transmission network.

12.5.3.4 Gas distribution

There are a number of Vector low to medium pressure local gas distribution lines located throughout the Project area.

Relocation of local gas distribution lines will be required along Onehunga Harbour Road, Onehunga Mall and Sylvia Park Road. The steel gas main on southern side of Sylvia Park Road will be removed were existing buildings are removed to facilitate the works. Where these assets are present within existing carriageway, concrete capping will be the primary treatment to minimise disruption to supply.

The Project team has been in discussion with Vector regarding its assets and is confident that a design solution can be found at locations where the proposed road alignment will impact gas distribution lines. Any required protection or realignment of the pipelines will be co-ordinated with the works for the Project as far as practicable, within the framework established through the NUMP as detailed in *Section 13.1: The Project Delivery Framework* of this AEE. All potential adverse effects on gas distribution infrastructure can be adequately managed.

12.5.3.5 Water supply

Within Sector 1, the Hunua 4 bulk watermain is suspended on the Manukau Harbour Crossing and then runs underground up Onehunga Mall and adjacent to and across the Galway Street rail corridor. The pipeline has a typical existing ground cover of approximately 3m shallowing to 1m under the rail corridor. As the EWL will pass under the Hunua 4 bulk watermain (beyond pier 1 of the existing bridge), no further works to protect or divert it during construction are required. Outside of the Interchange, the pipeline is at a depth where no impact is anticipated during construction or operation.

Within Sector 3, there are a number of significant assets running along Great South Road including the Hunua 3 bulk watermain, the Sylvia Park 700mm bulk watermain and the twin 1700mm wastewater siphon crossing Sylvia Park Road immediately to the west of the intersection with Great South Road. The valve chamber for the junction between Hunua 3 and Sylvia Park bulk watermain will require relocation out of the carriageway, which will involve temporary and then permanent diversion.

Within Sector 4, the 700mm Sylvia Park bulk wholesale watermain continues the length of Sylvia Park Road. As the Sylvia Park Road bulk watermain is located sufficiently to the north of the proposed ramps, it will not require relocation.

The Sylvia Park bulk wholesale watermain is at a depth of 1.7m beneath Sylvia Park Road and therefore will not require protection as part of the construction works. The Hunua 3 Bulk watermain runs along the western side of Mt Wellington Highway with a valve chamber positioned on Sylvia Park Road. The Sylvia Park ramp bridge piles have been positioned to avoid impacts on the pipeline and the valve chamber however consideration will need to be given during construction to the placement of machinery in relation to the assets.

The Hunua 1 bulk watermain continues east towards and beneath SH1 at a depth of 1.7m beneath Sylvia Park Road and therefore will not require protection or relocation as part of construction. This pipeline will be protected during bridge construction to minimise potential effects. The spacing of piers for the SH1 ramps has been increased to avoid having to relocate the Watercare bulk line valve chamber linking the Sylvia Park Watermain and Hunua 1.

Discussions have been held with Watercare and no particular issues are anticipated with any realignment of these services during construction of the Project. The NUMP, as detailed in *Section 13.1: The Project Delivery Framework* of this AEE, will set out the process to be followed for construction in the vicinity of existing utilities. Adhering to the procedures and measures set out in the NUMP will facilitate the management of effects such that any potential adverse effects on water supply infrastructure will be appropriately managed.

12.5.3.6 Water distribution and wastewater

Within Sector 3 and Sector 4, the water distribution pipe located on the southern side of Sylvia Park Road will be decommissioned where the pipeline is no longer required to service properties intended to be removed as part of the Project. The scour valve associated with the twin wastewater siphons located just south of the Sylvia Park Road crossing will be located within the new carriageway and a culvert/accessway will be provided to allow Watercare ongoing access.

Within Sector 5, there are two water mains that cross the Panama Road Overbridge and a 150mm watermain crossing the Princes Street Overbridge. This infrastructure will be relocated on to the new structures. An existing abandoned watermain crossing the Panama Road Overbridge will be removed as it is no longer required.

Discussions have been held with Watercare and no particular issues are anticipated with any minor realignment of these services during construction of the Project.

12.5.3.7 Telecommunications and telephone

Chorus, Vodafone, Vector Communications and FX Networks have telecommunications infrastructure throughout the Project area. Telecommunication cables throughout the Project area will need to be temporarily and then permanently relocated where they are affected by construction activities and the final alignment. Remaining services will require minor protection works where the ducts cross the Project.

The Project team has consulted with Chorus, Vodafone, Vector Communications and FX Networks to identify a preferred process for the protection of these assets. These solutions will be incorporated into the design of the Project and protection and/or permanent realignment of lines will be undertaken in conjunction with construction of the Project. The proposed road embankment and structures in Sectors 2 and 3 will include ducts that can be used in the future for new telecommunication cables.

There are two Spark cellular towers, one located at the south-eastern corner of Great South Road/Sylvia Park Road Intersection (Sector 4) and the other on the northwest corner of Frank Grey Place and Princes Street (Sector 5) in Ōtāhuhu. Both towers may require relocation and the Project team is in discussions with Spark regarding the appropriate locations for these towers.

No particular issues are anticipated with any minor realignment of telecommunications infrastructure and any adverse effects will be appropriately mitigated.

12.5.3.8 Stormwater

Within Sector 1, the existing stormwater infrastructure within the Neilson Street Interchange will need to be modified due to the increased impermeable catchment from the interchange ramps and overbridges.

Within Sector 2, the existing stormwater will be diverted as part of the construction of the new stormwater treatment system within the foreshore.

Within Sector 3, the Anns Creek culverts passing under Great South Road will be modified to service the new stormwater treatment system south of the EWL.

Within Sector 4, the Anns Creek stormwater infrastructure will be modified along the southern side of Sylvia Park Road to construct the new stormwater treatment system.

Within Sector 5, the existing motorway drainage system will need to be protected and/or modified as part of the widening works to facilitate the carriageway drainage and treatment.

Overall, the proposed stormwater treatment wetlands are located and designed to tie in with the existing network. Any adverse effects on stormwater infrastructure will be appropriately mitigated through relocation of the existing infrastructure as part of the Project.

12.5.3.9 Landfill leachate interception system

Auckland Council operates a leachate interception system for the Pikes Point closed landfill. This system intercepts groundwater from the closed landfill area and conveys it to the Watercare trade waste system for treatment. The system is discussed in further detail in *Section* 12.16*: Groundwater*.

Construction of the EWL in Sector 2 will directly impact the leachate interception system. The system will therefore be replaced and relocated as part of the works. The Project team has engaged with Auckland Council regarding the design, construction and operation of the relocated leachate interception system. This engagement will continue during the detailed design and construction of this system. Once constructed, the replacement leachate interception system will be transferred to Auckland Council for ongoing operation and maintenance.

12.5.3.10 Rail Network

Adjacent to Sector 1 is the Onehunga Branch Line and Onehunga Rail Station. The proposed works in Sector 1 will improve pedestrian and cycle access to the station through improved crossing facilities at the Neilson Street-Onehunga Mall intersection and the provision off road facilities connecting from the foreshore along Onehunga Harbour Road and Onehunga Mall.

The Southdown Freight Terminal travels north to west through Anns Creek in Sector 3. The Anns Creek viaduct has been designed to minimise operational effects on the ongoing use of the Freight Terminal and to avoid preclusion of potential future expansion and development of the site. As a result of engagement with KiwiRail, the design across Southdown Freight Terminal was revised from a skewed design to a perpendicular alignment to minimise potential adverse effects. In addition the location of the viaduct piers was designed in consultation with KiwiRail. During construction, all works will comply with rail safety requirements which will be detailed in the CEMP (see *Section 13.1: The Project Delivery Framework* for further discussion) but may require rail protection and/or periods of blocked lines. Ongoing liaison will occur with KiwiRail to minimise effects on rail operations.

The alterations to the Great South Road intersection require the widening of the rail overbridge to the south of the intersection. During operations there will be no effects on the operation of the rail line. The bridge widening will be staged to enable ongoing operations of Great South Road, as well as the rail line. During construction appropriate rail safety requirements will be implemented and ongoing engagement will occur with KiwiRail to minimise effects on their operations.

In Sector 4 along Sylvia Park Road, the Project has been designed to entirely avoid the rail corridor during construction and operation of the Project. The Project ramps' connection to SH1 will pass over the rail corridor. The operation of the Project will not affect the ongoing operation of this rail corridor. During construction appropriate rail safety requirements will be implemented and ongoing engagement will occur with KiwiRail to minimise effects on rail operations.

12.5.4 Measures to avoid, remedy or mitigate potential adverse effects on network utilities

The general design philosophy adopted for the Project has been to avoid potential adverse effects on existing network utilities, wherever practicable. However, not all potential impacts can be avoided due to the large scale of the Project and the considerable number of network utilities located within the Project area.

Areas where the Project will or may potentially result in adverse effects on utilities have been identified. Consultation with the relevant network utility provider has been undertaken and through this process, concept solutions for each utility have been discussed, and where possible, developed and incorporated into design.

These solutions typically involve one or more of the following approaches:

- Providing increased protection for the utility so that its operation is not adversely affected by the Project;
- Providing access to the utility so that its operation and maintenance is not adversely affected by the Project;
- Relocating or realigning part of the network utility to avoid or mitigate potential adverse effects; and
- Other specific measures (e.g. dust management) to address potential physical adverse effects.

Consultation with affected operators will continue during detailed design to ensure that any relocation, diversion or protection of network utilities will meet the requirements of the operators. Specific agreements will be developed with each affected network utility operator for detailed design and construction.

Specific measures are proposed during design and construction of some network utilities as discussed earlier in this section. These are summarised in Table 12-5.

Table 12-5: Specific measures for network utilities

Utility	Potential effects	Proposed measures to mitigate effects
Transmission lines	Dust during construction. Vibration during construction. Machinery strike. Access to assets during construction and on completion of the Project.	Manage construction activities near transmission assets. Relocate or increase the height of towers in consultation with Transpower. Ongoing liaison with Transpower to confirm specific measures for each location. Achieve clearances specified by the New Zealand Code of Practice for Electrical Safe Distances.
Electricity distribution lines – overhead and underground	Continuity of supply during construction. Conflict with final alignment. Machinery strike during construction.	Manage construction activities near lines. Underground some lines.
High pressure gas transmission	Continuity of supply during construction. Conflict with final alignment. Machinery strike during construction. Differential settlement from construction	Relocate pipeline where necessary in consultation with First Gas. Monitor settlement during construction. Protect pipe during construction.
Gas distribution lines	Continuity of supply during construction. Conflict with final alignment. Machinery strike during construction.	Manage construction activities near lines.
Water supply mains	Continuity of supply during construction. Conflict with final alignment. Machinery strike during construction.	Manage construction activities near pipes.
Water distribution and wastewater	Continuity of supply during construction. Conflict with final alignment. Machinery strike during construction.	Manage construction activities near pipes.
Telecommunications	Continuity of supply during construction. Conflict with final alignment. Machinery strike during construction.	Relocate cables/ducts and telecommunication towers where necessary in consultation with utility operator. Manage construction activities near lines.
Stormwater	Disruption to operation during construction. Machinery strike during construction.	Manage construction activities near pipes
Landfill leachate interception system	Damage during construction. Ongoing operation during construction.	Undertake detail design in consultation with Auckland Council. Manage construction activities.
Rail network	Disruption to operation during construction. Conflict with final alignment.	Undertake detailed design in consultation with KiwiRail. Manage construction activities near rail lines.

The process for engaging with network utility operators and for the Transport Agency's contractors undertaking the works in conjunction with the network utility operator's own contractors will be set out in the NUMP. This will include specific agreements made with network utility operators during the detailed design phase of the Project. Further details of the NUMP is contained in *Section 13.1: The Project Delivery Framework* of this AEE.

Overall, any operational adverse effects on network utilities have been avoided through design of the Project including planned relocation of utilities where required. Any adverse effects during construction can be appropriately managed through the measures outlined in this section.

12.6 Effects on values of importance to Mana Whenua

Overview

The Project traverses an area rich in Māori history. Mana Whenua have identified that, from the early 1840s to the present time, the development of Auckland has erased the visibility and legibility of their cultural landscape elements. As such, the exercise of kaitiakitanga and expression of the rich historical tapestry of the area has been limited. The Project is recognised both as having potential adverse impacts on values important to Mana Whenua and equally it provides a significant opportunities. The main opportunities are for the application of a design approach which reflects the principles of partnership through Te Tiriti o Waitangi through cultural landscape design and for the management of stormwater prior to discharging into the CMA. The acknowledgement of the Treaty and the approach that has been taken in assessing and delivering the Project with Mana Whenua is discussed further in *Section 15.1: Statutory Analysis of this AEE*.

Opportunities to acknowledge Mana Whenua cultural values through the concept design for the Project are described in *Section 6.0: Design of the Project* of this AEE. In particular, the Project has avoided or minimised physical impact on known cultural sites where practicable, provided a 'containment bund' to establish a physical barrier between the Māngere Inlet and historic landfills, and incorporates landscape design features to establish a more naturalised coastal edge inclusive of additional stormwater treatment to improve overall environmental outcomes for the Manukau Harbour in this area.

The cultural values report completed to support the AEE reflects the collaborative working process established for the Project. The process of engagement, Project option assessment and collaborative hui is a key component of acknowledging and respecting the mana of the Iwi/hapū involved.

When recognising the values of Mana Whenua, there is a need to consider the environment holistically. This has been reflected in the approach to engagement with Mana Whenua and in the approach to address the potential effects of the Project.

In respect of the physical works, the Project traverses a range of landscapes, values and significant sites and areas of value to Mana Whenua. These include:

- The cultural landscape, which includes historic areas through to current settlement, trade, economic prosperity and occupation that extend across the whole area;
- The water bodies of the Manukau Harbour and Tāmaki, which themselves have mana. The mauri of these water bodies is also significant; and
- Specific sites and features which both reflect the wider cultural landscape and are significant as their own entity. These include the Ōtāhuhu and Kāretu portages between Māngere Inlet and the east. It also includes other identified features and unique elements of the maunga landscape such as Te Hōpua, the pahoehoe lava flows, and the puna (springs) (e.g. in Onehunga). Other sites of settlement and occupation are also significant and include pā (such as Mutukāroa-Hamlins Hill), and urupā.

Mana Whenua and the Project team have identified the potential for the above values to be impacted both during construction and in the operation of the Project, both in terms of the physical works and in the way such works are undertaken.

In response to the ongoing engagement with Mana Whenua, the following Project design features and proposed measures to manage construction and operation works have been identified:

- The Project design has sought to avoid areas of significance value to Mana Whenua, such as Te Hōpua, Mutukāroa-Hamlins Hill and the Ōtāhuhu portage;

- A 'containment bund' or physical barrier between the Pikes Point landfills and the Māngere Inlet is expected to reduce the tidal flow of water (and potential leachate contamination) into the Māngere Inlet;
- The treatment of stormwater and leachate discharges from all proposed and some existing road surfaces and from the Onehunga-Penrose catchment will further improve water quality of discharges to the Māngere Inlet and Tāmaki estuary environment, seeking to enhance the mauri of these water bodies and as such acknowledge and restore the mana of these environments;
- To maintain and enhance active engagement and the principle of partnership with Mana Whenua, to respect and acknowledge their relationship to the environment and provide for an ongoing active role during the Project construction;
- To acknowledge and reflect the identified values of Mana Whenua in the physical environment, Te Aranga Principles have been core to the design. This is reflected and set out in the ULDF with processes for ongoing design inputs to key features of the Project;
- The full bridging of Ōtāhuhu Creek (including removal of the existing culverts on SH1) in acknowledgement of the significance of this historic portage. This measure also acknowledges and provides a positive response to the impacts on the wāhi tapu area of Te Apunga o Tainui, which are unable to be avoided by the Project design;
- Where potential adverse effects are unable to be avoided, additional measures have been proposed for the management and monitoring of works to recognise the significant wāhi tapu values. As such, specific protocols are proposed for undertaking works in culturally significant areas, particularly between SH1 and Ōtāhuhu Creek in acknowledgement of the sensitive sites in this area;
- Where existing infrastructure and land use results in significant impacts on the Kāretu portage, this Project proposes design and additional measures to appropriately recognise and remember this valued area (e.g. through signage, structure design and landscaping to provide for the legibility of this historic link at Sylvia Park Road); and
- To identify opportunities for Mana Whenua to provide for their social, economic and cultural wellbeing and for Mana Whenua to exercise kaitiaki over their taonga throughout construction and implementation of the Project. This is provided through ongoing discussions between the Transport Agency, Mana Whenua governance representatives and through the development of protocols in the procurement process.

12.6.1 Introduction

This section presents our understanding of the cultural values and issues of significance to Mana Whenua[64] in respect of the Project. This section draws from our engagement with Mana Whenua and inputs provided Mana Whenua during Project development[65]. A summary of the engagement with Mana Whenua is provided in *Section 9.7.3* of this AEE.

In developing the Project, recognition has been given to both the relationship of Tangata Whenua to their lands, culture and traditions in this area and the commitment to partnership between Mana Whenua and the Transport Agency (as representative of the Crown) founded through Te Tiriti o Waitangi. The acknowledgement of the Treaty and the approach that has been taken in assessing and delivering the Project with Mana Whenua is discussed further in respect of the approach to and process of engagement

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[64] Mana Whenua is a term used to describe Māori who have tribal links to Tāmaki Makaurau. Mana Whenua interests are represented by tribal authorities of iwi and hapū

[65] *Part E: Engagement* provides further detail on the engagement undertaken with Mana Whenua.

(see *Section 9.0: Engagement* of this AEE). Furthermore, it is recognised that the Treaty Settlements process provides important context to the Project. The settlements recognise the importance of the relationship of Mana Whenua to the environment of the Project area and the intergenerational responsibility of Mana Whenua to preserve, protect, manage and utilise the taonga of this area. This recognition is afforded in existing settlements[66] and in the outstanding claims, which include specific redress for the Manukau Harbour (provided for in the Tāmaki Settlement Collective) and the Wai 8 Claim.

While there are outstanding claims under other avenues, there are currently no recognised customary marine title groups under section 85 of the MACA Act. Therefore, there are no planning documents prepared by a customary marine title group that would be relevant under clause 3(c) of Schedule 4 of the RMA. Regarding Te Kawerau ā Maki Claims Settlement Act 2015, parts of the Project are within the Coastal Statutory Acknowledgement Area shown on map OTS-106-14[67]. The statutory acknowledgement in the Settlement Act contains obligations for consent authorities, the Environment Court and HNZPT. For example, consent authorities must have regard to the statutory acknowledgement when deciding, under section 95E of the RMA, whether the trustees are affected persons in relation to the activity. Regarding this Project, the Transport Agency has acknowledged that Te Kawerau ā Maki are Mana Whenua (along with other Iwi) and further that they have a role as Treaty Partner. The Transport Agency has engaged and consulted with Mana Whenua (including Te Kawerau ā Maki) and has involved them in the development of the Project as described in *Section 6.0: Description of the Project* of this AEE.

The Mana Whenua groups listed in Table 12-6 have been involved in the Project.

Table 12-6: Mana Whenua of the Project (Iwi and Hapū)

Mana Whenua	Organisation
Te Akitai Waiohua	Te Akitai Waiohua Iwi Authority
Ngāti Te Ata Waiohua	Te Ara Rangatu o Te Iwi o Ngāti Te Ata Waiohua
Ngāti Paoa	Ngāti Paoa Trust
Ngāti Maru Rūnanga	Te Runanga a Ngāti Maru
Te Kawerau a Maki	Te Kawarau a Maki Tribal Trust
Ngāti Tai Ki Tāmaki	Ngāi Tai Ki Tāmaki Tribal Trust
Ngāti Whatua Ōrākei	Ngāti Whatua Ōrākei Trust
Ngāti Whatua	Te Rūnanga o Ngāti Whatua
Te Ahi Waru	Makaurau Marae
Ngāti Tamaoho	Ngāti Tamaoho Trust

The cultural values assessed and reported in this AEE should be considered in the full context of the collaborative working process established for this Project. The process of engagement, of Project option assessment and of collaborative hui is a key component of acknowledging and respecting the mana of the Iwi / hapū involved and the principles of Te Tiriti o Waitangi (defining the relationship of the Crown and Mana Whenua). The approach is considered a key element in acknowledging the relationship of Mana Whenua to the environment in which the Project is located and impacts upon.

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[66] Ngāti Whātua Ōrakei Claims Settlement Act 2012, Te Kawerau ā Maki Claims Settlement Act 2015 and the Tāmaki Settlement Collective, 2012.

[67] Office of Treaty Settlement plan reference.

12.6.2 Existing environment

12.6.2.1 Māori history and heritage

There is an acknowledgement that there are many different interpretations and histories from Mana Whenua about the land in the Project area. A brief summary of the accepted Māori history amongst Mana Whenua is set out below.

Onehunga dates from the earliest time of occupation by the older tribes of Tāmaki such as Te Waiohua and Te Kawarau a Maki. By 1100AD, the Ōtāhuhu portage linking the Māngere Inlet with the Tāmaki River was already in use. Onehunga saw the arrival of the Great Fleet's Tainui Waka into the Project area via the Kāretu and Ōtāhuhu portages (in 1350AD). From this time onwards successive tribes gained territory on the isthmus by marriage and through allegiances warfare. Further specific commentary on the whakapapa for Mana Whenua to this area is provided in the Maori Values Assessment reports prepared by Mana Whenua on this project. The Project team acknowledge this whakapapa.

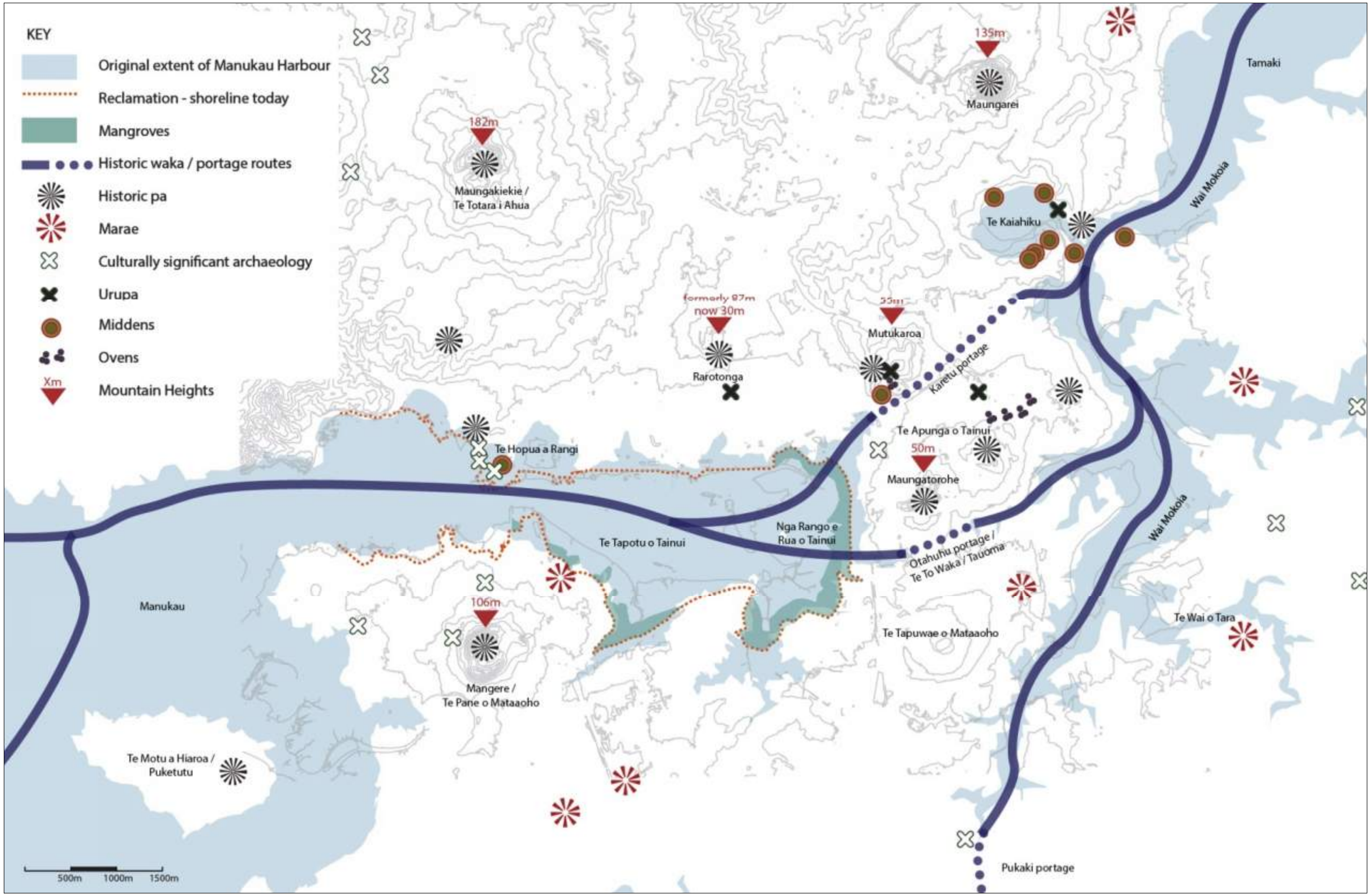
Historically, Onehunga was a desirable location for many reasons. Its location adjacent to the Māngere Inlet (once a rich source of food); proximity to strategic portages connecting the Manukau Harbour, Tāmaki River and Māngere Inlet; and its role as an important place of trade and commerce. The abundant natural resources of the foreshore and hinterland were an important resource, sustainably harvested by successive generations of tribal groups.

12.6.2.2 Cultural Landscape

Mana Whenua place particular importance on the cultural values of the Manukau Harbour as it has been a place of sustenance, commerce, transport and communication for hundreds of years. The harbour also has specific significance as a food basket for kai moana, strategic importance for east west movements both for waka and Māori people up to the present day and its contribution to the economic prosperity of Mana Whenua over time (e.g. with their involvement in the flax mills and for trade with Pakeha as the city of Auckland established). The soils in the Onehunga area have been important in the past as crops have flourished and provided an important resource for iwi and hapū.

During engagement with Mana Whenua, many shared their histories and stories, identifying connections to significant places within the Project area and broader region. The whole area is recognised as a cultural landscape, by the long history of occupation, settlement, trade and activity in the area. Within this landscape, specific sites and significant features are identified. These are shown on and discussed briefly below.

Figure 12-5: General location of culturally significant landscapes and sites



Te Waimokoia (Māngere Inlet)

The Te Waimokia is identified as a taonga. Notable features identified within the inlet include:

- The portages between the Manukau and Tāmaki harbours that extend from the reaches of the inlet, including the Ōtāhuhu and Kāretu portages;
- The small island Nga Rango Erua o Tainui, the final resting place of the skids used to haul the great waka Tainui across the Ōtāhuhu portage around 1300; and
- All coastline and riverbanks/marine and freshwater areas including Anns Creek.

Nga Tapuwae o Mataho

Several maunga form the backdrop and landscape setting of the Project (Te Pane o Mataaoho (Māngere Mountain), Maungakiekie (One Tree Hill), Maungarei (Mt Wellington), and Rarotonga (Mt Smart)). There are also features within the Project. In the immediate area features include:

- Te Hōpua ā Rangi, the basin of Rangi (the wife of the first Waiohua paramount chief Huakaiwaka), the tuff ring formally open to the Manukau Harbour but filled in 1930's and now bisected by SH20;
- Pahoehoe lava flows at Pikes Point and west of Alfred Street;
- Ōtāhuhu/Maungatorohe (Mt Richmond); and
- Views to maunga, including Māngere to the south and Maungakiekie in the north.

Several other significant maunga have been quarried out of the landscape, including Maungataketake (Mt Ellett), Te Ihu a Mataoho, Pukeiti / Puketaapapa (Otuataua Historic Reserve), Te Motu a Hiaroa (Puketutu Island), and Waitomokia (Mt Gabriel).

Portages

Waka portages were vital for east west trade and supported a strategic network of pā from the far north to the South Island (noted also in respect of the Māngere Inlet above). Those within the Project area are:

- The Kāretu portage linking Anns Creek with Kāretu, south of the Panmure Basin. The portage is located alongside Mutukāroa-Hamlins Hill;
- The Ōtāhuhu (Tauoma/Te To Waka) portage which was in use by 1100AD and was the most important in the area because of its location, gradient and length: it was the narrowest point between east and west coasts of New Zealand, sloping gently for less than 1km from the Tāmaki River to the Manukau Harbour; and
- The Pukaki portage, while outside the immediate Project area, formed part of the linked waterway routes.

Ancestral Pā

The ancestral pā in the area include:

- Mutukāroa-Hamlins Hill: a strategic site for the Kāretu portage, with many houses and storage pits among the cultivated slopes;
- Rarotonga: to the north of the Project area but whose cultural sites reach down towards the Māngere Inlet;
- Ōtāhuhu /Maungatorohe: just north of the Ōtāhuhu portage routes and closely associated with the portage;
- Mauinaina and Mokoia, fortified pā at the mouth of the Panmure basin positioned to control movement on the Tāmaki River;

- At Ihumatao on or around the volcanic cones of Te Ihu o Mataaoho/the nose of Mataaoho, and at Te Pane o Mataaoho; and
- Maungakiekie, dominating the centre of the isthmus between the harbours and one of the largest and most significant pā sites in the history of the area.

Te Apunga o Tainui

Within the cultural landscape, the area referred to as Te Apunga o Tainui is an area of specific heritage and history, initially for Māori settlement (referring to the arrival of the Tainui waka) and subsequently as the colonial military camp area (McLennan Hills). This area is geographically defined by the current landmark areas from Mt Wellington to the Ōtāhuhu Creek. Further information on the archaeological remnants and record of this area are provided in *Technical Report 3: Archaeological Assessment* in Volume 3. Mana Whenua have specific ancestral association with this area and on the basis of this, identify the area as wāhi tapu. This significance is formally acknowledged (in part) by the recorded and protected urupa to the west of SH1 in this area.

12.6.3 Consideration of cultural effects and management responses

Mana Whenua and the Project team have identified the potential for the above values to be impacted both during construction and in the operation of the Project, both in terms of the physical works and in terms of the way such works are undertaken (particularly for the latter in respect of the metaphysical effects on mauri and tapu of the environment and specific sites). The process of identifying the potential effects of the Project, and development of options to avoid, remedy and mitigate these effects is an iterative process. This section addresses both in an integrated manner.

12.6.3.1 Project benefits

An integral component of the consideration of the cultural effects of the Project is acknowledgement of the existence and importance of the residential and business activity of Auckland (as the country's major urban area). Economic activity in Auckland provides for the social and economic wellbeing of its residents, including Mana Whenua, mataawaka and other residents. In this regard, it is recognised that the EWL, as a Project to support the economic functioning of Auckland, will have benefits to the wider community including Mana Whenua.

There is potential for ongoing opportunities during construction and operation of the Project for Mana Whenua and mataawaka to provide for their social and economic wellbeing (and as a result cultural wellbeing). Acknowledgement of these opportunities is provided through ongoing discussions between the Transport Agency and Mana Whenua governance representatives and through the development of protocols and considerations for outcomes assessed in the procurement process. These opportunities are being explored in the partnership and collaboration arrangements discussed below.

12.6.3.2 Partnership and collaboration

Mana Whenua have acknowledged the ongoing journey that has been taken in building a relationship of collaboration on the Project and in the delivery of other transport projects. A core element of appropriately addressing the potential effects of the Project on cultural values is acknowledging and establishing enduring relationships between iwi/hapū and the Transport Agency at a consistent level across the various phases of a project.

In acknowledgement of this, the Transport Agency has established a number of levels of engagement and collaboration for this (and wider) Projects. These include:

- Project development between the Project team and Mana Whenua (which has informed the design, option evaluation, assessment and mitigation process to date); and
- Measures set out for the subsequent detailed design, during construction and operational processes (e.g. future contractors) (discussed further below).

The Transport Agency is also progressing wider levels of engagement between the Agency and Mana Whenua, for governance and leadership.

12.6.3.3 Alignment Design

The Project team has sought to recognise and acknowledge Mana Whenua cultural values in identification and design of the Project. In particular, alignment options and designs have sought to avoid potential adverse effects on cultural values. Examples of this approach include:

- A design which avoids impacts on the physical remnants and exposed lava of Te Hōpua. Design considerations include avoiding / minimising cutting into or through the tuff ring, avoiding significant geological areas and avoiding works that would require covering exposed lava flows in the CMA (e.g. to the west of the tuff ring in the Onehunga area);
- The proposed alignment avoids the mapped area of Mutukāroa-Hamlins Hill. Options that may have impacted on this feature, and designs that had the potential to require land from the reserve at Mutukāroa-Hamlins Hill (along Sylvia Park Road) were dismissed earlier in the options assessment process;
- A design which does not intrude on existing and protected views to valued maunga, including Māngere and Maungakiekie;
- Avoiding corridor options that would have increased the extent of impact on Te Apunga o Tainui (at Panama Road), in particular this refers to an option that provided a more easterly connection for the EWL at SH1, but also more recently an alignment and construction design for the ramps connecting the EWL with SH1 at Mt Wellington;
- Investigating alignment options through the Anns Creek area, that have sought to avoid impacts on outstanding and/or significant geological features (acknowledging there are some impacts on ecological features in this area that are not avoided); and
- Selecting the design option that removes the existing culvert obstruction of the Ōtāhuhu portage on SH1 and replaces them with a bridge. This provides opportunity to recognise the culturally significant Ōtāhuhu portage (discussed below).

In addition, in acknowledgement of certain adverse cultural effects of the Project and the opportunities that are afforded by the Project, the following alignment designs have also been developed:

- The provision for full bridging of Ōtāhuhu Creek acknowledges the significance of this historic portage. Recognition of the portage feature in design of the structures of this bridge will provide further opportunities to positively recognise this significant feature;
- The issue of reclamation of the CMA is significant for Mana Whenua, representing the permanent displacement of this taonga with land. Mana Whenua generally consider reclamation an untenable environmental impact. The extra-ordinary conditions of the northern coastal edge of the Māngere Inlet (which include extensive areas of landfill), the impacts of water discharging from land to the Harbour and the modification of the coastal edge in this area have all been considered in the identification of the opportunities provided by the Project. The design of the foreshore reclamation of EWL, provides for:
  - The construction methodology on the foreshore which includes the removal of materials from parts of the closed landfills along the Māngere Inlet and establishment of a ‘contamination containment bund’ or barrier between these landfills and the harbour. This is expected to reduce the tidal flow of water (and potential leachate contamination) between the Māngere Inlet and these landfills to recognise and enhance the mauri of the coastal environment;
  - The establishment of new areas to manage existing stormwater discharges from the wider Onehunga area (addressing activities which are currently degrading the mauri of the Māngere Inlet and as a result the wider Manukau Harbour);

- Restoration and rehabilitation of natural character / natural form of the Manukau Harbour edge to contribute to the restoration of mana to this area of the Māngere Inlet; and
- Carefully balancing the extent of reclamation from the Māngere Inlet; seeking to minimise the extent of reclamation while still achieving the contamination containment, water quality and restoration outcomes of the Project.

12.6.3.4 Te Aranga Principles

Te Aranga Principles are delivered through the design of the EWL, as set out in the ULDF. Embedded within the ULDF are processes for ongoing design inputs by Mana Whenua to key features of the Project. The ULDF will guide the ongoing development of the Project, focusing on design and integration of the Project into the surrounding environment, particularly both the urban areas of Onehunga and the coastal environment of the Māngere Inlet.

Key specific examples of measures from the ULDF which demonstrate the ongoing input of the Te Aranga principles in the delivery of the Project include:

- The concepts for recognition and acknowledgement of Te Hōpua and the commitment to contribution of Mana Whenua in the establishment of artworks in this area;
- The themes for and ongoing role of Mana Whenua input into the design and interpretive signage of the foreshore and in the Anns Creek area to acknowledge the value of this environment to Mana Whenua;
- The recognition of the Kāretu portage – the Project follows the alignment of the Kāretu Portage alongside Mutukāroa-Hamlins Hill for about 1km and offers an opportunity to improve awareness and legibility of the cultural values of this area. Specific measures proposed to appropriately recognise and remember this valued area include signage and interpretative information on the portage area, structure design and in particular the design beneath the viaduct structures through Anns Creek, as well as landscaping to provide for the legibility of this historic link at Sylvia Park Road; and
- The Ōtāhuhu portage – to recognise the portage in design of the bridge structure, including opportunity for passage beneath the bridge to maintain connectivity down the waterway.

In all cases, the application of the design principles is proposed to be undertaken in a process of ongoing consultation / engagement with Mana Whenua, to recognise wider values of kaitiaki and ahi kā.[68]

12.6.3.5 Effects on the mauri of the Māngere Inlet and waterbodies

A number of sections in this AEE consider the effects of sediment discharges to the CMA and the resulting impacts on ecological values (e.g. Sections 12.15, 12.20 and 12.21). Collectively, these assessments provide information for the assessment of the overall health or mauri of the Māngere Inlet and other water bodies impacted by the Project (including the Tāmaki Estuary). Mana Whenua input during construction and operation will both maintain opportunities for the effects on the mauri of the Māngere Inlet to be considered going forward and further contribute to recognising cultural values in respect of kaitiaki, ahi kā and rangatiratanga (governance and self-determination) in respect of this taonga.

[68] (noun) burning fires of occupation, continuous occupation – title to land through occupation by a group, generally over a long period of time.

12.6.3.6 Works on or in vicinity of culturally significant areas

Construction of the Project will require land disturbance activities that could have adverse effects on some of the following areas of cultural significance:

- Te Hōpua tuff ring;
- Pahoehoe lava flows in and around Anns Creek;
- Ōtāhuhu and Kāretu Portages;
- The culturally significant area between SH1 Mt Wellington and Panama including Te Apunga o Tainui; and
- The CMA.

The potential works in these areas include activities such as:

- Minor earthworks on the external and internal slopes of Te Hōpua tuff ring;
- Disturbance to the CMA (including coastal processes and marine habitats) during construction of the foreshore and structures in the CMA;
- Temporary erosion and sediment control ponds to manage sediment discharges during construction activities; or
- Restrictions on access during construction works, such as closure of access on the Ōtāhuhu Portage during construction of the proposed bridges (noting access is already constrained by the existing culverts on SH1).

To respond to the potential cultural effects on Mana Whenua values, protocols for Mana Whenua engagement throughout construction are proposed.

12.6.3.7 Archaeological Effects and Accidental discovery of artefacts

The archaeological assessment is contained in *Section 12.7.2: Archaeology* and *Technical Report 3: Archaeological Assessment* of *Volume 3* and it should be read in conjunction with this assessment. There are several sites of cultural significance and wāhi tapu within the Project area (discussed above). Construction of the Project will require earthworks and disturbance of ground surfaces in and around these known areas of previous Māori occupation. The works have the potential to disturb or uncover, previously unknown heritage artefacts of cultural significance. To minimise any potential impacts to these artefacts, specific tikanga protocols will be established for undertaking works in this area. This is in addition to the proposed accidental discovery protocols and Archaeological Authority to be sought for the Project. The specific tikanga protocols, and the more general accidental discovery protocols, will be prepared in consultation with Mana Whenua in advance of construction, and will be implemented during construction to ensure appropriate procedures are followed.

12.6.4 Operation and Monitoring of Project Outcomes

The principles of partnership and collaboration are proposed to extend through the operation of the Project and through monitoring and management planning will confirm the expected outcomes. This will include (but is not limited to):

- Participation of Mana Whenua in the review of monitoring reports for water quality and discharges to the CMA, reporting on ecological outcomes from the Project and in the development of any necessary contingency or response plans (e.g. if monitoring triggers are reached). This on-going role in the operation and management of the environmental outcomes of the Project recognises the kaitiaki role of Mana Whenua in this environment and provides an opportunity for the Maori world view and cultural values to be reflected in the development of any contingency or action plans prepared in response to monitoring outcomes.

- Opportunity for cultural monitoring processes are to be offered to Mana Whenua. Cultural monitoring will provide Mana Whenua an opportunity to identify and articulate the values and perspectives of the Māngere Inlet / Manukau Harbour and project environment that are significant to them. The monitoring will enable them to understand the environmental-cultural changes experienced in the Project area during construction and through to implementation, from a Maori perspective.

12.6.5 Summary of project measures to address cultural effects

The construction and operational effects of the Project on water bodies and areas of cultural significance are of particular concern to Mana Whenua. The measures to avoid, remedy or mitigate these effects are summarised below.

12.6.5.1 Construction

Mitigation and management measures that will be implemented during further project development to minimise adverse effects on cultural values and to recognise the relationship of Mana Whenua to the environment, are incorporated into various sections of this AEE including:

- Protocols for engagement and ongoing input from Mana Whenua in detailed design of the Project and during construction;
- Specific protocols and Te Aranga principles for the design of:
  - Structures at Te Hōpua;
  - Structures and elements of the foreshore design;
  - Structures in the Kāretu portage; and
  - The aesthetic treatment of the bridge and provision for public access beneath the bridge at Ōtāhuhu Creek.
- Protocols for recognition of Mana Whenua and the cultural significance of the landscape in which the Project sits (e.g. undertaking blessings for construction works);
- Protocols for cultural monitoring in significant sensitive sites (e.g. earthworks in the area of Te Apunga o Tainui, works in the vicinity of the historic coastline and works at Te Hōpua);
- An accidental discovery protocol for the Project will be developed and agreed with Mana Whenua and HNZPT. Further discussion of the accidental discovery protocol is contained in *Section 13.1: The Project delivery framework* of this AEE; and
- Sourcing of locally grown natives for proposed landscaping.

12.6.5.2 Operation

The following measures are proposed during the operation of the Project:

- Participation of Mana Whenua in the review of monitoring reports for water quality and discharges to the CMA, reporting on ecological outcomes from the Project and in the development of any necessary contingency or response plans (e.g. if monitoring triggers are reached); and
- The opportunity for cultural monitoring processes are to be offered to Mana Whenua (e.g. water quality).

12.7 Archaeology and built heritage

Overview

The Project is located in an area highly modified by urban development and reclamation. This has resulted in the destruction and damage of a number of recorded archaeological sites and probably also unknown or unrecorded archaeological remains or sites. Notwithstanding this, there are a number of archaeological sites recorded within, and in proximity to, the Project area. The works associated with the Project have been assessed as likely to have a moderate effect on previously recorded and unrecorded archaeology provided that works comply with mitigation measures or conditions.

Construction of the Project, and particularly earthworks, has the potential to affect archaeological sites and for unknown archaeological sites to be encountered. An application(s) for an archaeological authority will be submitted to HNZPT prior to the construction works commencing. The methods to record, analyse and monitor archaeological sites will be defined in that application and implemented in accordance with any conditions of the HNZPT authority during construction to appropriately manage the potential adverse effects on archaeology.

The Project sits in close proximity to a number of built heritage features. While these features will not be directly physically affected by the Project, construction has the potential to affect the heritage values and context and the structural integrity of these buildings. These effects include construction vibration and ground settlement, which can be appropriately managed during construction. Operational effects include limiting views and access to some built heritage places and are assessed to have minor to moderate effects on scheduled and listed built heritage places.

12.7.1 Introduction

This section outlines the actual and potential effects of the Project on archaeology and built heritage.

There are a number of archaeological sites recorded within and in proximity to the Project area. The actual and potential effects on archaeological sites for the Project comprise damage to or destruction of archaeological or heritage material. An archaeological assessment including a detailed description of the existing archaeological environment is provided in *Technical Report 3: Archaeological Assessment* in Volume 3.

The Project also sits in close proximity to a number of built heritage features. Potential adverse effects on built heritage include visual amenity, limited access and damage to the structural integrity of the built heritage features as a result of construction vibration and ground settlement. A built heritage assessment including descriptions of built heritage features is provided in *Technical Report 2: Built Heritage Assessment* in Volume 3.

This section does not provide an assessment of Māori cultural values. That assessment is contained in *Section 12.6: Effects on values of importance to Mana Whenua* of this AEE.

12.7.2 Archaeology

The methodology used to assess the archaeological environment along and within the vicinity of the Project alignment has involved both a desktop and field assessment.

12.7.2.1 Existing Archaeological Environment

Within the wider Project area, there are numerous archaeological sites recorded by the New Zealand Archaeological Association (NZAA) and other records such as Cultural Heritage Inventory (CHI) records. These include sites of Māori origin, including former settlement sites, middens, pits/terraces, burial sites and sites of Colonial era origin, including sea walls, sawmills and infrastructure. The recorded sites in proximity to the alignment are summarised in Table 12-7 and illustrated in Figure 12-6.

These sites are of limited archaeological value and significance because the majority have been damaged or destroyed by urban development and previous State highway construction.

There is also the potential for unknown archaeological sites to exist within the Project area. However, given the extent of land modification it is not possible to fully assess the extent and values of such sites prior to works.

Table 12-7: Recorded Archaeological Sites

Sector	Location relative to EWL	NZAA Site Number	CHI number	Site Type/Description	Condition
1	Within the EWL alignment	R11/99	6826	Settlement/Pa	Destroyed
1	Located on the southern edge of Te Hōpua	R11/352	5837	Midden Oven	Area has been extensively modified
1	Within the EWL alignment	R11/2743	N/A	Transport Communication	Archaeological remains
3	Located at Anns Creek	R11/1635	10107	Industrial Water Supply	Archaeological remains
4	Adjacent to Project (will not be affected)	R11/142	1176	Mutukāroa-Hamlins Hill Pit/Terrace/Settlement site	Archaeological remains
4	Within 60m of the Project	R11/1394	N/A	Pit/Terrace	Totally destroyed and built over by factories.
4	Within 60m of the Project	R11/898	1165	Pit/terrace	Site under commercial development
5	Within 100m west of Project	R11/10	N/A	Te Apunga o Tainui McLennan Hills (Pits/Terraces)	Destroyed by quarrying. Surrounding areas may have archaeological remnants.

Figure 12-6: NZAA Archsite recorded sites

In addition to the NZAA recorded sites in Table 12-7, there are other CHI sites adjacent to the site that contribute to archaeological values. These include amongst others the Onehunga Wharf (CHI 467) and the Old Māngere Bridge (CHI 659) and seawalls.

12.7.2.2 Assessment of effects on archaeology

The actual and potential effects on archaeology from the Project relate to the potential destruction, modification or damage of archaeological sites arising from the construction works. The archaeological effects of the Project will be limited to the footprint of the physical works.

The majority of the NZAA and CHI archaeological records are located outside the Project footprint and as a result will not be affected. Scheduled archaeological sites will not be affected. There is a midden record (R11/352 and CHI 5837) on the southern side of Te Hōpua. The NZAA detail record suggests this has largely been destroyed as a result of previous development, however associated unrecorded archaeological material may be encountered during works.

Remains of historic Onehunga Port infrastructure may also be affected in this area (CHI 467 and 469, and remains of R11/2743, being the Onehunga branch line rail embankment to the port).

There is the potential that unknown archaeological remains are encountered during construction. Accidental discovery protocols can set out the procedures to be followed should archaeological remains be encountered during construction.

The HNZPT Act provides for the identification, protection, preservation, and conservation of the historical and cultural heritage of New Zealand. The HNZPT Act defines an archaeological site as a place or structure associated with pre-1900 human activity and where there may be evidence relating to the history of New Zealand. It is unlawful for any person to modify or destroy, or cause to be modified or destroyed, the whole or any part of an archaeological site without the prior authority of HNZPT. An application(s) for an archaeological authority will be submitted to HNZPT prior to the construction works commencing.

Overall, as the Project is located in a highly modified area, including on areas of reclaimed fill, and known sites are identified as being largely destroyed, archaeological effects cannot be assessed with certainty but are expected to be minor, with the possible exception of the southern part of Te Hōpua, where a variety of archaeological material may be encountered during deeper works which may extend to the original seabed.

12.7.2.3 Measures to avoid, remedy or mitigate potential adverse effects on archaeological sites

The following measures are proposed to mitigate the potential adverse effects on archaeological sites:

- The Project team will continue to liaise with Mana Whenua, HNZPT, and Auckland Council Heritage staff with regard to developing a framework for management of Historic Heritage values during construction, in accordance with conditions of any HNZPT Archaeological Authority, and to identify opportunities for interpretive and commemorative material for any archaeological discoveries;
- For areas identified as having greater potential for archaeological discoveries, an Archaeological Authority(s) will be sought from HNZPT under the HNZPT Act; and
- For other areas of the Project, the Transport Agency Accidental Archaeological Discovery Protocol and AUP (OP) accidental discovery protocols (with input from Mana Whenua) will be applied, to ensure appropriate steps are taken in the event of archaeological discoveries.

The Project team has liaised with HNZPT during the preparation of the Application and this liaison will continue during subsequent stages of the Project.

The mitigation measures, methods and protocols set out above will appropriately manage the potential adverse effects of encountering archaeological or heritage material.

12.7.3 Built Heritage

The built heritage assessment has been undertaken for extent of the Project and the areas extending approximately 50-100m out from the boundary of the proposed works. The built heritage features have been assessed in two broad groups:

- Listed and scheduled historic heritage buildings and structures; and
- Other built heritage not listed or scheduled, but identified on Auckland Council's CHI and/or buildings or structures that contribute to the character of the area.

12.7.3.1 Existing Environment

The Project area has a rich history of European settlement as discussed in *Section 10.0* of this AEE. Within the area assessed a number of built heritage features have been identified. A complete list of these features has been included in *Technical Report 2: Built Heritage Assessment* in Volume 3. Table 12-8 summarises the key and/or listed built heritage features that may be impacted by the Project.

Table 12-8: Built Heritage within the Project area

Historic Heritage Feature	Address	Cultural Heritage Index No.	AUP (OP) ID	HNZPT Listing
Aotea Sea Scouts Hall	1 Orpheus Drive, Onehunga	100	2598 (Category A)	N/A
The Landing (former Manukau Tavern)	2 Onehunga Harbour Road, Onehunga	2861	2610 (Category B)	N/A
Shaldrick Building	50 Onehunga Mall	19951	2617 (Category B)	N/A
Waikaraka Park Stone Walls and Cemetery	175-243 Neilson Street	3219	1755 (Category B)	N/A
Onehunga Wharf	55 Onehunga Harbour Road, Onehunga	20036	2736 (Category B)	-

In addition to the built heritage features outlined below, the wider area contains scheduled and/or listed built heritage places and areas identified as having character and/or heritage values. This includes the Onehunga Town Centre and the character streets in Onehunga which are identified as special character areas. There are other buildings and structures in the Project area that are included in Auckland Council's CHI, or may have value in terms of contributing to the character of the area such as sea walls and the Onehunga Wharf remains.

Aotea Sea Scouts Hall

The Aotea Sea Scouts Hall (former Manukau Yacht and Motor Boat Club) is accessed via Orpheus Drive and Onehunga Harbour Road and is a significant and highly visible landmark and an aesthetically pleasing building.

The Aotea Sea Scouts Hall has high historic values, being one of the oldest boating club buildings in New Zealand.

The building has significant architectural values and has high cultural and social significance due to its contribution to the social and cultural life of Onehunga. The existing SH20 and Neilson Street Interchange have disconnected the Aotea Sea Scout Hall from the Onehunga Town Centre to some extent.

Other built features in the vicinity of the Aotea Sea Scouts Hall include the stone sea wall and Onehunga Wharf remains.

Figure 12-7: Aotea Sea Scouts Hall

The Landing

The Landing (former Manukau Tavern) is Onehunga's only remaining 19th century hotel in operation and has been in continuous use for its original purpose since its construction in 1879. The building has considerable historical significance due to its associations with people and organisations significant to the early settlement of Onehunga.

The building has moderate context significance due to the contribution it makes to the wider historical and cultural context, and proximity to Onehunga Wharf.

Figure 12-8: The Landing, Onehunga

Shaldrick Building

The Shaldrick Building, located at 50 Onehunga Mall, was built around 1880. The building is significant as it is the only remaining 19th century residential building at the southern end of the Onehunga Mall area.

The building has been assessed to have considerable local historical significance due to its connection to William Shaldrick, a prominent Onehunga resident and businessman.

Figure 12-9: Shaldrick House, Onehunga

Onehunga Wharf

The Onehunga Wharf, constructed in 1924, retains early cargo structures and a sea wall. The Onehunga Wharf has considerable local significance for its role as a hub for coastal shipping. For a period during the 1960s it was the largest coastal shipping port on the west coast of New Zealand. The port closed to international shipping in 1990, operating solely as a coastal port handling a wide range of cargoes to and from other New Zealand ports.

Waikaraka Park

Waikaraka Park was set aside for public use in 1881 for use as a recreation ground, rifle range and public cemetery. The Park has significant social and cultural significance due to its historical social contribution to Onehunga and the wider Auckland. The heritage features within Waikaraka Park are:

- The War Veterans Memorial dedicated to soldiers and service people, unveiled in April 1917;
- Stone walls surrounding Waikaraka Park;
- Stone caretakers cottages located in the north-eastern corner of the Park; and
- Built heritage features associated with the speedway in the north western corner of the site.

Figure 12-10 illustrates the historic heritage features within the Park.

Figure 12-10 : Waikaraka Park features

Key features

A Cemetery

B 1930s Grandstand

C Ticket Booth

D 1948 Toilet Block

E 1942 Caretakers cottage

F 1930s/40s toilet block

G Sports Fields

Note: Yellow (items A-G) represents places of historic interest and are included in the evaluation. Blue (H-K) indicates places excluded from the evaluation as these are modern service buildings providing toilets, changing rooms, sportsfield services and motorspeedway services. Red indicates the overall extent of Waikaraka Park and Cemetery.

12.7.3.2 Assessment of construction effects on built heritage

None of the built heritage features identified will be directly physically affected by the construction works for the Project. Construction will however have the potential to have indirect adverse effects associated with ground settlement and construction vibration.

The assessment of ground settlement effects set out in *Section 12.17: Ground Settlement* identifies that ground settlement associated with the Project will largely be generated by consolidation or compression of the ground from construction fill. Ground settlement beyond the immediate Project footprint is calculated to typically be in the range of 0-10mm (which is low). Adverse effects of settlement in this range, combined with the separation distances to the heritage buildings means that the potential effects on the structural integrity of heritage buildings and structures are assessed as negligible (see *Section 12.17: Ground Settlement* for further discussion).

The assessment of construction vibration is set out in *Section 12.11: Noise and vibration* of this AEE. That assessment identifies that the majority of heritage buildings and structures within the Project area are at a distance where the risk of building damage from construction vibration will be negligible. The Aotea Sea Scouts Hall and The Landing buildings are located in close proximity to the area of construction works (within 10m of the alignment), however, the adverse effects from construction vibration at this distance is still assessed as negligible (see *Section 12.17: Ground Settlement* for further discussion). Buildings may receive perceptible vibration when use of heavy machinery is being used. Low vibration methods of construction will be used wherever practicable to reduce vibration in the vicinity of sensitive land uses.

Vibration monitoring will be used to confirm that vibration intensive works occurring in proximity to heritage features are appropriately managed within the limits set out in *Section 12.11: Noise and vibration* of this AEE. Pre and post construction condition surveys will be undertaken for the Aotea Sea Scouts Hall and The Landing to record and monitor any potential structural damage as a result of construction.

Overall, the potential construction effects on built heritage will be negligible due to the distance of heritage features from the construction extents and the implementation of mitigation measures and monitoring.

12.7.3.3 Assessment of permanent works on built heritage

The Project will not result in the destruction of, or any physical damage to, any heritage features. The ongoing physical presence and operation of the Project has the potential to have an adverse effect on heritage values and visual amenity however, the Project also will have positive effects on some built heritage places within the Project area.

The operational vibration effects of the Project are assessed in *Section 12.11: Noise and vibration* of this AEE. This indicates that as this will be a newly constructed road, it is highly unlikely that there will be any adverse traffic noise and vibration effects on heritage buildings and structures within the Project area. Therefore, no adverse effect is anticipated from traffic noise and vibration on the physical form of heritage buildings and structures.

Adjacent to the Aotea Sea Scout Hall will be the realigned Orpheus Drive, the SH20 on-ramp and the connection to the SH20 overbridge. This will restrict views towards the building from the Neilson Street off-ramp, limiting opportunities to appreciate the main façade. Additionally, the Project will affect the usability of the club by the Aotea Sea Scouts who, during consultation, have identified concerns with safety for children, loss of access to Gloucester Park South and reduced context including views to and from Onehunga Town Centre. The Project will however have a positive effect on the context and improve local accessibility by changing Onehunga Harbour Road/Orpheus Drive to local road connection with walking and cycling facilities. Overall the Project will have permanent cumulative adverse effects on the Aotea Sea Scouts Hall, however this can be partly mitigated through the incorporation of appropriate landscaping. The positive effects of the Project described above will also contribute to minimising the impact of the adverse effects.

The reconfiguration of the Neilson Street Interchange and the establishment of the EWL within Sector 1, will physically and visually change the relationship of The Landing with the surrounding area and further isolate the Onehunga Wharf. Lowering the EWL in a trench adjacent to the Onehunga Wharf the proposed local road connection to Orpheus Drive and Onehunga Wharf, and the improved pedestrian and cycleway facilities, will contribute to mitigating this effect.

The establishment of a road directly adjacent to the southern end of Waikaraka Park and Cemetery will change its context and weaken its historic relationship with the Māngere Inlet. The key concerns for Auckland Council as land owner relate to construction (including noise, dust etc.), however overall Auckland Council is supportive of the operation and the future opportunities to enable active sports fields to be developed.

Discussions with HNZPT identified that amenity of the Cemetery is a particular concern. Potential adverse visual effects will be mitigated through urban design and landscaping on the cemetery side of the road to maintain a "green" outlook. A wider area is available for planting at the western extent of the cemetery. None of the Pohutukawa trees along the Cemetery access road will be affected by the Project. The landscape plans in Plan Set 4: Landscape show this proposed planting for this area.

The Project may have a positive effect on the northern end of Waikaraka Park due to the reduction in traffic volumes along Neilson Street. The widening of the Neilson Street / Captain Springs Road intersection will impact on the context of the northern end of Waikaraka Park however the effect of this will not be significant. The stone walls of Waikaraka Park are not affected by the Project.

12.7.3.4 Measures to avoid, remedy or mitigate potential adverse effects on Built Heritage

To manage the potential adverse effects of construction on historic heritage, vibration monitoring will be undertaken during vibration intensive construction works in proximity to heritage features. The monitoring will confirm the vibration levels experienced and allow construction methodologies to be altered in response to elevated vibration levels.

Building condition surveys of the Aotea Sea Scouts Hall and The Landing will be undertaken prior to works commencing to confirm the condition, context and physical features of the buildings. This information will be included in the CEMP. Post construction, a condition survey will be undertaken to record any potential structural damage as a result of the Project construction and any damage will be rectified in consultation with the building owner.

Landscaping and urban design elements, such as shared paths will reduce further isolation of the buildings and maintain connectivity with the wider environment. These elements are indicated on the drawings contained in *Plan Set 4: Landscape* in Volume 3 and the *ULDF* in Volume 4.

12.8 Assessment of geological heritage effects

Overview

There are several geological features located within the Project area – the Te Hōpua tuff crater, remnant lava features along the Māngere Inlet foreshore and pahoehoe lava flows within Anns Creek. All of these features have been compromised to varying degrees by urban development and their value as examples of volcanic features has been reduced as a consequence.

The Project will result in negligible adverse effects on Te Hōpua as a result of cut and fill required on and in proximity to the remaining tuff features. The new road largely avoids effects on the other remnants of lava flows located along the northern foreshore of the Māngere Inlet and in Anns Creek. In addition, the Project will have positive effects on the geological features along the Māngere Inlet foreshore.

The Project provides the opportunity to enhance knowledge of Auckland's volcanic heritage, and to improve the understanding of, and public access to, these features.

12.8.1 Introduction

This section presents the actual and potential effects of the Project on geological heritage. A detailed description of the existing geological heritage environment and the accompanying assessment of effects on geological heritage are provided in *Technical Report 4: Geological Heritage Assessment* in Volume 3.

The assessment of geological heritage describes the volcanic features in the Project area, explains how previous modification has affected the condition, identifies the values of the features and assesses the effects of the Project on the features. It identifies mitigation measures that can address potential effects.

The AUP (OP)[69] focuses on avoiding the adverse effects of inappropriate subdivision, use and development on the natural characteristics and qualities that contribute to an Outstanding Natural Features' (ONFs) values but also ensuring that any development of infrastructure is consistent with the protection of those values. The AUP (OP) lists the factors (or values) that were used to identify a natural feature as an ONF, and it also contains a description of the site and a classification of the site type. The AUP (OP) does not however list the geological qualities or characteristics that contribute to a classification for a particular ONF.

Technical Report 4: Geological Heritage Assessment identifies the qualities and characteristics of the ONFs, taking into account relevant information in the AUP (OP) including the factors that were used to identify the ONFs and the current state of those ONFs. The assessment then assesses the Project's potential adverse effects on those geological characteristics and qualities and consequently the values of the ONFs.

12.8.2 Existing Environment

Volcanoes are a distinctive feature in the Auckland landscape. Within a 20km radius of the CBD there are some 50 named volcanic vents which form the area referred to as the Auckland Volcanic Field. The Auckland Volcanic Field is geologically interesting due to its visual prominence and young age.

[69] Policy D10.3.3 of the AUP (OP).

The volcanic features within the Project area include:

- Te Hōpua (an ONF);
- Remnant basalt outcrops along the Māngere Inlet foreshore; and
- Pahoehoe lava flow remnants in Anns Creek (part of an ONF).

Technical Report 4: Geological Heritage Assessment contains plans showing the mapped extent of the ONFs at Te Hōpua and Anns Creek.

Te Hōpua and the remnant foreshore lava outcrops at Victoria Street and Pikes Point have been assessed to have limited geological heritage value in comparison to other features of the Auckland Volcanic Field. The Anns Creek Estuary flows are significant and the lava features within the Anns Creek East area are rare, not of themselves but because of the flora growing on them. Each of the volcanic features within the Project area are described further below.

12.8.2.1 Te Hōpua

Te Hōpua is a small volcano in the southern part of the Auckland Volcanic Field. In its original form, it was a roughly circular volcanic crater, enclosed by a raised tuff which was highest on the northern and north eastern sides, and lowest on the western side. It was the product of one of Auckland's smaller eruptions. When the sea-level rose, the tuff ring was breached on the south-western side and a shallow tidal lagoon was formed and marine and organic muds deposited within. The lagoon has been further filled with urban refuse and fill; and currently the crater floor exists as Gloucester Park with SH20 bisecting the crater. Due to the level of modification and the development of buildings, particularly on the eastern and northern sides, it is not easily identifiable as a volcanic feature with only limited outcrops of the tuff forming the ring remaining, largely on the northern side.

Figure 12-11: Aerial image of Te Hōpua and the western end of the Māngere Inlet foreshore
(looking north west across Onehunga with SH20 visible to the left)

In its current state, Te Hōpua has been assessed to have little value as a volcanic feature characteristic of the Auckland Volcanic Field – despite being referenced in statutory planning documents as an ONF. The AUP (OP) has categorised Te Hōpua as a Type B site. The AUP (OP) states that Type B sites are smaller more fragile landforms or other features that could be damaged or destroyed by relatively small-scale land disturbance or constructions. Te Hōpua has only limited outcrops of tuff remaining.

12.8.2.2 Lava Flow Outcrops

Prior to historic reclamation in Māngere Inlet, the original coastline comprised lava flow lobes emanating from Maungakiekie/One Tree Hill, Rarotonga/Mt Smart and Maungarei/Mt Wellington volcanoes. Due to past reclamation and land development, the lava flows have been largely destroyed.

There are remnants of the lava flows along the Māngere Inlet foreshore in the vicinity of Victoria Street, Pikes Point and within the Anns Creek Estuary, West and East areas. Along the Māngere Inlet foreshore, the remaining lava outcrops are not assessed to have any significant volcanic heritage value. In Anns Creek East the existing features are not particularly significant from a geomorphic perspective as the textures are mainly obliterated by weathering. In the Anns Creek Estuary area, within the Māngere Inlet, there is an area of uneven cooling textures representing one of the few examples of pahoehoe surfaces on basalt lava in Auckland. Small areas of mangrove scrub are likely to include unmodified lava flows and outcrops which have remained intact.

Figure 12-12: Aerial image of Māngere Inlet looking south east
(the triangular Pikes Point remnant lava flow is visible along the foreshore with Anns Creek to the upper left)

Figure 12-13: Aerial image of Anns Creek looking northwest
(the Southdown spur of the railway line is visible in the centre)

The distinctive "folded" pahoehoe lava flows within Anns Creek are annotated as an ONF in the AUP (OP). These are also categorised as a site Type B.

12.8.3 Effects on Volcanic Heritage

12.8.3.1 Te Hōpua

The Project works in proximity to Te Hōpua include minor earthworks on the western and south western edge, the establishment of an embankment on the north western edge and minor excavation on the southern margin of the tuff ring on the eastern side of The Landing. The tuff ring has been extensively modified, and the majority of the works will be on the already breached southern side or will not directly impact the tuff ring. The works will have a minor effect on the form of the outer slopes of the tuff ring.

The proposed works for the northbound off-ramp of SH20 will involve earthworks following the line of the existing off-ramp and across land that is filled and so will have no impact on the form of the tuff ring.

Along the southern extent of the tuff ring, a cut trench will excavate landfill material and below sea level will encounter tuff deposits. This area has been extensively excavated by current developments. The tuff deposits are located below sea level and earthworks in this location will have no impact on the form of the tuff ring.

The Project has minimised impacts on Te Hōpua, as far as practicable, by staying within existing modified areas and, where possible, within the Transport Agency existing designation. Given the significant level of modification that has already occurred, and the comparably smaller degree of additional cut that will occur as part of the Project, adverse effects of the Project on Te Hōpua's geological heritage values are assessed to be negligible.

12.8.3.2 Lava flow outcrops

a. **Foreshore outcrops**

The foreshore along the northern side of the Māngere Inlet is made up of the distal ends of lava flows from Maungakiekie/One Tree Hill and Rarotonga/Mt Smart volcanoes. The new road along the northern foreshore of Māngere Inlet has avoided volcanic features as far as practicable by largely avoiding the Pikes Point remnant. The volcanic features along the foreshore have been assessed as being of low geological heritage value, and adverse effects on these features have been largely avoided through Project design.

The proposed boardwalk in the Inlet will cross the remnant flows at Pikes Point and opposite the end of Victoria Street. These outcrops have little volcanic heritage value. The proposed walking and cycling connection along the foreshore, landscaping and signage with interpretive material will have positive impact for visibility and legibility of the features.

b. **Anns Creek lava flows**

The lava flows from Rarotonga/Mt Smart and Maungarei/Mt Wellington volcanics have largely been destroyed by the development of roads, rail and industrial buildings in the area. Within relatively small areas of mangrove scrub there are remnant patches of lava outcrop illustrating surface lava features.

The viaducts and associated construction access have been carefully located within the Anns Creek Estuary to avoid most of the ONF areas. The proposed construction methodology includes placing any temporary staging on the southern side of the bridge structure. This will avoid the most sensitive parts of the ONF and will minimise effects on the small areas that the bridge structure will overlap.

The Project construction works and the establishment of bridge piers through the Anns Creek East area have the potential to adversely affect these remnant lava flows. During design, the careful siting of viaduct piers has sought to avoid the lava flow outcrops as far as practicable. The proposed construction methodology seeks to disturb the lava features within Anns Creek as little as possible.

The Project includes landscaping and ecological restoration planting along the foreshore. This will enhance this area and provide an opportunity to link the geological heritage features of Anns Creek with Te Hōpua.

12.8.4 Measures to avoid, remedy or mitigate effects on volcanic features

The volcanic features within the Project area have been assessed to have low value within the Auckland Volcanic Field as they have been largely destroyed or modified by land development and reclamation. The Project will have some adverse effects on these features through the addition of new infrastructure within the Te Hōpua tuff ring and new infrastructure in Anns Creek.

At the same time, the Project presents an opportunity to realise positive effects by emphasising and landmarking these features and enhancing the general knowledge about these features.

The key avoidance and mitigation measures include:

- Enhancement of the park within Te Hōpua tuff crater to include interpretative material explaining its geological history and scientific values;
- Improving the link between Gloucester Park and the proposed pathway that runs along Māngere Inlet to the east. This path is largely on lava flows from Maungakiekie/One Tree Hill and Rarotonga/Mt Smart. The path enables the lava outcrops within the Māngere Inlet to be viewed and appreciated and presents an opportunity to develop a volcanic heritage walk;
- Establishing interpretive signage in Te Hōpua and at Anns Creek which provides educational opportunities and enhances knowledge of Auckland's volcanic field;
- Increasing access to Anns Creek; and
- Avoiding damage to lava flows during construction by excluding areas from the construction footprint and identifying a pier exclusion area within Anns Creek East. These will ensure that adverse effects are avoided on the most sensitive parts of the ONF. The exclusion areas are shown on the construction drawings contained in *Plan Set 11: Construction Activities*.

12.8.5 Conclusion

The Project will be built on, and in proximity to, volcanic features that are part of the Auckland Volcanic Field. This includes Te Hōpua and remnant lava flows of Maungakiekie/One Tree Hill, Rarotonga/Mt Smart and Maungarei/Mt Wellington volcanoes along the northern Māngere Inlet foreshore and in Anns Creek. These features have been extensively modified by various forms of development and their value as examples of volcanic features has been reduced (greatly for Te Hōpua, moderately for Anns Creek West and only a little for Anns Creek East) as a consequence. The further impact as a result of the Project will be minor. Additionally, the Project presents the opportunity to enhance recognition and knowledge of volcanic features which will have a positive effect on volcanic heritage overall.

12.9 Arboricultural effects

Overview

There are a number of trees within and in proximity to the Project area that contribute to the amenity and quality of the urban environment. There are no scheduled notable trees within the Project designation. The Project will require the removal of the majority of trees located within the construction footprint. The removal of these trees is unavoidable and will be mitigated through the landscape replanting that will be undertaken post construction.

The Project also has the potential to adversely affect trees that will be retained. Tree protection measures will avoid and minimise potential adverse effects on these trees.

12.9.1 Introduction

This section identifies and describes the trees with some amenity value within and in proximity to the Project area that are potentially affected by the Project works, assesses the effect of the Project on these trees and outlines measures to avoid, remedy and mitigate potential adverse effects.

The majority of the trees located within the Project footprint will need to be removed for construction of the Project. As a result, this assessment focuses on the potential effects on trees located adjacent to the Project footprint (e.g. due to works in the dripline or a need for pruning).

This section has been informed by *Technical Report 5: Arboricultural Assessment* in Volume 3.

12.9.2 Existing Environment

There are no scheduled notable trees under the AUP (OP) within the Project footprint although there are some within close proximity. . There are a number of unscheduled trees that have been assessed as having amenity or heritage value. There are also a number of trees located in the Project area that are in generally good health and form. The trees and groups of trees which contribute to the amenity and the urban environment in and in proximity to the Project area are outlined in Table 12-9. *Technical Report 5: Arboricultural Assessment* in Volume 3 provides a full schedule of the significant amenity trees that may be affected by the Project.

Table 12-9: Trees with significant amenity value in proximity to the Project

Location	Tree Description
Sector 1	• Pōhutukawa trees located on Onehunga Harbour Road opposite the Aotea Sea Scouts Hall to be removed. • Large Holm Oak on Onehunga Harbour Road to be removed. • Trees within Gloucester Park to be removed.
Sector 2	• Pōhutukawa trees lining the southern boundary of Waikaraka Park to be retained.
Sector 3	• No significant amenity trees identified.
Sector 4	• Trees along Clemow Drive to be retained
Sector 5	• Groups of trees at the Princes Street Interchange to be removed. • Street trees along Princes Street and Frank Grey Place to be removed. • Trees within Bedingfield Memorial Park to be removed.

Location	Tree Description
Sector 6	• Street trees along Alfred Street, Captain Springs Road and the northern end of Neilson Street to be removed. • Pōhutukawa tree in Waikaraka Park on the corner of Captain Springs Road and Neilson Street to be retained.

12.9.3 Assessment of effects on trees to be retained

It has been assumed that all trees within the Project footprint will require removal. The removal of these trees is unavoidable due to the scale of the works.

The majority of these trees are not species of notable value and have been used in mass planting to provide screening or used for landscaping. There are however a number of trees that provide significant amenity value as outlined in Table 12-9.

The Project will involve works in proximity to a number of trees on adjacent sites that will be retained (including several scheduled trees). Construction will include works in the dripline of trees and some trees may require trimming to enable construction activities to occur. If not appropriately managed, these activities have the potential to adversely affect the health of these trees.

12.9.4 Measures to avoid, remedy and mitigate

Tree protection measures will be implemented during construction to avoid and minimise the potential effects on trees to be retained (and on nearby scheduled notable trees). These measures will be developed by an arborist. This will include details of the trees affected and the works affecting them, specific tree protection methodologies, tree transplant feasibility (where applicable), tree removal and replacement planting.

Arboricultural assessments will be undertaken prior to construction commencing to confirm the characteristics of trees and to assess if any existing trees are worthy of retention and the protection measures for amenity trees adjacent to the works. If trees are identified within the Project footprint that may potentially be retained, an arborist will be consulted in order to determine if retention is appropriate. This will include consideration of the location of the trees relative to the works, assessment of tree health and long term viability and if alternatives to retaining the trees such as tree replacement is more appropriate. If retention is determined appropriate, specific protection measures will be implemented throughout the construction works, so that tree health is not adversely affected.

The removal of trees within the construction footprint will be mitigated through the replanting that will be undertaken after construction. Urban and Landscape Design Plans will be developed as set out in *Section 13.1.4* of this AEE. These plans will include replacing significant amenity trees with replacement trees of suitable/comparable species and size.

12.9.5 Conclusion

Overall, the implementation of appropriate tree protection measures during construction will avoid and minimise adverse effects on tree health of these trees to be retained or in close proximity to the Project footprint. The replanting proposed after construction in accordance with a landscape plan will appropriately mitigate the effects of the removal of amenity trees.

12.10 Landscape and visual

Overview

The Project is largely located in an active commercial and industrial urban environment where natural features have been heavily modified in the past. There is potential for the Project to have adverse effects on the natural character of the coastal environment, on natural features including identified ONF, as well visual effects on the natural and urban landscape. However, these effects will be experienced within that highly modified commercial and industrial context.

While the Project has potential to add further to adverse effects such as visual dominance of transport infrastructure, severance of the urban area from the coast, and reclamation of Māngere Inlet, the Project also has greater potential to help reverse some of the adverse effects of historical development and to positively contribute to restoration of the landscape. In particular, the EWL provides a catalyst to help restore and rehabilitate Māngere Inlet. The Project will improve water quality, naturalise the shoreline and enhance access to and along the inlet. There will be substantial positive visual and landscape effects for the community experiencing enhanced amenity and accessibility to the coastal environment, with a focus on active transport modes and recreational outcomes taking people into, and enabling an improved experience with the coastal environment. A new coastal path will enable the public to engage with a re-naturalised landscaped shoreline. This reverses many years of the Māngere Inlet being treated as an 'industrial backyard' and will assist to rehabilitate the image and mana of the inlet. The Project will also help rehabilitate Ōtāhuhu Creek as a culturally important natural waterway.

This is the strategy that lies behind the ULDF and measures incorporated in the Project design. A number of general and specific measures are proposed to address the potential adverse landscape and visual effects resulting from the construction and also operation of the Project.

Overall, the adverse landscape and visual effects will be appropriately mitigated and there will be substantial positive effects.

12.10.1 Introduction

This section presents the findings of assessments undertaken to determine the actual and potential landscape and visual effects of the Project. This includes consideration of effects on the natural and urban landscape, natural character of the coastal environment, natural features including ONF and visual effects. It encompasses matters relating to natural and urban landscape, natural character and visual effects. This assessment is supported by *Technical Report 6: Landscape and Visual Impact Assessment* in Volume 3.

12.10.2 Assessment methodology

The assessment of landscape and visual effects uses the definition of 'landscape' contained in the *New Zealand Institute of Landscape Architects Best Practice Note 10*[70] which defines landscape as "*the cumulative expression of natural and cultural features, patterns and processes in a geographical area, including human perceptions and associations*".

Within each Project sector, effects were assessed in terms of the natural landscape, urban landscape, natural character values, and visual effects. The effects identified and assessed included:

- Effects on natural character of the coastal environment;

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[70] *Best Practice Note: Landscape Assessment and Sustainable Management 10.1*, 2010.

- Effects on biophysical landscape processes including water quality and ecological health of the inlet (relying on input from other disciplines);
- Effects on landscape features, including those identified as ONFs;
- Effects on urban form and features, including the connection between Onehunga and Manukau Harbour;
- Effects on aesthetic qualities of the landscape as a whole (such as the aesthetic qualities of Māngere Inlet, the gateway experience to Auckland on SH20);
- Visual amenity from public and private places, taking into account the places from where the works will be visible, sensitivity of audience, prominence and amenity of the Project (taking into account properties adjoining the works, and public places such as Waikaraka Cemetery, Mutukāroa-Hamlins Hill);
- Effects on landscape use and activities, including amenity of and access to the coastal edge; and
- Effects on associative factors such as historical themes (Kāretu portage, Onehunga's relationship with harbour).

Photo simulations have been prepared from key representative public viewpoints within the Project area. The photo simulations are contained as *Plan Set 13: Photo Simulations* in Volume 2.

The assessment relies on the findings of other assessments with regards to biophysical aspects including: ecology (see *Section 12.20: Ecology*); heritage (see *Section 12.7: Archaeology and built heritage*); volcanic heritage (see *Section 12.8: Geological heritage)*; and coastal processes (see *Section 12.19: Coastal processes*).

The assessment also takes into account the relevant statutory provision including the NZCPS and the AUP (OP) Decisions Version. The following AUP (OP) overlays are relevant to landscape matters in the Project area:

- Three ONF are identified in the vicinity of the EWL: "Hōpua explosion crater and tuff exposure", "Southdown pahoehoe lava flows including Anns Creek" and "Hamlins Hills sandstone ridges and rhyolitic tuff";
- Significant Ecological Areas that cover Anns Creek, the remnant lava flow outcrops adjacent to Pikes Point, and a small salt marsh area in Te Hōpua crater; and
- A volcanic cone view shaft to Maungakiekie / One Tree Hill that passes over the intersection of the Project and Galway Street.

12.10.3 Existing Environment – Issues identification

A consistent theme of the area traversed by the Project is the extent to which the natural and urban landscape had been treated as an industrial backyard and dumping ground. It is the location of such activities as refuse landfill, noxious industries, and large scale transport infrastructure. The way in which the area has been perceived and managed in recent history is markedly at odds with its importance and centrality in earlier times. Themes of that earlier landscape include:

- The strategic role of the area for the east west Kāretu and Ōtāhuhu portages, and for the north south Ōtāhuhu land bridge;
- The centrality of Māngere Inlet within a landscape encircled by volcanic features; and
- Onehunga's position as the main town and port on the Manukau Harbour.

The existing landscape and visual context for each sector is summarised below.

The natural landscape in Sector 1 revolves around Te Hōpua volcanic explosion crater and tuff ring which is a pivot between Onehunga Town Centre and Onehunga Wharf. Te Hōpua is identified as an ONF in the AUP (OP). It is relatively small and has a low tuff rim, the highest part being in the north east corner nearest Onehunga Town Centre and the lowest part in the south west corner where it was breached by the Manukau Harbour to create the former lagoon. The natural landform has been substantially buried and modified through landfill reclamation, urban development and state highway construction. This historical development has resulted in modification of the tuff ring's physical landform and reduction of its legibility. The area is characterised by industrial buildings and transport infrastructure, and poor connectivity between Onehunga and the port and harbour.

There is a distinct contrast between the fine-scale urban development pattern of Onehunga and the coarse scale of the Te Pāpapa and Southdown industrial backdrop.

Within Sector 2, the Māngere Inlet is the central element of landscape upstream of the Manukau Harbour Crossing and includes the surrounding volcanic cones and urban backdrop. The main natural landmark is the inlet itself, characterised by its channels and tidal mudflats.

The northern shoreline of Māngere Inlet was formerly an intricate and deeply indented shoreline of basalt lava flows and tidal inlets. However, the shoreline was straightened and constructed as a sea wall, and the inlets infilled with refuse and other landfill. Such activities buried all previous features of the northern shoreline except from two small distal (outer) remnants of lava flows that remain beyond the rip rap sea wall. Despite the modifications, Māngere Inlet itself is still essentially a natural feature. It is dominated by the tidal processes, and is characterised by the natural channels and shoals and such transient features as the wading birds.

With the exception of Waikaraka Cemetery, the backdrop to the shoreline has been developed for industry. Historical development reclamation of the former harbour bed, burying of the lava shoreline features, discharge of contaminants to the harbour, dominance of the character by industrial activities, and severance of Onehunga from the Māngere Inlet. The area has been degraded physically and perceptually. It could also be said that the Māngere Inlet was invested with a poor image.

There are also two small remnants of the former tidal inlets. A small remnant saltmarsh is located immediately east of Te Hōpua crater. It is confined on its landward side by the edge of a landfill and reclamation, has a sea wall on its outer edge, and is crossed by the walkway/cycleway on a structure. Miami Stream is a small remnant of the much larger inlet that formerly occupied the west side of Pikes Point. Most of the inlet was reclaimed by landfill, leaving a narrow section alongside Miami Parade.

The existing esplanade reserve and Manukau Foreshore Walkway has a somewhat isolated character, hidden away behind industrial sites. While the industrial backdrop has low amenity, the path does afford an attractive outlook over the tidal inlet to the backdrop volcanic cones of Māngere and Ōtāhuhu/Mt Richmond.

In Sector 3, Anns Creek is the last natural remnant of the Māngere Inlet northern shoreline, although it is nevertheless modified. Anns Creek was formerly part of a much more extensive swampy area that flanked the south east side of Mutukāroa-Hamlins Hill and which was part of the Kāretu portage.

Anns Creek has a subtle assemblage of natural features, including areas of pāhoehoe lava classified as an ONF, an associated distinctive vegetation community, and a salt-to-fresh water sequence. Anns Creek is also partitioned into five parts by rail causeways, is infested with weeds, and the backdrop includes a rail marshalling yard, inland port, container storage and large industry.

Sector 4 includes the prominent natural landmark of Mutukāroa-Hamlins Hill, and culturally important former route of the Kāretu portage. The area is otherwise characterised by industrial activities, transport infrastructure and high voltage transmission line.

EWL will skirt the toe of Mutukāroa-Hamlins Hill and trace part of the historical Kāretu portage that formerly extended from the head of Anns Creek. The portage was via the swampy ground between Anns Creek and Kāretu, an inlet on the Tāmaki River. It will share a corridor with Sylvia Park Road, KiwiRail (Eastern Line), and the Ōtāhuhu-Onehunga transmission line.

Mutukāroa-Hamlins Hill is a prominent landmark rising above the surrounding urban development and encircled by key transport routes. It has cultural history associated with its former occupation as a settlement overlooking the Kāretu portage. The wide views from the summit ridge in particular include a view down the Māngere Inlet in the direction of the Manukau Heads. There has been some encroachment onto the flanks of the hill such as the South East Arterial along the north east side of the hill and the Pacific Rise office park in the south east corner.

Sector 5 comprises the existing SH1 corridor between Tip Top corner and the Princes Street Interchange. The land adjoining the corridor is partly industrial and largely residential.

In Sector 5, Ōtāhuhu Creek is the significant natural landscape feature. It is a main tributary of the Tāmaki River and culturally important as part of the Ōtāhuhu portage. Prior to Pākehā settlement, the Ōtāhuhu isthmus held the portages linking the Tāmaki River/Waitematā and the Manukau. At a broader context, the isthmus held the water-borne route between Northland and Waikato. Currently the creek is constricted by the existing SH1 causeway, incidental spoil dumped on the creek margins, and weeds which infest the banks. The Ōtāhuhu Creek in the vicinity of the Project has low-moderate natural character.

SH1 is flanked by housing on both sides. In some instances houses are quite close to the state highway. An exception is industrial uses adjacent to SH1 just south of the Ōtāhuhu Creek crossing.

Figure 12-14: View of remnant lava flows at Pikes Point

Figure 12-15: Anns Creek coastal edge

A number of landscape features in the Project area have been identified as having cultural significance; these are outlined in further detail in *Section 12.6: Effects on values of importance to Mana Whenua* of this AEE.

Historical associations with the landscape have been informed by *Technical Report 2: Built Heritage* and *Technical Report 3: Archaeological Assessment* in Volume 3, as well as *Technical Report 4: Geological Heritage Assessment* in Volume 3. Three areas that particularly contribute to landscape values within the Project area from a historical associations perspective are:

- Onehunga Wharf and surroundings;
- Aotea Sea Scouts Hall; and
- Waikaraka Cemetery and its surrounds.

12.10.4 Assessment of construction related landscape and visual effects

Construction of the Project will result in additional temporary adverse landscape and visual effects. Across the Project these effects are:

- In Sector 1, visual effects of the Project will be amplified during construction works. However, such works will be temporary in nature, and will take place within existing transport corridors where one might anticipate periodic highway construction;
- In Sector 2, there will be substantial disruption to the northern shoreline of Māngere Inlet during construction, and amplified adverse visual effects for Waikaraka Cemetery in particular. Such works will be temporary in nature, and will be outweighed by the subsequent enhancement of visual amenity, natural character and shoreline access following completion of the Project;
- In Sector 3, there will also be amplified adverse visual effects during construction, and temporary closure of the existing path. Such effects will be temporary in nature, and will occur against an industrial backdrop in a modified setting, and will be offset by enhancements to the shoreline path following completion of EWL;
- Sector 4, there will also be some adverse visual effects arising from construction activities, but these will be temporary, and will take place in the context of a landscape dominated by transport infrastructure and surrounding industrial and commercial properties; and
- Sector 5, the adverse visual effects will be amplified during construction, particular with respect of adjoining residential properties and on the immediate surroundings at Ōtāhuhu Creek. Such works will be temporary in nature, will take place in the context of an existing motorway, and will be offset by the enhancements once the Project is completed.

12.10.5 Assessment of landscape and visual effects

Effects are assessed for each of the Project sectors in the sections below. Measures to avoid, remedy or mitigate adverse effects are discussed within each sector. Such measures also fall under the umbrella of the ULDF (contained in Volume 4) and it should be read in conjunction with this assessment.

12.10.6 Sector 1 - Neilson Street Interchange and Galway Street connections

The main natural and urban landscape issues in Sector 1 are:

- Effects on Te Hōpua volcanic landform – its physical form, aesthetic values and legibility;
- Effects on connections between Onehunga Town Centre and Onehunga Wharf; and
- Visual effects of the EWL – particularly the Neilson Street Interchange overbridge and the Galway Street intersection.

The Te Hopua volcanic landform in Sector 1 has been substantially buried and modified through landfill reclamation, urban development and State highway construction. This historical development has resulted in modification of the tuff ring's physical landform and reduction of its legibility. The area is characterised by industrial buildings and transport infrastructure, and poor connectivity between Onehunga and the port and harbour.

The Project will reduce the legibility of Te Hōpua volcanic landform because of the increase in the number of traffic lanes encircling the outside perimeter of the crater and the construction of a new overbridge outside the north-west corner of the crater. The works will also accentuate the existing perception of the area as a transport interchange, reduce its visual amenity, and increase the visual barrier between Onehunga Town Centre and Onehunga Wharf. There will be a moderate degree of potential adverse effect compared to the existing situation.

12.10.6.1 Natural landscape

Potential effects in Sector 1 include physical damage of the Te Hōpua landform and effects on its legibility. There will be little physical damage of intact elements of the volcanic landform. The works will, however, further reduce the feature's legibility by:

- The increase in complexity of roading around the landscape feature;
- Interrupting the visual relationship between the crater/former lagoon and the Manukau Harbour with new approach ramps to the Neilson Street Interchange overbridge; and
- The Neilson Street Interchange overbridge will visually dominate a small section of tuff ring.

However, to put these effects into perspective, the volcanic landform already has low legibility and the works will mostly take place on areas that are already substantially modified.

The effect of the Project on the legibility or aesthetic value of Te Hōpua will therefore be only moderate.

12.10.6.2 Te Hōpua ONF landscape values

Te Hōpua has been identified as an ONF in the AUP (OP). The reasons for its classification are listed in Appendix 3.1 of the AUP (OP) and are the extent to which it:

(a) *Contributes to the understanding of geology of the region;*

(d) *Is a component of a recognisable group of geologically associated features;*

(e) *Contributes to the aesthetic value or visual legibility of the wider natural landscape;*

(g) *Has potential value for public education; and*

(h) *Has potential to provide additional understanding of Auckland's geology.*

Despite this classification, the previous modifications to Te Hōpua have reduced its naturalness as an ONF.

While the Project will encroach into the mapped ONF, the works will occur where the landform has been previously modified. The assessment of effects on geological heritage in *Section 12.8: Geological heritage* concludes that any effects on the subdued topographic feature in the northwest corner of the tuff crater will have only negligible effects.

Consideration of the extent of effects on the aesthetic value and visual legibility of the wider natural landscape with respect of the ONF needs to have regard to: the previous modifications; the dominant presence of development; and that Te Hōpua is not visually prominent and has low legibility. Taking these factors into account, the Project will have only moderate effects on the aesthetic value and visual legibility of the wider natural landscape with respect of the mapped ONF.

12.10.6.3 Natural character

The Project will add to the existing clutter of infrastructure around Te Hōpua and reduce its legibility as a former coastal landform. However, this part of the coastal environment is already characterised by infrastructure and other urban features. The works will mostly take place on land that has already been modified by earlier works.

The works will also remove an area of glasswort meadow in the vicinity of the Galway Street intersection. This is addressed in *Section 12.20: Ecology*. In terms of natural appearance, this area is small and dominated by a substantially modified shoreline and backdrop of industrial and transport infrastructure.

Any further reduction in natural character as a result of the Project will be small.

12.10.6.4 Urban landscape

Te Hōpua has always separated Onehunga Town Centre from its port. The Project will add a further physical and visual barrier between Onehunga Town Centre, the port and the Old Māngere Bridge.

Without mitigation, the degree of effect would be moderate relative to what are already poor connections. Measures to remedy and mitigate this situation that have been incorporated into the design of the Project include:

- Removing most of the heavy traffic that currently dominates the route between Onehunga and the Onehunga Wharf which will improve the amenity of this connection and provide opportunities for street upgrade works;
- Street upgrade works on both Onehunga Harbour Road and Onehunga Mall. The local overhead powerlines (distribution lines) along this section of Onehunga Harbour Road and Onehunga Mall are to be placed underground;
- A bridge will connect Onehunga Harbour Road with the Onehunga Wharf in the vicinity of The Landing. At this location the EWL is in trench so that the visual and physical connection will be re-established;
- The existing pedestrian and cycle bridge crossing over Onehunga Harbour Road will be replaced on the alignment of Old Māngere Bridge; and
- There will be improvements in the connectivity between Old Māngere Bridge and the proposed new coastal path to the east along the shore of Māngere Inlet, and to the west along Orpheus Drive which will no longer be part of an on-ramp to SH20.

While EWL will introduce a further visual severance between Onehunga and the harbour, such adverse effects will be offset by the positive effects of the improved physical connection to the Onehunga Wharf area and the adjacent cycle / pedestrian paths, and the streetscape enhancements.

The Aotea Sea Scouts Hall occupies an unusual location on what was formerly a spit between the crater lagoon and the sea. The Project will have both adverse and positive impacts on its setting and amenity. Adverse effects will arise because the approach ramps to the Neilson Street Interchange overbridge will be constructed east of the hall, with a slip lane and Orpheus Drive between the ramps and the hall. The ramp will be faced with an approximately 5m high retaining wall. The proposed on-ramp will be a more dominant structure increasing existing severance. However, Orpheus Drive access to the Aotea Sea Scouts hall will be much quieter than at present. To put the visual amenity effects in perspective, the eastern outlook from the Aotea Sea Scouts Hall is already affected by the existing State highway, and the hall's primary western outlook to the Manukau Harbour will not be affected.

12.10.6.5 Visual effects

The Project will increase the extent to which the area is dominated by state highway and road infrastructure. The most prominent elements will be the new Neilson Street Interchange overbridge, the Galway Street intersection, and the highway works around the outside perimeter of Te Hōpua tuff ring.

There are both positive and negative effects as a result of the Project on people within the vicinity of the Project.

For travellers on SH20, the EWL and connecting roads, the new interchange and associated roads around Te Hōpua will be in keeping with general expectations for such urban roads and State highway interchanges. However, the Project will increase the dominance of this node by highway works and detract somewhat from the composite views.

For pedestrians and cyclists, the Onehunga Wharf area is a node for walking and cycling routes. The Project will add to the visual dominance of traffic and roading already generated by the existing SH20 and Onehunga Harbour Road. Certain routes will however be improved by the removal of heavy traffic from local roads.

For the occupants of nearby buildings the outlook from buildings overlooking Te Hōpua crater is already dominated by foreground motorway. EWL will not fundamentally change, but will intensify, this character. Such effects will be in the context of an outlook dominated by industrial development, and will be offset to an extent by the removal of the existing heavy traffic from the immediately adjacent local roads.

For the Aotea Sea Scouts Hall, the approaches to the Neilson Street Interchange overbridge and slip lane will detract from the hall's visual amenity. Nevertheless, to put such effects in perspective, users of the Aotea Sea Scouts Hall are transitory, the eastern outlook is already affected by the existing State highway, and the hall's primary western outlook to the Manukau Harbour will not be affected.

For users of the Taumanu-Onehunga Foreshore and Manukau Cruising Club, the Neilson Street Interchange will become part of the outlook from parts of Taumanu-Onehunga Foreshore however, it will be relatively distant and will be viewed in the context of existing state highway.

12.10.6.6 Volcanic view shaft

The Galway Street intersection falls beneath a view shaft to One Tree Hill (O11), originating from SH20 at the Manukau Harbour Crossing. However, the view shaft contours in the vicinity are well above the height of the intersection and will not be affected by the Project.

12.10.6.7 Measures to mitigate potential adverse effects for Sector 1

In addition to the Project's design principles, mitigation measures and improvements proposed for this sector include:

- Streetscape works to improve the Onehunga Harbour Road vehicle connection between Onehunga Town Centre and the wharf, taking advantage of the substantial reduction in heavy traffic that will occur on this road;
- Locating the EWL in a trench adjacent to the Onehunga Wharf, and bridging the trench to connect with the Onehunga Harbour Road and with Orpheus Drive to the west;
- Streetscape works to highlight the pedestrian/cycle route between Onehunga Town Centre and Onehunga Wharf, tracing the crater rim on the west side of Onehunga Mall;
- Reinstatement of the cycle and pedestrian bridge connecting Onehunga Mall with Old Māngere Bridge (or its replacement bridge), which will connect also with the new coastal path along Māngere Inlet; and
- Providing the opportunity for an artwork encircling the crater to highlight its form and presence and restore some of the legibility that has been lost historically.

With the implementation of these measures, there will be a small improvement in connectivity between Onehunga and the Onehunga Wharf Area compared to the existing situation, and the artwork will restore some of the legibility of the landform and contribute to the aesthetic quality of the node.

12.10.7 Sector 2 – Foreshore works along Māngere Inlet foreshore including dredging

The main landscape and urban design issues in Sector 2 are:

- Effects on the inter-tidal mud-flats and remnant lava reefs along the northern shoreline;
- Effects on the natural character of Māngere Inlet;
- Visual effects of the Main Alignment; and
- Effects on connections between Onehunga and Māngere Inlet.

There will be both adverse and positive effects on Māngere Inlet. On the one hand, there will be adverse effects as a consequence of reclamation of the tidal mudflats, potential adverse effects of a road adjacent to the shoreline and the perception of EWL as a barrier between the land and Māngere Inlet. On the other hand, there will be positive effects from naturalising the shoreline, improving the quality of water discharges from the inland catchments, improving access to and along the shore, improving connections between Onehunga and the Māngere Inlet, and improving the image and mana of the inlet.

The balance of landscape, visual and natural character effects for Sector 2 will be substantially positive. EWL will provide the opportunity to help restore and rehabilitate Māngere Inlet. It will provide a positive frontage to the Inlet in response to many years of it having been neglected and poorly treated.

12.10.7.1 Natural landscape

The Project is to be constructed on embankment that straddles this shoreline, partly on land and partly in the CMA. The road will higher than the typical existing ground level. The road will accentuate the straight shoreline and form a barrier between the land and Māngere Inlet.

The Project incorporates naturalising the shoreline on the seaward side of the EWL to improve natural character and public connection with Māngere Inlet. A local precedent for such naturalisation is the Onehunga Foreshore Restoration Project completed in 2015.

The proposed works comprise two major landforms to echo the original shoreline, and to be in scale with Māngere Inlet as a whole. The landforms will comprise peninsulas faced in basalt rock designed to echo fingers of lava, pebble and shell banks (beaches), and marshland contained behind the pebble banks and peninsulas. The constructed landforms will restore a more natural appearance to the shoreline and rehabilitate the existing straight line sea wall, echoing the original pattern of lava flows and inlets. A coastal path will connect the landforms by means of a boardwalk which will provide a closer connection with the Māngere Inlet shoreline compared to the existing situation. The mangroves that will establish on the inland side of the boardwalk will soften the appearance of the road embankment.

The remnant lava flows at Pikes Point and opposite the end of Victoria Street are incorporated within the re-naturalised shoreline thereby giving them a more realistic looking context. The design will help embed the road behind the landforms.

The wetlands and biofiltration beds within the headlands will treat stormwater from the road and the Onehunga-Penrose Catchment. The intent is that the wetlands appear part of transitional shoreline features rather than typical land-based stormwater ponds. It is considered that naturalisation of the shoreline requires landforms of sufficient size to suit the scale of Māngere Inlet as a whole. The wetlands will contribute to that visual scale while fulfilling a water quality function.

The eastern landform contains two ‘headlands’ and a pebble-and-shell bank that will not have access from the walkway so as to provide some separation to improve the habitat value for seabirds.

The design approach to restoring Māngere Inlet was developed at the instigation of, and in consultation with, the Mana Whenua group. Hui held during the design process highlighted Mana Whenua’s view that the Māngere Inlet is currently in a poor state. Principles identified including restoring respect to the inlet and harbour, restoring water quality by treating stormwater to the highest practicable level, restoring habitat for species inhabiting the inlet, and allowing for people to connect with the inlet. At the same time, there is a desire to balance these outcomes with minimisation of reclamation.

The following design techniques have been used to maximise naturalisation of the shoreline while minimising the potential reclamation footprint, enhancing public access to the shoreline and aiding in restoring the mana of the Māngere Inlet:

- Limiting reclamation to separate landforms rather than a continuous reclamation seaward of the road embankment, and using boardwalks to connect the landforms into a park;
- Aligning the landforms perpendicular to the road to maximise the shoreline width relative to footprint;

- Detailing the shoreline to maximise features within the inter-tidal zone;
- Use of a combination of wetland and biofiltration beds to reduce the potential footprint for stormwater treatment;
- Using innovative techniques, such as internal timber baffles, to reduce footprint and increase the impression of the wetlands as continuous estuarine marshland.

12.10.7.2 Natural character

There is overlap between landscape and natural character matters in this sector, and, as with the former, there will be both adverse and positive effects on natural character.

On the one hand, there will be adverse biophysical effects because of the reduction of tidal mud flats, the subsequent reduction in foraging habitat for wading birds, and changes in natural coastal processes. On the other hand, there will be some biophysical benefits resulting from the improved quality of water discharged to the inlet and some offset measures incorporated in the design such as roosts and pebble/shell banks. At the same time, the shoreline will have a more natural appearance and will enable a more natural experience of Māngere Inlet.

There will be a mix of adverse and positive effects on biophysical aspects of natural character, and perceptions of natural character will be enhanced. Taking these matters together, it is considered that the Project will go some way to restoring natural character.

12.10.7.3 Urban landscape

Onehunga currently has only a weak connection with Māngere Inlet. The inlet is largely 'walled-off' behind industrial properties, access is limited to the end of a handful of no-exit roads, and the existing coastal walkway is somewhat isolated. While Waikaraka Cemetery does have a frontage to the inlet, it is inward focused with views partly blocked by a row of pōhutukawa trees.

The Project could potentially form an additional barrier between Onehunga and Māngere Inlet. However, it is considered it will strengthen connections in the following ways:

- EWL will provide a frontage making Māngere Inlet more visible and 'front of mind';
- IN this area EWL will have a markedly distinct character from the eastern parts of the route in recognition of the Inlet frontage. This can be achieved with design elements such as:
    - Operational speed environment in keeping with an urban arterial;
    - Alternate median treatment, planting street trees and installing high quality custom street furniture;
    - Wide promenade footpath and contrasting road and footpath surface materials;
    - Improving pedestrian and cycleway connections; and
    - City street light standards.
- The re-naturalised shoreline and coastal path will similarly create a positive frontage to the Māngere Inlet and enhance public connection to the inlet;
- The Project will complete the southern part of Onehunga's street grid by tying together three cul-de-sacs; and
- The Project will provide a choice of path along the Māngere Inlet. The road-side path will provide slightly more elevated views over the Inlet, as well as surveillance of the shoreline path.

12.10.7.4 Visual effects

There are both positive and negative effects as a result of the Project on people within the vicinity of the Project.

Travellers on the Main Alignment will constitute a new audience for views of Māngere Inlet. While the road itself will be in keeping with likely expectations for a major urban arterial, and the industrial backdrop on the inland side has relatively low amenity, the Main Alignment will nevertheless provide a high amenity outlook over Māngere Inlet to the backdrop volcanic cones.

There will be both adverse and positive effects on views across the Māngere Inlet. On the one hand, the Project will introduce a busy arterial road along the northern shoreline. However, to put this in perspective, the shoreline is currently characterised by a rip-rap sea wall, a thin band of vegetation and a backdrop of industrial properties. On the other hand, the proposed mitigation works will create a more naturalistic appearance, particularly for the elevated views from the Manukau Harbour Crossing. On balance, it is considered the views across Māngere Inlet will be enhanced.

For users of the coastal path, while the new coastal path will be affected by the presence of traffic, it will nevertheless have a higher amenity, be closer to the water and engage with a greater variety of landform and shoreline features and likely attract more users due to the improved visibility of the coastal path.

At the Waikaraka Cemetery, the Project will open a frontage to the cemetery and also to the sports fields planned by Auckland Council on the triangular area east of the cemetery. The Project will detract from the current secluded and relatively quiet atmosphere however, such effects will be softened by the retention of the existing stone wall and row of pōhutukawa along the boundary.

For adjacent industrial properties the effects on the visual amenity of adjacent industrial properties are not considered to be of any significance because the area does not have high visual amenity.

12.10.7.5 Measures to mitigate potential adverse effects for Sector 2

In addition to the Project's design principles, mitigation measures and improvements proposed for this sector include:

- Tying the cul-de-sacs into a completed street grid with a frontage to Māngere Inlet, and designing the road to convey a positive urban character;
- Naturalising the northern shoreline with landforms and inlets echoing the original shoreline features;
- Incorporating wetlands to treat stormwater from the industrial catchments, improving water quality in the inlet;
- Providing a coastal path to enable public access and appreciation of the naturalised shoreline;
- Incorporating elements to mitigate ecological effects including offshore roosts and areas of naturalistic shoreline with no public access; and
- Incorporating design measures to ensure an urban arterial character.

The proposed mitigation works combined with the design techniques discussed above will help to:

- Rehabilitate the natural appearance of Māngere Inlet;
- Rehabilitate the physical qualities of the Inlet;
- Soften the appearance of the Project and recognise the Inlet frontage;
- Enhance public access to and connection with the Inlet; and
- Help restore the mana of Māngere Inlet.

12.10.8 Sector 3 – Anns Creek from the end of the reclamation to Great South Road

The main landscape and urban design issues for Sector 3 are:

- Effects on remnant aspects of the natural landscape including the fresh-to-salt water sequence in Anns Creek, the lava field along the northern shore, and the associated vegetation;
- Effects on parts of the lava field classified as an outstanding natural feature; and
- Visual effects of the viaduct structure across Anns Creek and Great South Road.

The potential effects on biophysical aspects of the landscape in Anns Creek are significant because of the significance of the lava features and associated rare plant communities that include endangered plant species.

There will be some adverse effects on more general aesthetic aspects of landscape and natural character because of the scale of the viaduct and its alignment across parts of Anns Creek and Great South Road. While it will be prominent from a number of locations, it will nevertheless be in context with the industrial backdrop and with the modified nature of Anns Creek itself.

Measures to mitigate adverse effects include restoring the vegetation communities within Anns Creek, interpreting such natural features, recognising the Kāretu portage, improving avifauna habitat in adjacent parts of Māngere Inlet, and propagating the vegetation communities and endangered species to the new landforms in Māngere Inlet.

12.10.8.1 Natural landscape

Anns Creek is the only remnant of the inlets on the northern shore of Māngere Inlet. In contrast to Sector 2, Anns Creek is characterised by an intricate shoreline. In places the lava has a pāhoehoe surface, a smooth but rucked up appearance that evokes the fluid nature of hot lava. The vegetation associated with the lava is a distinctive shrubland and herb field that is a unique community containing rare and threatened plant species. Anns Creek itself contains a sequence between mudflats, mangrove forest, salt marsh, and brackish wetland. It is the remnant of an ecotone that would once have extended to a freshwater marshland around the toe of Mutukāroa-Hamlins Hill.

Although EWL is mostly on structure across this area, there is potential for piers and construction to damage the significant lava features and mosaic of vegetation communities (both terrestrial and estuarine). There is also potential for some indirect rain-shadow or shading effects on vegetation. The extent to which such effects are avoided will depend on the precise location of piers and the detailed construction methodology. This is discussed further in *Section 12.20: Ecology*.

In terms of aesthetic aspects, the viaduct and the Great South Road intersection will be prominent structures and will add to the industrial character of the area. To put this in perspective, the landscape is currently dominated by an industrial backdrop that includes containers often stacked higher than the proposed viaduct, an expansive rail marshalling yard, a power station, and an electricity transmission line. Anns Creek itself is partitioned into five parts by railway causeways.

The Anns Creek viaduct and its continuation over Great South Road will add to the industrial backdrop of what is already a substantially modified corner of Māngere Inlet.

12.10.8.2 Natural character

Within Sector 3 there is an overlap between effects on the natural landscape discussed above and effects on natural character. In summary, there will be potential adverse effects on biophysical aspects of natural character including the significant lava features, the associated lava-field vegetation community with endangered plant species, and the saltwater to freshwater communities.

In addition to potential adverse effects on lava features and vegetation communities, the EWL viaduct will also detract from the overall natural appearance of the area, although such effects will take place against the existing context of a substantially modified landscape with an industrial backdrop.

The Project design has been to avoid as far as practicable any adverse effects on the lava features and associated community. The remaining effects on the natural landscape and natural character will be mitigated by rehabilitating parts of Anns Creek itself. Such mitigation includes:

- A restoration programme that addresses the whole of the creek between Great South Road and the open Māngere Inlet including removal of weeds and dumped spoil (where practicable), and restoring indigenous vegetation;
- Restoring the top of Anns Creek immediately adjacent to Great South Road;
- Recreating similar conditions and propagating the lava-field vegetation community and endangered plant species to the new landforms in Māngere Inlet; and
- Interpreting the lava features, the associated plant communities, and the cultural significance of the Kāretu Portage.

12.10.8.3 Effects on ONF lava features at Anns Creek

Several areas of lava at Anns Creek are classified and mapped in the AUP (OP) as an ONF. The reasons for its classification are listed in Appendix 3.1 of the AUP (OP) and are the extent to which they:

"(a) Contribute to the understanding of Auckland's geology;

(c) Are outstanding representative examples of the diversity of landform and geological features of Auckland;

(d) Are part of a recognisable group of geologically associated features;

(g) Have potential value for public education; and

(i) The state of preservation of the feature."

There is also a distinctive assemblage of plants (ferns, herbs and shrubs) growing in conjunction with the lava including some rare and endangered species as discussed in *Section 12.20: Ecology*. The lava features are not classified for aesthetic or other landscape reasons, although they are distinctive and interesting.

The viaduct and Great South Road intersection piers construction work will largely avoid these features, although there will still be some adverse effects on the plant species below the proposed structures.

12.10.8.4 Urban landscape

The Project will have little adverse effect on the urban landscape in this sector. The road will be in keeping with the character of adjacent transport and industrial activities. While the Project will have some disruption on the industrial properties traversed, such disruption will be minimised by traversing properties on structure. At the same time, the Project will have positive effects by creating a more interconnected street network, connecting Onehunga Town Centre and the industrial areas with the intersection of Great South Road and Sylvia Park Road and tying in the cul-de-sac end of Hugo Johnston Drive.

12.10.8.5 Visual effects

Travellers on the EWL will constitute a new audience. The road will provide wide views because of its elevation, such views will include the industrial landscape, Māngere Inlet and Mutukāroa-Hamlins Hill.

For travellers on the Great South Road and KiwiRail lines the Project will be a prominent feature in views from the railway line and Great South Road. The grade separated Great South Road intersection will potentially affect views of Mutukāroa-Hamlins Hill for this audience. However, it will be seen in context with the surrounding industrial character and is balanced by new views of Mutukāroa-Hamlins Hill from EWL.

For views across Māngere Inlet, the length of the viaduct will amplify the visibility and prominence of the EWL in such views. Nevertheless, the viaduct will be reasonably distant in views from across Māngere Inlet and will be seen in the context of the industrial backdrop, and will appear much lower than the backdrop of Mutukāroa-Hamlins Hill.

From Mutukāroa-Hamlins Hill, the Project will be one element of an expansive industrial landscape spread out below the hill.

For adjacent industrial properties the EWL will appear as a dominant feature, however effects on the visual amenity of adjacent industrial properties are not considered to be of any significance as the area does not have high visual amenity even compared to some other industrial areas.

Users of the coastal path that traces the shoreline of Anns Creek are the group of people most adversely affected in this sector. The new Main Alignment viaduct will cross the existing coastal path twice and will otherwise be a prominent backdrop to people using the path. While the effects will be moderately high, they will also be in the context of an existing industrial backdrop to this area. On the other hand, EWL will usefully extend the path to the east.

12.10.8.6 Measures to mitigate potential adverse effects for Sector 3

In addition to the Project's design principles, mitigation measures and improvements proposed for this sector include:

- Restoring the natural plant communities through removal of weeds and dumped spoil, enrichment planting, and pest control;
- Recreating similar conditions and propagating the lava-field vegetation community and endangered plants to the new landforms in Māngere Inlet;
- Interpreting and highlighting the significance of the lava and vegetation community from the coastal path and from the bridge overlooking the east Anns Creek area;
- An elevated shared path (the 'Kāretu portage shared path') to recognise the Kāretu Portage and to reduce the visual prominence of EWL;
- Connecting the east west pedestrian and cycle path to Great South Road and beyond (currently the path terminates at Hugo Johnston Drive);
- Improving the avifauna habitat in adjacent Māngere Inlet to support Anns Creek; and
- Softening the appearance of the Project to ensure its appearance is akin to an arterial road through design measures such as high quality street furniture, street trees, improved pedestrian and cycle connections, and signage.

12.10.9 Sector 4 Great South Road to SH1 at Mt Wellington

The main landscape and urban design issues are:

- Visual effects of the viaduct and ramps - including any impacts on views to landmarks: including Mutukāroa- Hamlins Hill;
- Visual effects for adjacent industrial and commercial properties; and
- Visual effects on Mutukāroa-Hamlins Hill.

The new Mt Wellington ramps will have some moderate adverse visual effects for passers-by on SH1 and surrounding roads, and for occupants of nearby industrial buildings. However, such effects will take place in the context of a landscape already dominated by transport infrastructure and industrial land uses.

There will only be slight adverse effects on Mutukāroa-Hamlins Hill. Rather, the hill's role as a landmark at the centre of transport routes will be accentuated.

Positive effects in this sector include:

- Improving connectivity for cyclists and pedestrians by the proposed elevated shared path where EWL is on structure between Māngere Inlet and 19 Sylvia Park Road and connecting through to Sylvia Park town centre;
- Improving connectivity and legibility of the road network through a new intersection at the corner of Great South Road, Sylvia Park Road and the Main Alignment along Māngere Inlet; and
- Recognition of the Kāretu Portage.

Overall the adverse and positive landscape and visual effects will be balanced in this sector.

12.10.9.1 Natural landscape

There will be few adverse effects on the natural landscape. The Project does not encroach onto Mutukāroa-Hamlins Hill which is the only significant natural feature in the vicinity. A small basalt cut face at Tip Top corner will be lost but, while it is a feature of interest because it expresses the underlying geology, the cutting itself is not natural.

12.10.9.2 Urban landscape

Changes to the urban landscape will consist of:

- A strip of industrial properties sandwiched between Sylvia Park Road and the railway line is to be removed to accommodate the widened road;
- The Great South Road intersection will become a more significant node which will have some positive effects on connectivity and urban form legibility;
- There will be connectivity and visual amenity benefits from the elevated shared path; and
- The overhead local power distribution lines along Sylvia Park Road will be undergrounded which will have a small positive effect on visual amenity.

12.10.9.3 Visual effects

The Sylvia Park Ramps will be prominent structures for travellers on both SH1 and the EWL. At present the Tip Top building is a waymark associated with a bend in SH1. For southbound SH1 travellers, the southbound EWL ramp will partially obstruct views of the Tip Top building from a section of SH1. For northbound SH1 travellers, the EWL southbound ramp over SH1 will have a small impact on views of Mutukāroa-Hamlins Hill. At the same time, the northbound ramp will open up new views of Mutukāroa-Hamlins Hill for travellers moving from SH1 west onto the EWL.

The existing Transpower 220kV HEN-OTA A transmission line will also be modified by Transpower to accommodate the ramps between EWL and SH1. The design to date involves replacing the lattice tower located on the boundary of 6 and 8 Monahan Road (opposite the Tip Top building) with a pole structure of similar height (around 54m) in an immediately adjacent location. The lattice tower located adjacent to the Turners & Growers site, is to be replaced by twin poles also approximately 54m high adjacent to the existing tower. These twin poles will be located between the north and south-bound EWL-SH1 ramps. New twin poles will be built on the north side of the ramps in order to lift the transmission line above the ramps. The new twin poles will be approximately 52m high and located in the triangle between the railway line, the Mt Wellington Highway, and SH1. The transmission lines will add to the visual clutter of an area already dominated by infrastructure. The additional height and clutter will be offset to some extent by the use of poles, which are generally regarded as being more attractive than conventional lattice towers.

For the rail lines and local road network the Project will increase the extent to which the area is dominated by transport infrastructure. The scale and character of Sylvia Park Road will change, and the Eastern Rail Line and Mt Wellington Highway will be crossed by additional overbridges. While it will add another layer, the interchange will be seen in the context of what is already a complex array of arterial roads, railway line, SH1, and transmission line.

The Great South Road intersection will also increase the prominence of EWL for users of the local roads and railway. However EWL will be seen in conjunction with a complex array of existing infrastructure.

For people using Mutukāroa-Hamlins Hill, the clearest views of EWL will be from knolls at the southern end of Mutukāroa-Hamlins Hill. The Sylvia Park Ramps in particular will be prominent structures in such an outlook. Nevertheless, the Project will be part of a middle-ground landscape already characterised by infrastructure and a matrix of industrial buildings. Therefore, there will be no effects of any significance on the visual amenity of Mutukāroa-Hamlins Hill.

Users of the new pedestrian/ cycle path will constitute a new audience. The proposed elevated shared path will add considerably to the interest and amenity of the path for users and will also mitigate views of EWL from the south.

For adjacent properties, potentially the most visually affected properties include those on both sides of SH1 including at Pacific Rise.

12.10.9.4 Effects on Mutukāroa-Hamlins Hill ONF

Those parts of Mutukāroa-Hamlins Hill that fall within the reserve boundaries are mapped as an ONF in the AUP (OP) decisions version. Reasons for which it is classified as an ONF are the extent to which the hill:

a) *Contributes to the understanding of Auckland's geology;*

b) *Is rare or unusual;*

c) *Is an outstanding representative example of the diversity of landform and geological features of Auckland;*

d) *Contributes to the aesthetic value or visual legibility of the wider natural landscape;*

e) *Has community associations or public appreciation;*

f) *Has potential value for public education;*

g) *Has potential to add to the understanding of Auckland's geological and biological history; and*

h) *The state of preservation of the feature.*

The AUP (OP) describes Mutukāroa-Hamlins Hill as a rare, unmodified example of the Waitematā sandstone ridges that underpin much of Auckland, and that it also contains the best example of a rhyolitic tuff deposit in Auckland.

The Project will not physically encroach onto Mutukāroa-Hamlins Hill, and will have minimal adverse effects on its landscape qualities. The hill's role as a landmark surrounded by transport routes will be accentuated. Whilst the EWL will affect views of Mutukāroa-Hamlins Hill from Great South Road these will be balanced by views for road users created by EWL.

For completeness it is also noted that Project will not affect the volcanic viewshaft from SH1 to Maungakiekie/One Tree Hill, which originates north of the Project and is oriented in the opposite direction.

12.10.9.5 Measures to mitigate potential adverse effects for Sector 4

The mitigation measures proposed for Sector 4 are set out in the ULDF and include:

- Connecting the east west walkway/cycleway to connect with the Sylvia Park Town Centre;
- Recognise the former Kāretu portage that was aligned along this route; and
- An elevated shared path (the Kāretu portage shared path) to recognise the cultural significance of the portage and reduce the visual prominence of EWL.

12.10.10 Sector 5: SH1 at Mt Wellington to the Princes Street Interchange

The main landscape and urban design issues are:

- Effects on the natural and cultural value of Ōtāhuhu Creek;
- Visual effects for travellers on SH1, particularly arising from the removal of vegetation and installation of noise walls; and
- Visual effects for adjoining properties.

Ōtāhuhu Creek is the significant landscape feature in Sector 5, being a main tributary of the Tāmaki River and culturally important as part of the Ōtāhuhu portage. The proposed works will have substantial positive effects by opening up the creek corridor, both physically and visually, and by restoring its image and mana.

There are potential adverse visual amenity effects for adjoining residential properties resulting from reduced separation from SH1, loss of the green buffer, installation of noise walls, and encroachment into properties. However, while noise walls have adverse visual effects in themselves, at the same time they will screen SH1 and reduce noise. There will be a potential reduction in amenity for travellers on SH1 because of the replacement of the existing green buffer with a hard-edged boundary of noise walls.

Proposed mitigation of visual aspects includes re-establishing vegetation in the SH1 corridor in front of the noise walls, and offering planting within affected properties on the opposite side of the noise walls. The combination of such vegetation will soften the appearance of the walls, reduce the potential for graffiti, and re-establish something of a green buffer on either side of the corridor.

12.10.10.1 Natural landscape

The only significant natural feature is Ōtāhuhu Creek, a tidal arm of the Tāmaki River important because it is also part of the historic Ōtāhuhu portage. The creek is constricted by the existing causeway and culvert of SH1. As a consequence, there is no longer an open channel along the creek. Rather, the creek upstream of SH1 is choked by mangroves. Ōtāhuhu Creek is also visually constricted by weed vegetation on the banks.

While the proposed EWL works include widening SH1 by one lane in each direction, at the same time it will remove the causeway and replace it with a bridge. An additional bridge to take temporary traffic diversions during construction is also to be retained on the east side of SH1 to provide a new pedestrian and cycle connection.

The landscape strategy is to restore Ōtāhuhu Creek as a physically and visually open waterway. The proposed works will have substantial positive effects by opening up the creek corridor (physically and visually), and restoring natural character. They will help restore the natural landscape of the Ōtāhuhu Creek in line with its cultural significance, and will increase the creek's visual presence as a waymark from SH1.

12.10.10.2 Natural character

The only location in which natural character effects arise is at Ōtāhuhu Creek. These matters overlap with natural landscape matters discussed above.

EWL will have positive effects on physical aspects of natural character because of the replacement of box culverts with a bridge, removal of incidental reclamation adjacent to SH1, and removal of weed species from the creek banks in vicinity of SH1. The opening up of the waterway and removal of weed vegetation that currently blocks views will also have some positive effects on the appearance of natural character.

12.10.10.3 Urban landscape

Works will be confined to the margins of SH1 and therefore effects on the urban landscape will be largely confined to effects on adjacent properties.

Within this sector, the main urban landscape matter is the reconfiguration of the Princes Street Interchange. While the works will not fundamentally change the existing situation, there will be connectivity benefits from increasing the capacity of the crossings and intersections and from the more direct and legible footpaths on the new configuration of the Princes Street overbridge.

The bridge to be used for temporary traffic diversion during construction of the SH1 bridge over Ōtāhuhu Creek is to be retained following construction to provide a new pedestrian and cycle connection linking the Princes Street East peninsula with the Panama Road peninsula. The bridge will improve connectivity between the two areas, and would also help connect coastal reserves along both sides of Ōtāhuhu Creek.

12.10.11 Visual Effects

For industrial properties, the visual amenity effects on these properties will be limited having regard to their industrial and typically inward-looking nature.

Most of Sector 5 is bordered by residential properties. There will be adverse visual effects because the separation with SH1 will decrease and noise barriers will be installed along the boundaries, in many cases replacing a green buffer. While noise walls have adverse visual effects in themselves, at the same time they will screen SH1 and have amenity benefits by reducing noise.

The visual amenity for travellers on SH1 will reduce because the existing green buffer will be replaced with a hard-edged noise barriers. To put such effects in perspective, the existing vegetation is of mixed quality, is limited in depth, and has gaps in places which reveal a mix of fence style and exposure to rear yards. Proposed mitigation includes planting in front of the noise barriers following construction.

12.10.11.1 Measures to mitigate potential adverse effects for Sector 5

In addition to the Project’s design principles, mitigation measures and improvements proposed for this sector include:

- Replacing the existing causeway with a bridge;
- Removing incidental reclamation adjacent to the SH1 causeway;
- Avoiding noise walls within the creek corridor where possible;
- Re-establishing vegetation in the SH1 corridor in front of the noise walls;
- Removing weed species on the banks in the vicinity of SH1 to maximise views along the creek;
- Removing sufficient mangroves to reinstate an open channel both upstream and downstream of SH1; and
- Installing markers to highlight Ōtāhuhu Creek as a waymark on SH1.

12.10.12 Sector 6: Onehunga local road works

There are no landscape and urban design issues of any particular note within Sector 6.

12.10.12.1 Natural landscape

There are no natural landscape matters that will be affected. In each case the land is modified and there are no natural features of note.

12.10.12.2 Urban landscape

There will be some benefits in tying together the southern end of Onehunga's street grid. Captain Springs Road is relatively important in this respect because it extends through both industrial and residential parts of Onehunga, linking with Neilson Street, Church Street and Mt Smart Road. Likewise, the port link road will connect Miami Parade through to the Main Alignment.

The Project avoids encroaching onto Waikaraka Cemetery. It will not encroach on the historical basalt wall along its boundary and the basalt caretaker's cottage at the intersection of Captain Springs Road and Neilson Street.

12.10.12.3 Visual Effects

There will be no visual amenity effects of significance on users of Waikaraka Park. While Captain Springs Road will become busier, and will encroach into the berm on the Waikaraka Park side of the road requiring the removal of some street trees, the works will take place outside the existing park and, in particular, outside the stone boundary wall.

For the occupants of industrial properties, the widening of Captain Springs Road will encroach into the berm and require removal of some street trees in front of industrial properties on the eastern side of the road. While there will be some visual effects on these properties, such effects will be limited due to the commercial and industrial nature of these properties. The port link road will be entirely within an area devoted to large scale industrial activities and will have no adverse visual effects on adjacent properties.

12.10.12.4 Measures to mitigate potential adverse effects for Sector 6

There are no specific mitigation measures proposed for Sector 6 beyond incorporating good design principles.

12.10.13 General approach to landscape and visual effects mitigation across the Project

The general approach taken to landscape and visual effects across the Project is to avoid or mitigate effects through good design which is documented in the ULDF. The Transport Agency has worked with some stakeholders (including Mana Whenua) to develop an ULDF for the Project. The ULDF that has been prepared for the Project is contained in Volume 4.

The overall purpose of the ULDF is to:

- Demonstrate how the design of the Project supports the Transport Agency's strategic commitment to high quality urban design outcomes; and
- Demonstrate alignment between the Transport Agency and other agencies (e.g. Auckland Council and Auckland Transport) in integrating their planning, transport and urban design initiatives for the area.

The ULDF outlines some of the measures designed to mitigate adverse effects, and to go some way to restoring the existing environment. It comprises the following:

- Three high level design themes;

- Principles and outcomes that apply across the Project as a whole (e.g. outcomes for such elements as earthworks, bridges, paths, walls, road-side furniture, landscaping); and
- Principles and outcomes that apply to specific localities.

The three design themes underpinning the ULDF are:

Respect the place	Addresses such matters as responding to the natural and urban landscape, expressing the cultural footprint of Mana Whenua, and interpreting the area's heritage. In particular it is to assist in reversing the lack of respect given to the area during the development of the last 80 years or so.
Restore the whenua	Addresses the rehabilitation of the land and water, particularly the rehabilitation of Māngere Inlet and Ōtāhuhu Creek.
Reconnect the people	Addresses the transport connections for all modes (motorists, cyclists, and pedestrians), connection between Onehunga and the port, and connections between Onehunga and the Māngere Inlet.

The plans and drawings contained within the ULDF provide a vision for the integration of the Project with wider land use and development. It provides details and concepts which have been used in this AEE to assess the Project and, where appropriate, in the recommendation of mitigation for the Project.

The ULDF has been a source document which has informed elements of the Project design and will continue to do so beyond the concept design which is described in *Section 6.0: Description of the Project* of this AEE. By providing clarity on the expected design outcomes, the ULDF will promote consistent design quality throughout the detailed design and delivery of the Project.

The specific measures for each sector (set out earlier in this section) are incorporated into the ULDF. In general implementing the ULDF will:

- Soften the appearance of the main Alignment, reinforce it as an arterial road, and provide smooth transition between the landscape in which it sits;
- Ensure pedestrian connectivity is provided between the Main Alignment and the Māngere Inlet;
- Provide for connectivity between the Project, surrounding local roads, Māngere Inlet and Onehunga; and
- Recognise the Kāretu Portage.

These design outcomes will be achieved during detailed design of the Project by incorporating such as:

- Signage;
- Traffic calming measures;
- Carefully selected materials (including road and footpath surfaces);
- Street lighting;
- Specific design features which achieve a distinguished shared path;
- Custom street furniture for the Inlet frontage;
- Gateway structures;
- A design statement shared path where EWL is a structure in Sectors 3 and 4 (incorporating art) to highlight the Kāretu Portage; and
- Improved pedestrian connectivity.

Drawing from the ULDF, landscape concept plans have been prepared for the Project and are contained in *Plan Set 4: Landscape* in Volume 2.

12.10.14 Conclusion

The existing landscape forming the Project's setting has suffered the effects of being used as an industrial backyard for refuse landfills, noxious industries, and large scale infrastructure. This has resulted in the following:

- Te Hōpua tuff crater has been substantially modified and covered with urban development and infrastructure;
- The former intricate volcanic shoreline of the Māngere Inlet has been lost beneath refuse landfill;
- Māngere Inlet has been subject to contamination and has been walled off behind industrial development;
- Anns Creek has been partitioned by causeways, encroached upon by reclamation, and infested with weeds; and
- The former Kāretu and Ōtāhuhu portages have been submerged beneath urban development and Ōtāhuhu Creek has become constricted, both physically and visually.

While the Project has potential to increase visual dominance of transport infrastructure, the severance of the urban area from the coast, and reclamation of Māngere Inlet, the Project also has the potential to help reverse some of the adverse effects of historical development and to contribute to restoration of the landscape. Such a strategy lies behind the ULDF and the urban and landscape aspects incorporated in the Project. The strategies to achieve this are designed to:

- Rehabilitate and restore the degraded landscape of Māngere Inlet;
- Reconnect Onehunga with Māngere Inlet and its port;
- Enhance the legibility and aesthetic qualities of Te Hōpua tuff crater;
- Restore Anns Creek;
- Rehabilitate and re-open (physically and visually) Ōtāhuhu Creek;
- Recognise the Kāretu Portage; and
- Improve pedestrian and cyclist connectivity.

Overall, the adverse landscape and visual effects will be appropriately mitigated and there will be substantial positive effects. The Project, seen as a whole, will go some way to restoring the natural and urban landscape.

12.11 Noise and vibration

Overview

Construction of the Project will result in increases in existing noise levels during the construction period. Potential construction noise has been assessed in accordance with *New Zealand Standard NZS 6803:1999 Acoustics – Construction noise* (NZS 6803) and construction vibration in accordance with criteria within the Transport Agency's *State Highway Construction and Maintenance Noise and Vibration Guide.* During construction, some activities such as night works adjacent to dwellings have the potential to result in elevated noise that cannot be made to comply with the recommended criteria and these will be managed using best practice measures to achieve the most appropriate outcome practicable. Where possible permanent (traffic) noise mitigation measures will be installed at the beginning of construction in order to also mitigate construction noise.

Potential noise from operation of the Project is assessed against *New Zealand Standard NZS 6806:2010 Acoustics - Road traffic noise - New and altered roads* (NZS 6806). This Standard requires identification of sensitive receivers (such as dwellings and schools) within 100m of the road edge and establishes noise criteria categories for altered roads based on a Best Practicable Option (BPO) approach. The sensitive receivers for the Project are located in Sector 1 and Sector 5. Most buildings currently experience high levels of noise is due to their proximity to existing state highways and major local roads.

Once constructed, the Project will result in an overall reduction in noise levels currently experienced by sensitive receivers adjacent to SH1 and SH20 as a result of implemented noise mitigation measures. While high noise levels cannot be mitigated at all dwellings, the proposed mitigation involving acoustic barriers will result in significant noise level reductions of up to 9 dB compared to the existing levels at the most affected dwellings. Where acoustic barriers are not able to achieve noise levels suitable for residential amenity, building improvements are considered.

No notable adverse vibration effects from the operation of the Project have been identified.

12.11.1 Introduction

This section presents the findings of investigations undertaken to determine the actual and potential effects from noise and vibration associated with the construction and operation of the Project.

This section has been informed by *Technical Report 7: Traffic Noise and Vibration* and *Technical Report 8: Construction Noise and Vibration* in Volume 3.

12.11.2 Identifying the existing noise environment

The existing noise environment for the Project is characterised by a number of different land uses. The predominant environment in Sectors 1-4 is transport related and industrial in character which in places result in high ambient noise. In Sector 5, and lesser so Sector 1, other receivers include residential (short and long term accommodation) and active/passive recreational activities. In these Sectors, the presence of SH20 and SH1 respectively controls the high ambient noise environment.

For the purpose of assessing noise from roads, NZS 6806 focuses on identifying and managing effects on Protected Premises and Facilities (PPFs), which are sensitive receivers. PPFs are defined as buildings used for residential activities such as dwellings, hotels and motels in residential areas, marae, overnight medical care, boarding houses, elderly homes, educational facilities, and playgrounds within 20m of buildings used for teaching purposes. Commercial and business uses are not considered to be PPFs as they are not considered to be noise sensitive, and are therefore excluded from the assessment. NZS 6806 applies to PPFs in urban areas that are located within 100m from the edge of the closest traffic lane for the new or altered road.

The PPFs for the Project are predominantly the residential sites located close to the Neilson Street Interchange and adjacent to SH1 between Panama Road and the southern extent of the Project. There are no PPFs associated with Sectors 2, 3, 4 and 6. In total there are 401 PPFs that were assessed for the Project. Most of these PPFs currently experience high levels of noise due to their proximity to existing state highways and major local roads.

Short and long duration noise levels were measured at 14 locations within the Project area to establish the existing noise environment. The results are set out in Table 12-10.

Table 12-10: Traffic noise survey results

Location	Measured noise level	Derived noise level
Long duration surveys	**dB LAeq(24h)**	**dB LAeq(24h)**
13 Kotahi Road, Mt Wellington	65	n/a
24 Frank Grey Place, Ōtāhuhu (Auckland Motorway Alliance yard)	66	n/a
14 Onehunga Harbour Road, Onehunga (The Landing)	66	n/a
88 Panama Road, Mt Wellington	75	n/a
Short duration surveys	**dB LAeq(15min)**	**dB LAeq(24h)**
13 Frank Grey Place, Ōtāhuhu	67	65
1 Deas Place, Ōtāhuhu	70	68
36 Mataroa Place, Mt Wellington	68	66
102 Hillside Road, Mt Wellington	69	67
96 Captain Springs Road, Onehunga	65	63
Waikaraka Cemetery (water end)	54	53
31 Onehunga Harbour Road, Onehunga	74	72
16 Mona Avenue, Māngere Bridge	51	49
31 Norana Avenue, Māngere Bridge	49	48
Norana Park, Māngere Bridge	46	45

The noise surveys indicate that many of the PPFs are located in high noise environments. Of the 401 PPFs assessed along the Project, 257 are currently in Category A (up to 64dB $L_{Aeq(24hr)}$), 69 in Category B (64 to 67dB $L_{Aeq(24hr)}$) and 75 in Category C (more than 67dB $L_{Aeq(24hr)}$).

12.11.3 Construction noise and vibration assessment methodology

12.11.3.1 Construction noise standards

In assessing the construction noise and vibration effects, the main construction activities and equipment generating noise and vibration were identified and assessed against recommended project criteria to determine the actual and potential noise and vibration effects. A Best Practicable Option (BPO) approach was taken to identify methods to manage and mitigate potential adverse effects.

The standard used in New Zealand to measure construction noise effects is NZS 6803. The recommended noise limits from NZS 6803 are summarised in Table 12-11 and Table 12-12. The AUP (OP) incorporates the requirements of NZS 6803 in regards to construction noise.

Potential construction noise effects are typically assessed for compliance with NZS 6803, rather than as changes to existing noise levels. This is because construction noise is always noisier than ambient levels and often cannot be reduced to the applicable operational noise levels of the zone. NZS 6803 anticipates this and makes allowance for higher noise levels.

As the construction works will exceed 20 weeks duration in most locations, the “long term duration” criteria of NZS 6803 apply, which are five dB more stringent than the typical duration criteria.

Due to the high ambient noise levels, including at night time adjacent to SH1 and SH20, alternative night time criteria were determined using the "background noise level plus 10" approach which is referenced in NZS 6803.

Whilst night works will be limited as far as practicable, some night works may still be required. The construction noise criteria of NZS 6803 provide for lower noise levels on Saturday and Sunday nights. However, due to traffic and safety considerations for existing SH1 and SH20, night works are unlikely to occur on Friday and Saturday evenings but will occur on Sunday nights when there are lower traffic volumes on these routes. In order to provide two consecutive quiet nights, it is appropriate that the lower "quiet night" noise levels apply to Friday and Saturday instead of Saturday and Sunday. This has been applied in Table 12-11.

For works not on SH1 or SH20, works may occur on Friday and Saturday nights especially if works are required to tie in with coastal tidal cycles. However, no residential receivers would be affected and works will still be subject to the criteria identified.

Table 12-11: Construction noise criteria for dwellings

Time of week	Time period	dB LAeq	dB LAmax
Sunday to Thursday	06.30-07.30	55	75
	07.30-18.00	70	85
	18.00-20.00	65	80
	20.00-06.30	60	75
Friday	06.30-07.30	60	75
	07.30-18.00	70	85
	18.00-20.00	45	75
	20.00-06.30	45	75
Saturday and Public Holidays	06.30-07.30	45	75
	07.30-18.00	55	85
	18.00-20.00	45	75
	20.00-06.30	45	75

Table 12-12: Construction noise criteria for industrial or commercial premises for all days of the year

Time period	dB LAeq
0730-1800	70
1800-0730	75

12.11.3.2 Construction vibration standards

The criteria within the Transport Agency Guide *State Highway Construction and Maintenance Noise and Vibration Guide* (the Noise and Vibration Guide 2013) were used to assess the vibration effects of the

Project. The guide establishes two categories for the assessment: annoyance (Category A) and building damage effects (Category B).

The annoyance criteria (Category A) of the Noise and Vibration Guide 2013 set criteria to avoid annoyance at receivers generally based on BS5228-2. The Category B criteria range from 1mm/s to 10mm/s based on the German DIN 4150-3:1999 Standard which is a conservative standard designed to avoid all damage to buildings. However, there is provision to relax the criteria if they cannot be practicably met, provided that a vibration expert is engaged to assess, monitor and manage potential construction vibration effects. This approach enables effects to be assessed during construction activities, with procedures established in advance of the works to respond to any identified adverse effects on buildings which may be or have been caused by the construction activities.

The BPO for vibration seeks to avoid annoyance by meeting Category A criteria, and if that is not practicable, then not to exceed the Category B building damage criteria. All identified risks will be managed by site specific mitigation and measurement at the time of construction.

12.11.4 Assessment of construction noise effects

Construction activities will result in increases in existing noise levels over the construction period. Such an increase is most noticeable in low noise environments, where construction noise is either a new source or a dominant source of noise.

The following activities have the potential to result in exceedances of the noise criteria:

- Piling, construction and demolition of bridges due to proximity of works to dwellings;
- Construction of retaining walls and acoustic barriers;
- Some bulk earthworks;
- Construction of structures and pavements, depending on acoustic screening;
- Pavement preparation and surfacing; and
- Precast bridge construction and lifting.

12.11.4.1 Commercial and industrial receivers

Commercial and industrial sites are located throughout Sectors 1 to 4. Many of the buildings are likely to be exposed to noise levels above 70dB L_{Aeq} during the day time and above 75dB L_{Aeq} during part of the night time. This is in the context of an existing high noise environment in most locations.

The effects of noise on commercial activities will vary significantly depending on the sensitivity of activities. Many industrial activities are unlikely to be adversely affected however retail, sales, offices etc. may be affected to a greater extent. The primary effect is likely to be an interference with communication as well as general annoyance where concentration is interrupted. In general, night time construction within the commercial or industrial area will result in low risk of annoyance due to premises being vacant.

Noise effects on commercial and industrial receivers will be considered on a case-by-case basis for sites where the recommended project level criteria are exceeded. Site specific noise management schedules will be developed and implemented in consultation with the affected receivers to manage effects where necessary.

12.11.4.2 Residential receivers

In Sector 1 there are a number of dwellings that already experience a high noise environment. The construction activity for the Project has been assessed to have a low risk of breaching the NZS 6803 night time noise limit at the residential dwellings, however these should be assessed on a case-by-case basis and appropriate mitigation implemented as required.

A significant number of dwellings are located within Sector 5 adjacent to SH1. These will at times be exposed to construction noise levels in excess of 70dB L_{Aeq} during the day and to noise levels of greater than 60dB L_{Aeq} during the night. The first row of dwellings adjacent to a works area will generally be exposed to high noise levels exceeding the noise criteria and the second row receiving noise levels compliant with the criteria. Night time construction noise may exceed the night time noise criteria at dwellings three to four rows from the area of works.

In the Māngere Inlet, dredging will occur 24 hours per day due to tidal constraints. The dredging is expected to comply with the 70dB L_{Aeq} daytime noise limit at all relevant receiver locations. The residential properties in Māngere Bridge are located at least 250m from the dredging activity which, at that distance will enable the noise associated with dredging to also comply with the 45dB L_{Aeq}-night time noise criterion at the residential receivers.

Standard NZS 6803 anticipates that at times, construction noise cannot comply with the recommended criteria. If this will occur, specific BPO mitigation measures will be adopted to avoid unreasonable noise as required by Section 16 of the RMA. The duration for which a construction activity (which exceeds the criteria) can be considered reasonable depends on site-specific circumstances and may vary from site to site and activity to activity. For example, if day time noise criteria are anticipated to be exceeded for several days but neighbouring residents are not at home, no one would be affected and therefore mitigation may not be required beyond communication with the residents. Night time works can similarly be managed by good communication, being time specific and, as a last resort, offering alternative accommodation in some circumstances.

12.11.5 Assessment of construction vibration effects

Vibration predictions are less reliable than noise predictions, due to difficulties with accurate modelling of ground conditions. Vibratory rolling, vibropiling and impact piling pose the greatest risk of exceeding the Noise and Vibration Guide 2013 criteria and creating adverse vibration effects. Based on the proposed construction methodology and the setbacks from buildings, risks of building damage were assessed and buildings identified where there is a medium or high risk of exceeding the criteria. As the setbacks between the works area and the buildings cannot be increased, low vibration methods of construction are recommended in specific circumstances.

12.11.5.1 Commercial and industrial receivers

Some commercial and industrial activities are located close to the proposed works within Sectors 1 to 4, within around 10m of the alignment. These commercial buildings will receive perceptible vibration when compaction is being undertaken, however it is unlikely that the unoccupied building damage limit (Noise and Vibration Guide 2013 Category B) would be breached at this distance.

The Noise and Vibration Guide 2013 criteria do not provide amenity (Category A) vibration limits for commercial buildings during the night time because these buildings are not normally occupied during these times. As a result, vibration intensive activities will generally be scheduled for the night time in commercial areas, wherever practicable (with controls in place to comply with the higher unoccupied Category B limits (building damage)). If a commercial building is occupied during the night time effects can be managed through good communication.

Overall it is assessed that vibration levels are unlikely to result in damage to commercial and industrial receivers.

12.11.5.2 Residential receivers

Dwellings in Sector 5 are typically located around 15m to 20m from the closest extent of works but some dwellings are located less than 10m from retaining walls or potential earthworks operations. As this sector is densely developed, a significant number of dwellings could experience effects from vibration during construction. Vibrating rollers used on the SH1 widening works are likely to generate most noticeable vibration. The effects of vibration are likely to be more of nuisance (Category A) rather than avoidance of property damage (Category B).

12.11.5.3 Managing vibration effects

In the first instance, low vibration methodologies should be considered as far as practicable. Where not possible, alternative methods can be used to manage vibration effects. Methods may include engaging with the property owners and occupiers, pre-construction building condition surveys and monitoring of vibration levels.

12.11.6 Underwater Noise

Impact piling is proposed for the piers of the Anns Creek Viaduct, located approximately 600m from the low tide line of the Māngere Inlet. Piling is also required for the construction of the boardwalk between the headland features on the foreshore in Sector 2. This will require a significant number of piles to be driven at a typical distance of 20-40m from the toe of the road embankment.

The impact piling is predicted to produce high levels of underwater noise. Noise levels received by marine mammals that are above what they normally experience, can result in changes to their hearing sensitivity either temporarily or permanently.

Underwater noise is a matter for the coastal permits considered under the provisions of the regional coastal plan provisions of the AUP (OP). The assessment below has been developed in consultation with the Project ecologist and acoustic specialist. The AUP (OP) contains no noise limits, however blasting, impact and vibratory piling, and marine seismic surveys are listed as restricted discretionary activities that require an acoustic assessment addressing the following matters:

- The health and wellbeing of marine fauna (including threatened and at-risk species) and people from the noise associated with the proposal;
- The practicability of being able to control the noise effects;
- The social and economic benefits to the community of the Project (addressed in other sections of the AEE); and
- The extent to which the adverse effects of the noise will be mitigated.

The Māngere Inlet is not a notable feeding, breeding or rearing site for marine mammals nor is it a migration path for any marine mammals that may be affected by underwater noise. The only identified species of interest that may be affected by underwater noise in the highly unlikely event that they venture into the Māngere Inlet, are common dolphins and orca.

There is no New Zealand guidance on underwater noise effects. However, the US Department of Commerce National Oceanic and Atmospheric Administration provides guidance on the noise levels received by marine mammals which will likely result in changes in hearing sensitivity, either temporarily or permanently. The onset thresholds for the permanent loss of hearing in marine mammals caused by acoustic trauma are 230 dB re 1 µPa peak, and 187 dB re 1 µPa2/s SELcum. The maximum safe exposure noise levels are 154 dB re 1 µPa µPa2/s SEL for marine mammals.

Permanent hearing loss in marine mammals may be experienced within 10m from a single strike of the impact piling (230 dB re 1 µPa peak) and within 210m as a result of cumulative piling exposure(187 dB re 1 µPa2/s SELcum). Safe exposure levels will be experienced beyond 350m (154 dB re 1 µPa2/s SEL and below). The intertidal zone consists of shallow mudflats with low risk of underwater noise effects.

The following performance standards are recommended to be implemented:

- PTS onset threshold: 230 dB re 1 µPa peak and 187 dB re 1 µPa2/s SEL_{cum}
- Effective quiet: 154 dB re 1 µPa2/s SEL.

Specific measures to reduce or control the effects of underwater noise will be included in the Coastal Works CEMP (as set out in *Section 13.1.5: Management plans and other information*). This includes soft starts and gradually increasing the intensity of the piling and minimising duty cycle.

In the event that the main contractor determines that such piling is required elsewhere within the Project that is with 350m of potential marine mammal habitat, mitigation measures such as visual or passive acoustic monitoring of marine mammals and low power or shut down procedures will be prepared as part of the site specific noise management plans.

Overall, the presence of marine fauna that will be affected by underwater noise is unlikely in the area of piling and if they did venture into the inlet, the recommended performance standards will ensure a safe exposure level.

12.11.7 Measures to avoid, remedy or mitigate adverse construction noise and vibration effects

12.11.7.1 Construction noise management

The most effective way to control construction noise is through good on site management and communication within the Project team and with external parties. General noise mitigation measures that are good practice measures are set out in *Technical Report 8: Construction Noise and Vibration* in Volume 3.

A Construction Noise and Vibration Management Plan (CNVMP) will be prepared for the Project setting out how these measures will be implemented for the Project. The CNVMP will identify the noise risks and establish the management procedures that will be used in each area. It will include:

- Summary of project noise limits and assessments/predictions;
- General construction practices, management and mitigation;
- Noise management and mitigation measures specific to activities and/or the receiving environment;
- Monitoring and reporting requirements including procedures for handling complaints; and
- Procedures for review of the CNVMP throughout the Project.

Noise and vibration management schedules will be prepared for construction activities that have the potential to exceed the construction noise criteria. The schedules will identify the noise and vibration risks and set out how the BPO has been applied to the management and mitigation of noise for specific sites and activities. It is anticipated that schedules could be required for activities such as:

- Piling and demolition of bridges;
- Bulk earthworks in close proximity to dwellings; and
- Construction of structures and pavements close to dwellings.

Measures to mitigate effects could include on site structural mitigation (acoustic barriers) prior to commencement of works. Night time works can similarly be managed by good communication, being time specific and, as a last resort, offering alternative accommodation in circumstances.

12.11.7.2 Construction vibration management

Typical measures for mitigating and managing construction vibration effects include:

- Use of low vibration techniques where practicable (e.g. using bored rather than driven piles);
- Pre-start building condition surveys for buildings in close proximity to construction works that have been identified to cause high vibration levels;
- Monitoring of vibration levels where required, and

- Communication and liaison with affected parties.

These measures will be captured in the CNVMP.

12.11.7.3 Management of underwater noise during construction

The measures proposed to manage underwater noise during construction are set out in *Section 12.11.6* above.

12.11.8 Traffic noise and vibration assessment methodology

The assessment of operational effects involved establishing the existing noise environment and identifying any sensitive receivers referred to as PPFs within the Project area. This was followed by assessing the potential effects of the Project on these PPFs based on the modelled predicted noise levels for these PPFs from the Project and consideration of methods to mitigate actual and potential adverse effects.

The design year is a concept that is used for several engineering disciplines (refer to *Section 12.2: Traffic and Transport* of this AEE). It requires the design of a Project to be based on a future year, making an allowance for changes in traffic volumes over that time. NZS 6806 requires a design year between 10 and 20 years after the opening of the Project to the public. The year 2036 has been selected as the design year for the Project, which allows for an opening year up to 2026. The design year has been used to assess the difference between the do-minimum scenario where the Project is not implemented, and with the Project including mitigation.

There are three elements to the operational noise assessment:

1 Assess the actual and potential noise effects from operation of the Project;

2 Assessment of noise effects through determination of noise level changes; and

3 Assessment comparing the number of people that may be highly annoyed by traffic noise with and without the Project.

Firstly, NZS 6806 has been used to assess the actual and potential noise effects from operation of the Project. This Standard is based on the BPO approach and aligns with the duty to avoid unreasonable noise under section 16 of the RMA. The Standard establishes noise criteria categories which are not based on existing ambient noise levels, but are dependent on traffic volume and distinguish between new and altered roads. For this Project, the relevant category is that of altered road because the section of new road along the foreshore and connection to SH1 at Mt Wellington does not contain any PPFs within 100m and the remainder of the Project involves alterations to the existing SH1 and SH20.

NZS 6806 does not set rigid noise limits but gives categories (A, B and C) of noise criteria as set out in Table 12-13 and requires the BPO be identified to mitigate road traffic noise.

Table 12-13: Noise categories

Category	Altered Roads dB LAeq(24h)	New Roads with a predicted traffic volume >75,000 AADT at the design year dB LAeq(24h)	New Roads with a predicted traffic volume of 2,000 to 75,000 AADT at the design year dB LAeq(24h)
A (primary external noise criterion)	64	64	57
B (secondary external noise criterion)	67	67	64
C (internal noise criterion)	40	40	40

Under NZS 6806, structural noise mitigation options (e.g. road surface material and barriers) will be assessed, and if practicable, the noise levels within Category A should be achieved. If this is not practicable then structural mitigation should be assessed to achieve Category B noise levels. However, if it is still not practicable to comply with Categories A or B then building modification mitigation may be implemented to ensure the internal criterion of Category C is achieved. The upper category (Category C) provides a backstop against adverse health effects, such as sleep disturbance, by requiring the insulation of houses if the external noise would not be sufficiently reduced using the BPO. The preference is for structural mitigation rather than building mitigation in order to protect the widest possible area rather than rooms in specific PPFs only.

Secondly an assessment of noise effects through determination of noise level changes has been undertaken. This involved interpreting the general subjective responses of people based on international research to predict noise level changes along the Project.

Thirdly there has been an assessment comparing the number of people that may be highly annoyed by traffic noise with and without the Project. The assessment compared the percentage of people predicted to be ‘highly annoyed’ by traffic noise along the alignment for the existing and future (both with and without the Project) scenarios. This allowed the potential positive and negative effects to be assessed based on their significance and the number of people affected.

There are no national standards or rules in the Auckland planning documents for operational vibration from road traffic. The Norwegian Standard NS 8176.E.2005 specifically addresses transportation vibration and can be applied where relevant. However, traffic vibration is generated by uneven road surfaces, which will not occur from a new road that will be maintained under the Transport Agency’s maintenance policy.

12.11.9 Assessment of operational traffic noise effects

Adverse traffic noise effects can include:

- Amenity effects on residents in the vicinity;
- Annoyance;
- Sleep disturbance; and
- Health impacts associated with these effects.

The assessment of effects from road noise has been undertaken in three stages being the assessment of compliance with NZS 6806, assessment of noise level changes, and comparing the number of people likely to be highly annoyed by traffic noise with and without the Project.

In undertaking the assessment, the following has been considered:

- Ambient noise levels (both measured and predicted);

- Future noise levels from traffic on the Project;
- Areas that may be adversely affected by road traffic noise from the Project based on an assessment of compliance with NZS 6806;
- Whether mitigation following the BPO would reduce these effects and can be practicably implemented and assessing the level of reduction that can be achieved; and
- The overall effects of the Project for the wider area, based on likely annoyance reaction from residents in the area.

For the purpose of assessment, the PPFs in Sectors 1 and 5 have been grouped into areas sharing similar characteristics with one in Onehunga and six along SH1. Figure 12-16 shows these areas.

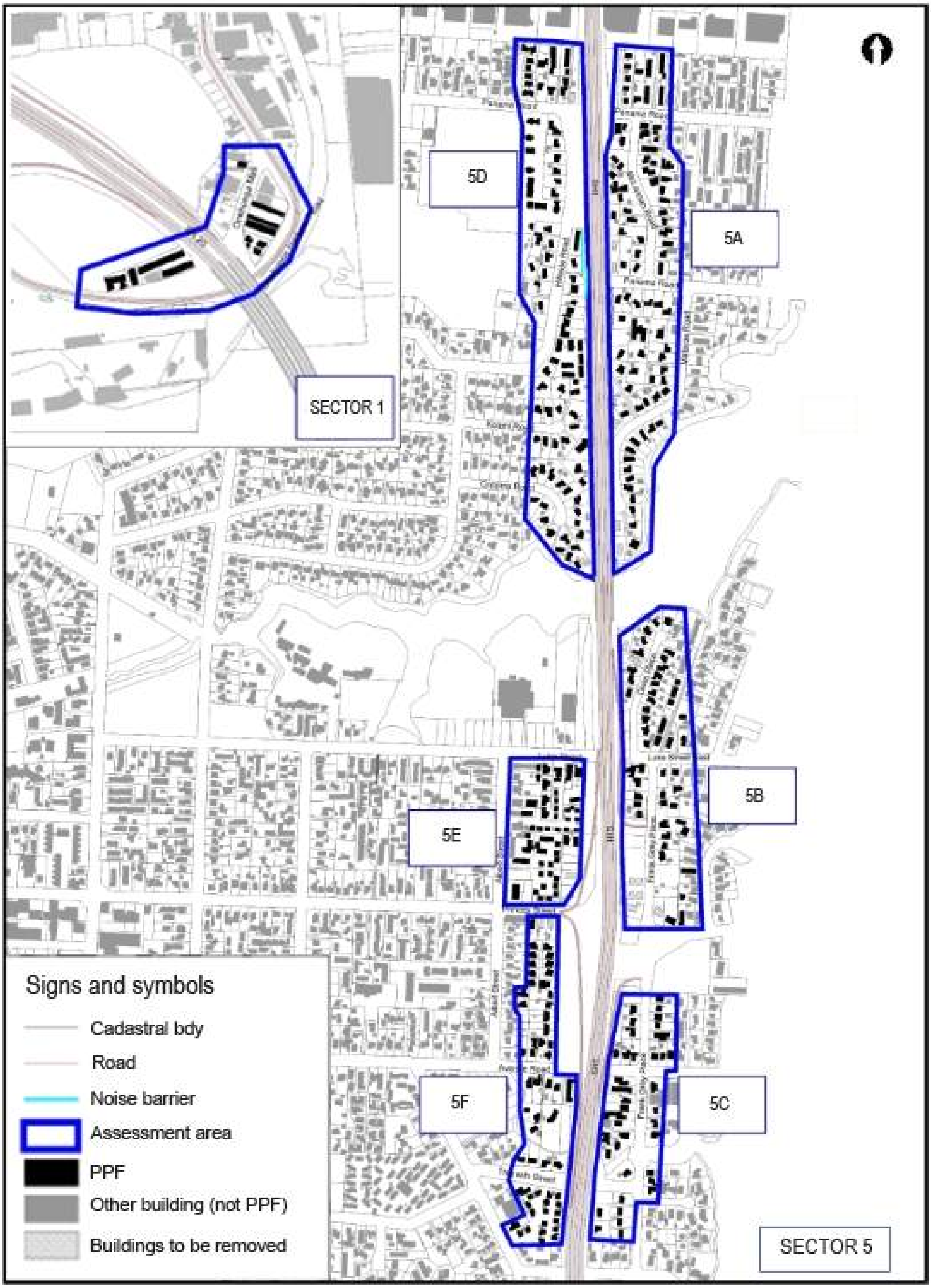
Noise modelling was used to predict traffic noise levels from the Project and to determine whether mitigation is needed for PPFs. The model accounts for terrain, ground conditions, atmospheric conditions and road parameters (e.g. road surface, traffic volume and speed, vehicle type and gradient) including existing safety and acoustic barriers.

For each of the noise assessment areas, the PPFs were combined into the categories of NZS 6806 (i.e. Categories A, B and C), and then the noise levels identified in five decibel bands (from less than 55 dB to more than 75 dB $L_{Aeq(24h)}$) to assess the number of people potentially affected by traffic noise. This process was undertaken four times to assess the existing situation (in 2016), the design year (being 2036) without Project, the design year with Project and the design year with the Project and preferred mitigation.

The change in noise levels for the design year without the Project (i.e. do nothing) and with the Project including the preferred mitigation are set in Table 12-14.

The location of the proposed acoustic barriers described in the following sections are shown in *Plan Set 3: Road Alignment* in Volume 3.

Figure 12-16: Grouping of PPFs for assessment



12.11.9.1 Sector 1, Onehunga

Several PPFs are located in this sector including two and three level apartment buildings, single level houses and a motel. All are located within an existing high noise environment. The existing noise levels for the 12 PPFs within this sector range from 60 to 73dB $L_{Aeq(24h)}$. In the context of the surrounding urban environment the existing noise exposure is considered reasonable, balancing the need for, and impact of, the road network to the locality.

The anticipated noise effects are from vehicles on SH20, the ramps, and local and business traffic movements. With no noise mitigation, the Project is predicted to change the overall noise level only insignificantly and to an unnoticeable degree. Recommended mitigation includes an acoustic barrier, being a 2.0 m acoustic barrier on SH20 adjacent to Onehunga Mall and building modification mitigation. With the recommended mitigation, noise levels for most PPFs are predicted to reduce slightly, with a number of Category C dwellings (requiring building mitigation) reducing to either a noise Category A or B in the design year (2036).

Overall, the Project with the recommended mitigation will have a slight positive effect with noise levels lower for the 2036 design year with the preferred mitigation option than compared to the 2036 Without Project scenario and also the present day scenario.

12.11.9.2 Sectors 2, 3 and 4

Sectors 2, 3 and 4 have not been assessed as there are no sensitive receivers.

12.11.9.3 Sector 5A, Mt Wellington (Southbound)

This sector extends from just north of Panama Road to Ōtāhuhu Creek (east of SH1) and is predominantly residential. The existing noise levels for the 86 PPFs within this area range from 53 to 75dB $L_{Aeq(24h)}$. At present, there are currently no acoustic barriers along this section of SH1.

With no noise mitigation, the Project will only slightly increase the ambient noise level experienced within this area. The dwelling at 73 Panama Road is predicted to receive the highest noise level increase from the Project, of just under 5 dB. The reason is the height of the dwelling in relation to Panama Road making the change in noise level difficult to mitigate through structural methods. Building modification mitigation will be considered for this property.

There will be a significant drop in the number of people adversely affected by noise levels from existing numbers in the design year, despite the increase in traffic volumes projected due to the proposed mitigation measures. There is also a reduction in the number of dwellings receiving noise levels in Category C which are changing to noise levels within either Category A or B.

Overall, the Project with the recommended acoustic barriers ranging from 1.1m to 3.0m and building improvements is predicted to provide an improvement to the existing noise environment in this area.

12.11.9.4 Sector 5B, Ōtāhuhu North (southbound)

This area extends from Ōtāhuhu Creek to Princes Street East, located east of SH1. It includes the southbound off-ramp of SH1 at the Princes Street Interchange. At present, there are no acoustic barriers along this section of SH1. This area contains 48 PPFs with existing noise levels ranging from 54 to 72dB $L_{Aeq(24h)}$. Most dwellings near SH1 are beyond the southbound off-ramp and somewhat separated from the traffic and therefore experience slightly lower noise levels.

The Project with the recommended 2.4m high acoustic barrier is predicted to improve the existing noise environment compared with both the Without Project scenario and the present day. The number of people calculated to be highly annoyed by noise is predicted to reduce due to the lower noise levels. Additionally, all Category C dwellings are predicted to receive reduced noise levels within either Category A or B with the recommended mitigation.

Overall, the Project with the recommended mitigation is predicted to provide an improvement to the existing noise environment in this area.

12.11.9.5 Sector 5C, Ōtāhuhu South (southbound)

This sector is located adjacent to the southbound lanes of SH1 and extends from Princes Street East to just north of Water Street in Ōtāhuhu (approximately 100m south of the Project extent). It contains 39 PPFs with existing noise levels ranging from 56 to 75dB $L_{Aeq(24h)}$. While most PPFs in this area are separated from SH1 by the southbound on-ramp, noise levels are elevated, with 9 dwellings currently identified within Category C. Similar to the two previous areas, it has no existing acoustic barriers and is predominantly residential.

With the recommended 1.8m to 3.0m high acoustic barriers, all but one existing Category C dwelling in the design year will change to receive noise levels in either Category A or B (as shown in Table 12-14). Building modification mitigation should be considered for the remaining Category C building. With the preferred mitigation, a reduction in the number of people potentially highly annoyed by the noise environment is predicted.

Overall, the Project with the recommended mitigation is predicted to provide an improvement to the existing noise environment in this area.

12.11.9.6 Sector 5D, Mt Wellington (northbound)

This sector covers the residential area west of SH1 from Panama Road to Ōtāhuhu Creek. At present, there is a concrete acoustic barrier which runs the length of four residential dwellings along Hillside Road. This area contains 109 PPFs. The existing noise levels in this area range from 56 to 74dB $L_{Aeq(24h)}$. with a large number of dwellings receiving noise levels above 65dB $L_{Aeq(24h)}$.

The proposed Springpark development at Panama Road (while not implemented) has obtained building consent by the land developer and has been considered as part of this assessment. The dwellings at 15A to 15D Coppins Road will be removed to facilitate the Project and therefore have not been considered.

The introduction of the recommended acoustic barriers ranging in height from 1.1m to 3m and building modification mitigation is predicted to result in a significant improvement in the residential noise environment, in particular, significant reductions for the 13 PPFs which are currently most affected by road traffic noise. Many Category C dwellings will receive reduced noise levels within Category A or B.

The number of people highly annoyed is predicted to reduce noticeably with the preferred acoustic barriers.

Overall, the Project with the recommended mitigation is predicted to provide an improvement to the existing noise environment in this area.

12.11.9.7 Sector 5E, Ōtāhuhu North (northbound)

This sector is located west of SH1 extending from Ōtāhuhu Creek to the northbound on-ramps at the Princes Street Interchange. The existing noise levels for the 49 PPFs range from 55 to 70dB $L_{Aeq(24h)}$. The PPFs within this area, particularly where located below the ramp level, are well shielded from noise generated on SH1.

With the introduction of the recommended acoustic barrier of 2.4m in height, 16 of the PPFs are predicted to receive a noticeable reduction in noise level. This includes all PPFs that currently receive noise levels in Categories B or C. While the overall number of people likely to be highly annoyed only reduces marginally, overall, the operation of the Project will have a positive effect on the existing noise environment as the PPFs in high noise areas of 65dB $L_{Aeq(24h)}$ or higher move into lower noise level bands.

Overall, the Project with the recommended 2.4m high acoustic barriers is predicted to provide an improvement to the existing noise environment in this area.

12.11.9.8 Sector 5F, Ōtāhuhu South (northbound)

This sector is located west of SH1 adjacent to the northbound off-ramp at the Princes Street Interchange. This sector extends to Water Street, approximately 100m south of the extent of the Project. This area is predominantly residential with dwellings set back from the northbound off-ramp of SH1 at the Princes Street Interchange. The area contains 58 PPFs, with existing noise levels predicted to range from 52 to 74dB $L_{Aeq(24h)}$.

A timber fence acting as a noise barrier has been installed adjacent to 113 Albert Street. The barrier construction is board and batten nailed timber and is unlikely to sustain the acoustic performance required by P40, the Transport Agency's Noise Mitigation Specification and NZS 6806. For this reason, the barrier has not been included in the existing situation modelling.

The recommended acoustic barriers ranging between 1.8m and 3.0m in height will result in an improvement in the overall noise environment with 11 of the PPFs receiving a noticeable noise reduction. The remainder of the PPFs are predicted to receive no or only marginal noise level reduction as they are sufficiently setback from SH1 to not require noise mitigation (refer to Table 12-14). With the recommended acoustic barrier, all but two dwellings are predicted to receive noise levels within Categories A or B compared to nine PPFs in Category C without the Project.

Of the two dwellings which remain in Category C, the dwelling at 113 Albert Street is double storey and elevated above SH1. Therefore acoustic barriers will not be effective and mitigation for the upper floor will be addressed through building modification mitigation with agreement of the landowner. Similarly, the dwelling at 48 Water Street is elevated above SH1 and is difficult to shield with acoustic barriers. Building modification mitigation will be investigated to address the effects on this dwelling.

Overall, the Project with the recommended mitigation is predicted to provide an improvement to the existing noise environment in this area.

12.11.9.9 Summary

The comparative assessment of the predicted noise levels indicates that the current high traffic noise and resulting annoyance levels would reduce for the majority of PPFs. The changes are due to improvements outlined as mitigation particularly for the residential areas alongside SH1, which currently have minimal or no noise mitigation. The changes expected for PPFs in each assessment area are shown in Table 12-14.

Table 12-14: Change in noise for PPFs along the alignment

Change in noise level (between the do nothing and preferred mitigation options)	Effect classification	Number of sensitive receivers in each assessment area						
		1	5A	5B	5C	5D	5E	5F
9 – 11 dB reduction	Significant positive	-	1	-	-	1	-	-
5 – 8 dB reduction	Moderate positive	-	18	3	11	12	3	7
3 – 4 dB reduction	Slight positive	3	15	4	8	16	13	4
1 – 2 dB reduction	Negligible	3	30	11	18	27	12	16
Less than 1 dB change	None	2	15	17	2	48	17	29
1 – 2 dB increase	Negligible	4	4	11	-	5	4	2
3 – 4 dB increase	Slight adverse	-	2	2	-	1	-	-
5 – 8 dB increase	Moderate adverse	-	1	-	-	-	-	-
Total PPFs		**12**	**86**	**48**	**39**	**109**	**49**	**58**

Overall, the Project provides positive effects for most people especially those presently affected by the most elevated noise levels.

12.11.10 Assessment of operational traffic vibration effects

Where roads are well-maintained, traffic vibration is unlikely to generate adverse effects. Vibration effects on adjacent properties arise where the road surface is in poor condition. The Transport Agency has a comprehensive road maintenance policy, and, as the Project is a new construction for the most part, adverse traffic vibration effects are not anticipated.

With the implementation of the Transport Agency road maintenance policy, it is unlikely that the Project road surface will ever degrade significantly, so effects are predicted to be negligible for all receivers.

12.11.11 Measures to avoid, remedy or mitigate potential operational traffic adverse effects

12.11.11.1 Operational traffic noise management

A BPO approach was adopted to identify options for noise mitigation where adverse effects were assessed to be at a level that mitigation was required. Under NZS 6806, where noise levels within Category A can be met with the implementation of the BPO for noise mitigation, then Category A applies. Where Category A cannot practicably be achieved, then mitigation to achieve the noise criteria within Category B is subject to the BPO test. If the noise criteria of Categories A or B are not practicably achievable, then the "backstop" Category C will be met with the adoption of the BPO.

There are three general methods to control traffic noise generation or effects:

- Noise reducing road surface materials;
- Acoustic barriers; and
- Building improvements.

The Project will use noise reducing road surface materials including Open Grade Porous Asphalt (OGPA) road surfacing (or similar) on the new road Main Alignment and dense asphalt (or similar) on the ramps.

Acoustic barriers are generally only considered appropriate where, as a minimum, an average of 3 decibels mitigation can be achieved (where many dwellings are located close to each other). No barriers are proposed where:

- Dwellings are significantly elevated relative to the road and a noise barrier would not be effective;
- The upper floor of multi storey dwellings cannot be mitigated; and
- The required barrier may be too high for a residential context.

The potential adverse visual, shading and safety effects of the acoustic barriers, and effectiveness of the mitigation measure, mean that they are not suitable in all circumstance.

Where acoustic barriers are not sufficient to achieve noise levels within Categories A and B, acoustic treatment/modification of buildings will be investigated. There are 22 PPFs with a residual Category C classification that may require building modification mitigation.

The recommended acoustic barrier and building modifications are set out in Table 12-15.

Table 12-15: Noise mitigation measures

Assessment Area	Approx. Barrier heights	Approx. Barrier lengths	Sensitive activities considered for building modification
Sector 1 (Area 1 in TR7)	1.8m	120m	2
Sector 5A (Area 5 in TR7)	1.1m height 1.8m height 2.4m barrier 3m barrier	39m 64m 299m 356m	13
Sector 5B (Area 6 in TR7)	2.4m height	240m	0
Sector 5C (Area 7 in TR7)	1.8m height 2.4m height 3m height	44m 127m 105m	2
Sector 5D (Area 2 in TR7)	1.1m height 1.8m height 2.4m height 3m height	40m 201m 242m 421m	3
Sector 5E (Area 3 in TR7)	1.1m height 1.8m height 2.4m height	41m 100m 305m	0
Sector 5F (Area 4 in TR7)	1.8m height 2.4m height 3m height	30m 306m 40m	1

The details in Table 12-15 are approximate and subject to detailed design. The location of the proposed acoustic barriers are shown in *Plan Set 3: Road Alignment* in Volume 3.

12.11.11.2 Operational traffic vibration management

The assessment of operational vibration has identified that due to the new road surface and implementation of the Transport Agency's road maintenance policy during operation, the Project is unlikely to generate adverse vibration effects.

12.12 Air quality

Overview

No specific resource consents or other RMA approvals are required for the Project in relation to operational air quality matters. Vehicle emissions are not controlled under district or regional plans.

The increase in concentration of operational air pollutants arising from vehicle traffic in Sector 5 is predicted to slightly exceed the NO2 (Nitrogen Dioxide) guideline level, both with and without the Project. In 2026 all other contaminant levels comply with the air quality standards along the length of the Project. Overall the effects from operational air quality are improved as a result of the Project. Reduced general traffic and heavy vehicles on key arterials and local roads will be beneficial for local air quality. Of note are local schools and early childhood centres in close proximity to existing busy roads which will benefit due to reduced traffic.

During construction, there are some specific sites along the Project with higher sensitivity to the construction air quality effects of dust. The generation of dust can be reduced by implementing a number of measures. For example construction roads can be well metalled and regularly watered during dry periods and excavated surfaces can be watered and stabilised immediately after works.

12.12.1 Introduction

This section outlines the actual and potential air quality effects which arise during the operation and construction of the Project.

There is a direct relationship between air quality and the number of vehicles on roads. Operational air discharges are generated by vehicles and include the combustion of fuels, brake wear and road dust. Vehicle emissions are of concern because many pollutants which are released are known to cause adverse health effects. These include gases such as NOX (Nitrogen Oxides) and VOCs (benzene) and particulate matters (PM10 and PM2.5).

During construction, the concrete batching facility based in Construction Yard 3 (Waikaraka Park) has the potential for adverse air quality discharges from cement associated with the mudcrete process. Construction works have the potential to generate dust from vehicle movements on access tracks, reclamations and areas being earthworked. The Project has some sensitive areas where hazardous air pollutants could arise (e.g. from closed landfills or asbestos dumps such as at 141 Hugo Johnston Drive). An assessment of air quality effects has been prepared as *Technical Report 9: Air Quality Assessment* in Volume 3.

12.12.2 Construction air quality

12.12.2.1 Assessment Methodology

The assessment has been undertaken in accordance with the *Transport Agency Air Quality Guide*[71]. The assessment of dust effects associated with construction works involves confirming that there are "no objectionable or offensive effects" as outlined in the Ministry for the Environment "*Good Practice Guide for Assessing and Managing Environmental Effects of Dust Emissions".* Effects are usually beyond the site boundary. No specific consents are required for the discharge of contaminants into air from construction of the Project, provided the relevant permitted activity standards are met. The standards for

[71] Transport Agency, June 2014

permitted activities include managing contaminants likely to affect human health, property or the environment, offensive or objectionable odour or dust beyond the boundary of the work site, and visible emissions. As there are no specific assessment criteria for dust, and as dust contains PM10, the dust generating activities have also been assessed against the Resource Management (National Environmental Standard for Air Quality) Regulations 2004 (NESAQ).

The Transport Agency Air Quality Guide presents a checklist to evaluate the construction air quality risk. The factors affecting the risk are the number of highly sensitive receivers and the scale of the earthworks activity. The area identified as potentially affected by construction dust nuisance are sensitive receivers located within 200m of the Project construction footprint. Specific activities identified as being sensitive to dust include residential properties in Sectors 1 and 5 and sites in Sector 4 used for uncovered car storage which are particularly sensitive to dust deposition. Due to the number of sensitive receivers and volume of earthworks the air quality risk is rated as high.

Construction dust effects are influenced by the location and separation distance between the construction areas and sensitive receivers along the Project, and the nature and extent of construction activities.

In accordance with the Transport Agency Air Quality Guide, as the dust risk associated with construction of the Project is assessed as being high, a Construction Air Quality Management Plan (CAQMP) should be prepared. This document (or section of the proposed CEMP) will describe a range of appropriate dust management and emission controls (as set out in Section 12.12.2.3), to be applied by the construction contractor at the time of construction to minimise the effects of dust.

12.12.2.2 Assessment of construction air quality effects

The potential air quality effects from construction of the Project include:

- Dust arising from construction activities, vehicle movements and wind entrainment from unsealed surfaces;
- Hazardous air pollutants from the disturbance of contaminated soils including landfills and asbestos;
- Odour and landfill gas (including methane) from the disturbance of closed landfills; and
- Engine exhaust emissions from construction vehicles.

The potential health effects of dust are closely related to particle size. Human health effects of airborne dust are mainly associated with PM10 (particles less than 10 μm), because these are small enough to be inhaled.

Total Suspended Particulate (TSP) is the particle size fraction that is most commonly monitored in New Zealand for the assessment of dust impacts. TSP is considered to be any particle smaller than 100 μm (microns) in diameter. Nuisance effects can be caused by particles of any size, but are most commonly associated with those larger than 20 μm (micrometer) because they will settle and deposit on surfaces. Deposited particulates have minimal physical health impact, but may cause nuisance in sensitive areas due to soiling. Because it is relatively large in size, deposited particulate usually falls out of the air within a short distance of the source and usually within 100m to 200m.

a. **Discharges from concrete batching**

The construction of the Project will require large quantities of fill which will likely be sourced from excavated marine sediments, then stabilised with cement to form mudcrete. The concrete batching plant and mudcrete operation will be located in Construction Yard 3 in Waikaraka Park and will produce approximately 1,000 tonnes of mudcrete per day. Potential discharges into air from concrete batching include dust from aggregates and cement powder.

Aggregate dust is usually inert, only causing nuisance (amenity) effects. However, cement dust is basically calcium oxide (CaO), which is highly alkaline when dissolved in water and can be corrosive to skin.

Concrete batching has the potential to generate fugitive discharges of dust, a fraction of which is likely to be PM_{10}. In practice, most of the material used on site has a considerably larger particle size – cement dust typically has an aerodynamic diameter in the range 30µm to 50µm, while sand and aggregates are larger still. Dust particles larger than about 20-30 µm in aerodynamic diameter have the potential to cause localised 'dust nuisance' e.g. soiling of surfaces.

Dust from concrete cutting (such as required for the removal of the Ōtāhuhu Creek culverts) also has the potential to generate cement dust if not appropriately controlled.

Provided the appropriate emissions controls and good on-site management are implemented, adverse effects of discharges to air from the concrete batching plant will be adequately avoided or mitigated.

b. **Dust from general construction activities**

General construction activities have the potential to generate dust. This includes from activities such as topsoil removal and spreading, earthworks, cut and fill operations, and the removal of existing hard surface such as paths and roads. Dust can also be generated from vehicles using access tracks and other construction areas, and from the removal of existing hard surfaces such as existing paths and roads.

The key area of concern is excessive dust deposits causing soiling of property, nuisance to highly sensitive receivers (i.e. residents and uncovered vehicle storage areas) and effects on network utilities (e.g. power lines). Dust can also affect visibility in the immediate work area and its surrounds.

The effects of dust from construction at sensitive receivers will be greatest during strong wind and dry conditions. Within the Project area, the dominant wind speeds are 1.5 to 5.0 m/s (for 58% of the time), with wind speeds in excess of 8 m/s being less frequent (for 5% of the time). Wind speed above 5m/s will start to give rise to airborne dust from exposed surfaces, particularly after extended periods without rainfall. High wind speeds above 10m/s have the most potential for excessive dust if winds are blowing towards the direction of sensitive receivers. Therefore, wind speeds with the potential to generate airborne dust are less frequent, occurring approximately 18% of the time. Wind speeds above 5.0 m/s are highest in the Māngere area (39% of the time) but much lower in Onehunga and Penrose (10.8% and 5.1% respectively).

The prevailing wind direction is south-westerly during the summer months (when the greatest risk of dust discharges occurs due to dry conditions). This will cause increased dust deposition to the north east of the Project construction area.

There are a number of measures that can be used to minimise the generation of dust during construction. These are set out in *Section 12.12.2.3* below.

c. **Hazardous air pollutants from contaminated soils**

There is a potential for offensive or objectionable odour to be discharged during disturbance of contaminated soils and closed landfills at Galway Street and Pikes Point East and West. The primary contaminants of concern are arsenic, copper, zinc and lead. If not appropriately managed, the discharges of dust from these areas may cause adverse effects on human health through either direct inhalation or ingestion.

The standards and guidelines for safe exposure to the identified soil contaminants are commonly set as annual averages, reflecting that adverse health effects from these airborne contaminants are more likely to occur after exposure to low levels over a long period of time. The construction proposed for this Project is not classified as a long period of time from an air quality perspective. In addition, the identified contaminants are likely to be adsorbed onto soil particles and therefore dust management methods will minimise effects.

The measures used to control general dust emissions (set out in Section 12.12.2.3) are equally appropriate for the control of discharges from contaminated sites as for general dust discharges. With the use of these dust control measures, the potential for adverse effects due to discharges of dust from contaminated land is extremely low.

The site at 141 Hugo Johnston Drive (Construction Yard 4) is known to contain high levels of asbestos. If not appropriately managed, the disturbance of this site could discharge hazardous air pollutants in the form of airborne asbestos. For this to occur, the asbestos fibres must be present in sufficient concentration to pose a risk, and the exposure must be frequent and occur over long periods of time. The construction workers who will be uncovering and handling the asbestos directly are most at risk of exposure to airborne asbestos fibres. The risk of long term exposure is low, as the total construction duration at this location may be periods of weeks or several months at most. The use of personal protective clothing and training in handling the materials can minimise the risk to construction workers. Any asbestos found during excavation works will need to be handled and removed by a specialist asbestos containing materials contractor. The measures proposed for the investigation, handling and removal of asbestos material are addressed in *Section 12.18: Contaminated land* of this AEE.

d. **Odour and methane gas from landfills**

Construction of the Project requires disturbance of some historic landfill areas. The decomposition of material in areas of historic landfill results in the generation of gas and odour. There are several closed landfills along the Main Alignment and other areas where unknown fill material has been deposited. Monitoring completed for the Project has identified landfill gas in the wells installed at and near the Galway Street and Pikes Point East and West landfills.

The disturbance of these landfill areas can cause the following effects:

- The release of landfill gas which poses a safety risk due to the explosion risk; and
- The release of odour which poses a risk of nuisance or amenity effects.

Landfill gas is predominantly comprised of methane and also, depending on the types and age of the waste, may also contain hydrogen sulphide and small amounts of nitrogen, oxygen and hydrogen. It may also contain organic compounds that are potentially hazardous, such as benzene and toluene. Methane is not generally considered a toxic gas, however it is extremely flammable even in low concentrations when mixed with other chemicals. Hydrogen sulphide is also toxic and flammable at high concentrations and has a pungent odour. Odour may be generated by hydrocarbon contaminated soils within landfills, particularly when first exposed.

The monitoring of methane by use of portable methane gas detectors can to help minimise risk and provide early warnings should gas levels become dangerous. Typically the first alarm level would be 10% of the lower explosive limit, which in the case of methane at 10% of the 5% lower explosive limit is 0.5%. Hydrogen sulphide has a workplace exposure limit of 10 ppm (an 8 hour time-weighted average).

Potential adverse effects from landfill gas and odour can be mitigated by providing appropriate management and mitigation measures as set out in *Section 12.12.2.3*.

e. **Emissions from construction vehicles and machinery**

The operation of heavy vehicles and machinery during construction can potentially cause adverse air quality effects that create nuisance for nearby sensitive receivers particularly during strong wind conditions.

Construction vehicles will generally use arterial routes (e.g. Church Street and Neilson Street) and the State highways and less frequently, local roads. The total number of construction truck movements anticipated for spoil removal is in the order of 60 truck trips per day on Neilson Street, 110/day during construction of the embankment and 40 trucks/day during each of the other construction stages. Given the volumes of traffic in the vicinity of the Project, any additional traffic generated by construction activities will not result in a measurable increase in concentrations of vehicle related pollutants at locations close to highly sensitive receptors.

Other sources of emissions during construction include smoke and odour from diesel fuelled vehicles, generators and machinery which primarily result from poor engine maintenance. These can be minimised through regular checks and maintenance.

f. **Summary**

Through the use of appropriate emissions control and good on-site management, adverse effects caused by discharges of contaminants into air from the construction of the Project are able to be adequately avoided or mitigated and contained within the Project site boundaries.

12.12.2.3 Measures to avoid, remedy or mitigate potential adverse construction air effects

Using the Transport Agency Air Quality Guide, the Project is assessed as being of high risk and therefore air quality management must be incorporated into construction.

Mitigation measures for potential air discharges from the concrete batching plant will be addressed in a Concrete Batching Plant Management Plan (as part of the CEMP) and may include:

- The use of water on aggregate stockpiles and areas used for vehicle movement (fixed water sprays or water trucks) and windbreak fencing where appropriate;
- Transporting, storing and handling bulk cement in fully enclosed systems with any displaced air being discharged via bag filter units;
- Venting of air displaced from silos via filter units;
- Fitting cement silos with pressure relief valves (to avoid over-pressurisation) and high fill alarms;
- Cleaning up any spills as soon as detected by sweeping or vacuuming; and
- Requiring all bulk deliveries of cement to be made during operating hours, so that site staff can oversee the delivery.

Dust emissions from general earthworks and the disturbance of contaminated material (including asbestos) can be mitigated by measures during construction such as:

- Dampening down works areas (where necessary);
- Minimising exposed areas of earthworks;
- Loading spoil materials from a low height;
- Watering down works areas prior to commencement;
- Suspension of works during periods of high winds;
- Covering any stockpiles or soil heaps; and
- Establishing a wheel wash where necessary for construction vehicles, machinery and generators.

Regular checks and maintenance of construction machinery will reduce emissions.

The above mitigation measures and corresponding actions will be contained within the air quality section (forming a CAQMP) of the CEMP ensuring the proposed mitigation measures are applied by contractors when undertaking the works. Further discussion of the CEMP is contained in *Section 13.1.5: Management plans and other information.*

There are a range of controls available to manage the risks of landfill gas and the release of odour during construction. These controls are set out in detail in Appendix E of *Technical Report 17: Contaminated Land Assessment* and include:

- Managing earthworks with landfill waste by the installation of controls, minimisation of the excavation zone, and isolation from influences that could compromise the environment and human health;

- Appropriate handling, transportation and disposal of landfill waste (including a specialist in asbestos, where required);
- Management of landfill gas and odour during construction and long-term;
- Design considerations for permanent works including a high permeability leachate interception system;
- Leachate management and disposal during construction;
- Reinstating landfills with a landfill cap following construction; and
- Managing construction in confined spaces and human health contact with chemical and biologically contaminated materials.

Landfill gas will be monitored during construction activities.

12.12.3 Operational air quality

No specific resource consents or other RMA approvals are required for the Project in relation to operational air quality matters as discharges to air from mobile sources (in this case, vehicles using the road) are permitted under the AUP (OP)[72].

The methodology for assessing operational air quality effects is based on Transport Agency and Ministry for the Environment guidelines[73]. This broadly involves a staged technical assessment of effects, preparation of an environmental and social responsibility screen followed by a preliminary technical assessment using an air quality screening model. The air quality screening model predicts exposure levels at the kerbside and at the nearest sensitive location and then compares them to the relevant human health based air quality criteria for each road link. The criteria specified by the air quality standards and guidelines are designed to protect the health of the most vulnerable people in the community. The model provides a worst case assessment of potential air quality impacts.

As with other technical assessments the assessment consenting approach has adopted the year 2026 for assessing the differences between the air quality with and without the Project.

The screening assessment undertaken for the Project indicates that the air quality criteria will not be exceeded. This means that the air quality risk is low and therefore a more detailed technical assessment (beyond that undertaken) is not required for the Project.

12.12.3.1 Sensitivity of the receiving environment

Sectors 1 to 4 and 6 of the Project are areas with a relatively low sensitivity to potential adverse effects of air emissions on human health and amenity values. This is as a result of predominantly industrial land uses in these areas. The AUP (OP)[74] identifies that Business – Heavy Industry zone is an area with low air quality.

The parts of the Project that are most sensitive to potential air quality impacts of vehicle emissions are the dwellings/motel on Onehunga Harbour Road in Onehunga, and residential land uses adjacent to SH1 and at Princes Street. Whilst these residential land uses are more sensitive to potential adverse effects,

[72] Rule E14.4.1(A114), AUP (OP) Decisions Version.

[73] NZ Transport Agency, "*Guide to assessing air quality impacts from state highway projects*", December 2015 and Ministry for the Environment, "*Good practice guide for assessing discharges to air from land transport*", 2008.

[74] Chapter E14.4(Air Quality) of the AUP (OP) Decision Version.

they already experience high traffic volumes on adjacent roads, and contain many dwellings close to the road (i.e. within 20 m). Based on this, the existing air quality in these areas is poor.

An analysis of existing air quality data for the Project area indicates that background levels currently comply with the NESAQ. As with other urban areas of Auckland, air quality is influenced by both wintertime domestic solid fuel heating emissions and vehicle emissions. Industrial discharges are a much lower contributor to regional emissions contributing less than 10% overall. The prevailing wind direction and speed also have localised effects on air quality.

12.12.3.2 Assessment of operational air quality effects

The Project will result in a reduction of general traffic and heavy vehicles on key arterial and local roads including Neilson Street, Church Street, Onehunga Mall, Mt Smart Road, Mt Wellington Highway, Favona Road and Mahunga Drive. Reduced traffic on these roads will reduce vehicle emissions and improve air quality in the immediate environment. The redistribution of air quality from the removal of heavy vehicles from local roads in residential areas will have positive effects where there are a high number of sensitive receives (e.g. schools). Increases in traffic are predicted on the strategic routes such as SH20, SH1 and Sylvia Park Road. This increase is due to improved access diverting traffic away from residential and commercial areas. Further details of the traffic and transport changes resulting from the Project are set out in *Section 12.2: Traffic and Transport* of this AEE and in *Technical Report 1: Traffic and Transport Assessment* in *Volume 3*.

There are currently large volumes of heavy vehicles on the local road corridors connecting to SH1 and SH20. The congestion accessing the State highways is a notable factor influencing vehicle emissions both in the Project area and in the wider environment. Heavy vehicles are proportionally much higher emitters of pollutants than light vehicles. Of relevance for local roads is that, generally, reduced traffic movements equate to reduced emissions.

The Project will result in a redistribution of heavy vehicle traffic throughout the Project area and there is predicted to be a reduction in traffic on some local roads and an increase in others. The roads predicted to experience an increase in traffic are primarily within areas of industrial/commercial land use and minimal residential land use. Generally, increasing speed and reducing congestion in turn reduces emissions of PM_{10} and NOx. Increases in these emissions as a result of increased traffic on some local roads is assessed as being low with overall effects being negligible.

Operation of the Project is forecast to slightly increase emissions of NO_X and PM_{10} on the existing State highways with the Project, while significant reductions are predicted throughout the Onehunga-Penrose area and to a lesser extent in Māngere Bridge and Ōtāhuhu.

Figure 12-17 and Figure 12-18 show the redistribution of the concentration of heavy vehicle traffic, where green represents a reduction and red an increase (i.e. reflecting the location of the proposed Project).

Figure 12-17: Change in PM10 emissions (grams/day) with Project in 2026

Figure key: Increase Decrease

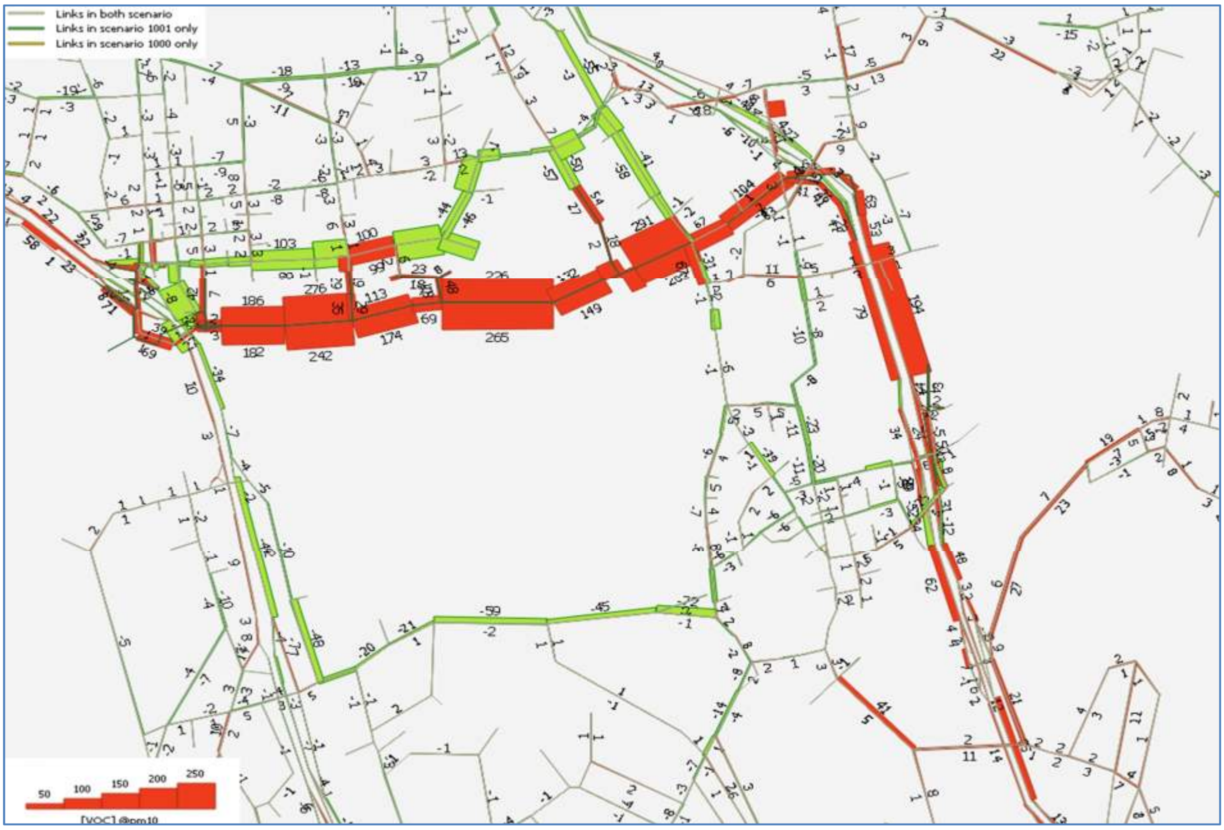
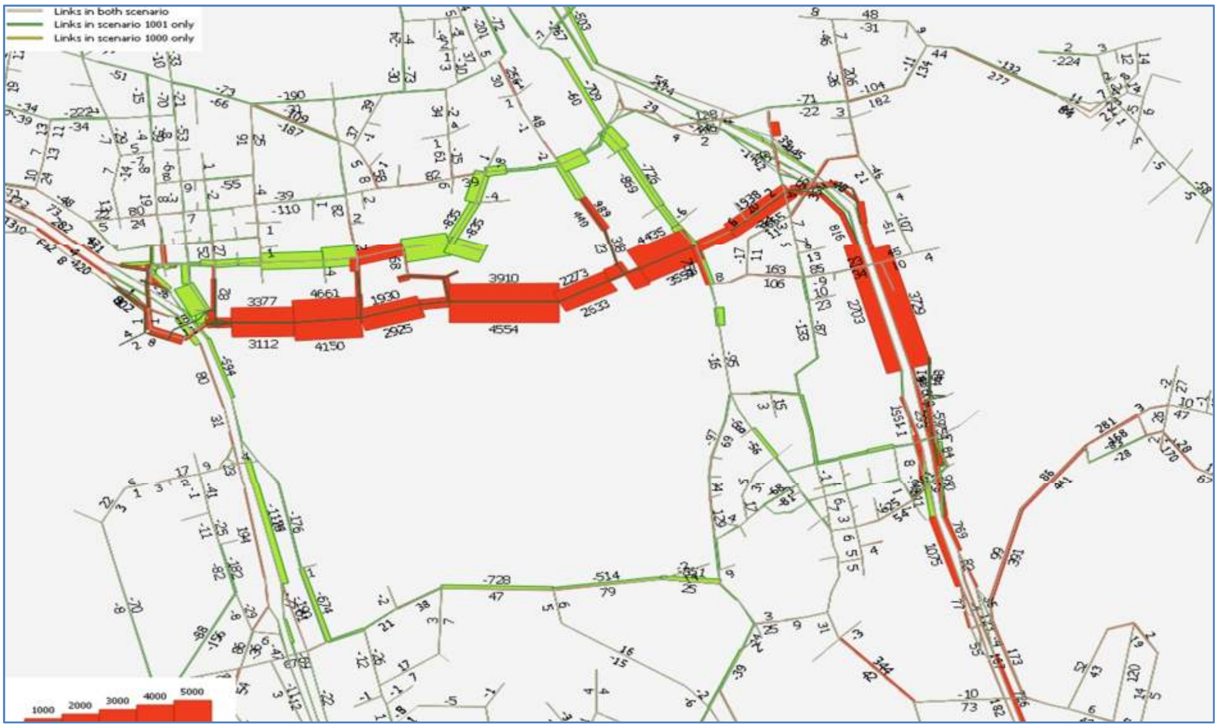


Figure 12-18: Change in NOx emissions (g/day) with the Project in 2026



Modelling indicates air quality improvements to a wider area than the direct Project area. As a result, sensitive activities located near existing busy roads will benefit from a reduction in vehicle emissions. Of note are a number of schools and early childhood centres which are adjacent to roads which will benefit from less traffic and congestion in the future. These are (as illustrated on Figure 12-18):

- Onehunga Primary School – 122 Arthur Street;
- St Joseph's School –125 Church St;
- Ōtāhuhu Intermediate School – 22 Luke St;
- Ōtāhuhu Primary School – 41 Station Road; and
- Te Papapa School – 219 Mt Smart Road.

There are other schools and childcare centres located within the wider Project area, however, these do not received the same benefit. These are:

- Young and Amazing – Mays Road;
- Piccolo Park – Mt Wellington Highway; and
- Waipuna Preschool Centre – Carbine Road.

The sectors of the Project that contain the most sensitive receivers are Sector 1 (Neilson Street Interchange) and Sector 5 (SH1 – Panama Road to the Princes Street Interchange). These areas already experience high traffic volumes and a number of houses are located close to existing roads. For these areas, the modelling indicates that cumulative concentrations from the operation of the Project, alongside the existing environment, are unlikely to exceed relevant operational air quality standards. However, people living in close proximity to SH1 will have a slight increase in exposure to vehicle-related contaminants. SH1 roadside PM_{10} concentrations are modelled to increase by 0.9 - 1.5 µg/m^3 and NO_2 concentrations by 2.6 - 4.0 µg/m^3. The cumulative concentration of NO_2 is predicted to slightly exceed the annual guideline in 2026 for one of the Project scenarios that has been modelled. As the screening model is highly conservative, it is considered unlikely that the increase in pollutants arising from vehicle traffic due to the Project in this location will exceed any of the relevant air quality standards or guidelines.

Significant reductions in vehicle emissions are predicted throughout Onehunga, and to a lesser extent Ōtāhuhu and Māngere Bridge.

All other contaminant levels will be compliant with the air quality standards.

Overall the operational air quality will be improved as a result of the Project, except for a few localised spots where the guidelines may be approached or exceeded, and the effects will be negligible.

12.12.3.3 Measures to avoid, remedy or mitigate potential adverse effects

The Transport Agency already undertakes monthly monitoring, using NO2 passive samplers at over 120 sites across the State highway network. The monitoring occurs at a variety of potential sensitive locations near State highways, including dwellings and schools. Where necessary, the Transport Agency responds by promoting projects to reduce emissions, optimising operations on the State highway and using information and technology to assist motorists with travel choices.

12.13 Construction traffic

Overview

The Project will have significant positive traffic and transport effects overall, however construction of the Project will result in some temporary adverse effects on road users arising from the required working spaces, the resulting temporary road layouts and increased heavy construction vehicles using existing state highways and local roads during construction. Construction activities will also require closure of some footpaths, pedestrian crossings, road shoulders, cycle lanes and traffic lanes as well as implementation of temporary speed limits resulting in travel time delays and effects to some property accesses.

The construction methodology for the Project has been developed to avoid adverse effects as far as practicable. Remaining effects can be managed by implementing appropriate and considered temporary traffic management during construction. There is established industry best practice for the safe and efficient management and operation of temporary traffic management during construction. This focuses on planning and implementing temporary traffic management safely, minimising disruption and inconvenience for road users and adjoining residents and businesses, and avoiding unnecessary disruption and cost by considering scheduling of construction works and activities.

Temporary traffic management will be implemented through a Project Construction Traffic Management Plan Framework (CTMPF) which will be supported by more detailed planning for specific sites or activities.

12.13.1 Introduction

This section presents the findings of investigations undertaken to determine the potential construction traffic effects of the Project. The assessment is supported by *Technical Report 10: Construction Traffic Impact Assessment* in Volume 3 including a draft CTMPF for the Project.

The Transport Agency's *Traffic Control Devices Manual* (2008) provides guidance on industry good practice for construction traffic, including, where necessary, regulatory requirements in relation to the use of traffic control devices. The primary standard, which forms part of the manual for planning, coordinating and implementing temporary traffic management during construction of the Project is the *Code of practice for temporary traffic management* (COPTTM). The Transport Agency's COPTTM describes best practice for the safe and efficient management and operation of temporary traffic management on all roads in New Zealand. COPTTM includes practices for the development of Temporary Traffic Management Plans for all roads in New Zealand and outlines requirements and guidelines for temporary traffic management.

The Transport Agency is the road controlling authority for all state highways including the motorways in Auckland. The Auckland Motorway Alliance (AMA) operates and maintains the Auckland State highway network on behalf of the Transport Agency. For this reason, all traffic management activities affecting the state highways associated with construction of the Project will require approvals from the AMA.

Auckland Transport is the road-controlling authority for all local roads within Auckland. All works and traffic management activities affecting the local road corridor will need to be approved by Auckland Transport through the Corridor Access Request application process. The Corridor Access Request process is set out in Section 26 of the Auckland Transport Code of Practice, and requires applications to comply with the following key requirements:

- Plan and implement temporary traffic management safely in accordance with the requirements in COPTTM;
- Minimise disruption and inconvenience for road users and adjoining residents and businesses; and
- Avoid unnecessary disruption and cost through conflicts in the timing of works and activities.

COPTTM and Auckland Transport Code of Practice are the two overarching documents that will be used to inform planning and implementation of any temporary traffic management activities required for the construction of the Project.

12.13.2 Methodology for assessing effects

The assessment of temporary traffic effects is primarily based on traffic engineering first principles and has been supported by traffic modelling. The traffic models (as discussed in *Section 12.2: Traffic and transport* of this AEE) were designed primarily for future forecasting of steady state and normal operating conditions but have been used to inform the construction traffic effects assessment noting that temporary traffic also consists of discrete and highly variable circumstances which traffic models cannot always accurately respond to. The modelling covers an area from Mt Albert Road and Greenlane in the north (across SH20 and SH1 respectively) to Manukau City Centre in the south. Details of the model development, calibration and validation are detailed in the Traffic Modelling Report attached to *Technical Report 1: Traffic and Transport Assessment* in Volume 3.

Two modelling scenarios were used to assess the temporary construction traffic effects of the Project:

- The 2017 Do-Minimum (includes opening of the Waterview Connection); and
- The 2026 Do-Minimum (includes the Waterview Connection but excludes the Project).

Construction of the Project is estimated to take place between 2018 and 2025, following the opening of the Waterview Connection scheduled in early 2017. The opening of the Waterview Connection itself is a significant change to the wider road network in Auckland which presents additional considerations for traffic effects of the Project.

While traffic data has been collected for the existing traffic conditions (at the time of preparing this AEE), these were not considered to be an appropriate representation of the base case conditions as the Waterview Connection has yet to open. The 2017 traffic model has been used to represent the base case for the initial year of construction (2018) due to the similarity in the year of representation and more importantly because it captures the Auckland road network after the Waterview Connection is open.

On the other end of the construction programme spectrum, the 2026 traffic model has been used to represent the final year of construction again because of similarities in the year of representation and because the effects of the Waterview Connection are represented.

Both the 2017 and 2026 traffic models include the additional auxiliary lanes on SH20 in both directions (between Queenstown Road and Neilson Street Interchanges) to reflect the early works programme currently scheduled for completion by early 2017.

12.13.3 Existing traffic environment

The description of the existing traffic and transport environment is included in *Section 11.0: Description of the Existing Environment* of this AEE. Further details on the existing environment, methods and findings of transport investigations are contained in *Technical Report 10: Construction Traffic Impact Assessment* in *Volume 3*.

12.13.4 Assessment of construction traffic effects

An assessment of the traffic effects expected during construction of the Project has been undertaken based upon the construction methodology set out in *Section 7.0: Construction of the Project* of this AEE. This construction methodology is indicative and will be subject to detailed design and confirmation by a Project construction contractor(s).

During construction, reduced speed environments, detours, narrowing or closure of lanes and temporary traffic signalling may result in temporary traffic impacts on the road network. These impacts include:

- Impacts on capacity of existing carriageways through shoulder/lane narrowing, realignment and temporary speed limits;
- Temporary closures of existing carriageways though lane/ramp/intersection closures and detours, temporary speed limits;
- Impacts arising from site access locations and movements through site access from a local road or motorway and escorted entry/exit manoeuvres;
- Impacts on public transport provision through traffic management and bus stop closures/ relocations;
- Impacts on pedestrians, cyclists, and mobility routes or crossings through footpath and cycleway closures/detours/realignments;
- Impacts on property access, parking, and manoeuvring through removal of roadside car parking, construction of temporary property access and reduction/closure of site manoeuvring areas;
- Possible damage to local roads; and
- Inconvenience from traffic management measures including changing road layouts at intersections and localised congestion.

Associated traffic nuisance effects including dust, fumes, noise and vibration are assessed in Sections 12.12 and 12.11 respectively of this AEE.

12.13.5 Effects on each sector across the Project Area

The following sections set out the anticipated traffic effects expected for each of the sectors during construction of the Project.

12.13.5.1 Sector 1 (Neilson Street Interchange)

The following effects have been identified which are specific to Sector 1:

- Simultaneous works on SH1 and SH20 have the potential to reduce wider network resilience due to reduced capacity on both motorway corridors at the same time;
- Reconstruction of the on/off-ramps at the Neilson Street Interchange could affect traffic access to and from the Onehunga area;
- Site access and egress points on SH20 have the potential to impact on traffic flows on the motorway mainline. The exact location and number of these access points will need to be confirmed by the construction contractor once the construction methodology has been confirmed in consultation with the Transport Agency as the road controlling authority;
- Construction may affect access to some private properties;
- Diversion of motorway routes have the potential to affect residential areas. However, diversions would be limited to non-local roads at non-peak times and at times of low traffic flow as far as practicable; and
- Road closures have the potential to create traffic effects at times of high traffic flows. However, these will be limited to non-peak times (such as overnight) as far as possible.

12.13.5.2 Sector 2 (Māngere Foreshore)

The following effects have been identified which are specific to Sector 2:

- The construction of the foreshore embankment will require the closure of the Manukau Foreshore Walkway for pedestrians and cyclists. Alternative routes will be required for cyclists and pedestrians while the path is closed. These routes may include staged sections of the new foreshore walkway or temporary local road routes developed in consultation with Auckland Transport.

12.13.5.3 Sector 3 (Anns Creek)

The following effects have been identified which are specific to Sector 3:

- An increase in construction traffic movements around Great South Road and Sylvia Park Road to and from the proposed site yards without appropriate restrictions (such as turning movements) may result in adverse effects on the operation of the intersection;
- Temporary change in the configuration of the intersection layout at Great South Road and Sylvia Park Road. The final temporary intersection layout during construction will need to be confirmed in consultation with Auckland Transport and the Auckland Transport Operations Centre;
- Temporary lane closures and closure of the Great South Road/Sylvia Park intersection will be required to the facilitate the construction of the EWL/Great South Road/Sylvia Park Road intersection. Such closures will occur at night with appropriate diversion routes provided;
- Temporary closure of the footpath on the western side of Great South Road, eastern side of Sylvia Park Road and the Manukau Foreshore Walkway. Alternative provision for pedestrians and cyclists will be provided in consultation with Auckland Transport and Auckland Transport Operations Centre;
- Temporary delays to bus routes around Great South Road and Sylvia Park Road intersection due to construction works. The implications of the works at the intersection will be co-ordinated with Auckland Transport Metro;
- Temporary closure of freight rail lines servicing MetroPort and passenger lines on the southern rail line at Great South Road will be required during construction. Replacement rail bus services for passenger trains will also be required. The implications of the works at the intersection will be co-ordinated with MetroPort, KiwiRail and Auckland Transport Metro;
- Access to some of the properties on Hugo Johnston Drive, Sylvia Park Road and Great South Road will be affected during construction. Some secondary property access points may require closing during construction periods. Temporary property accesses will be constructed where necessary with some restricted traffic movements; and
- Parking will be temporarily removed from parts of the southern end of Hugo Johnston Drive during construction.

12.13.5.4 Sector 4 (Sylvia Park Road and Mt Wellington ramps)

The following effects have been identified which are specific to Sector 4:

- Access to some private properties along Sylvia Park Road will be affected; and
- Increase in delays around the Mt Wellington Highway/Sylvia Park Road intersection during construction.

12.13.5.5 Sector 5 (SH1, Panama Road and Princes Street)

The following effects have been identified which are specific to Sector 5:

- Potential for cumulative traffic effects if there are simultaneous works on the SH1 mainline at the Mt Wellington Interchange and the Princes Street Interchange;
- Simultaneous works on SH1 and SH20 have the potential to reduce network resilience due to reduced capacity on both corridors if not scheduled to minimise this effect;
- Reconstruction of the Panama Road Bridge could affect local access and buses. The bridge will need to be kept open to traffic, at least as a single lane, due to the bus route along Panama Road and the local access function across the motorway performed by the bridge. To safely operate the Panama Road Bridge as a single lane with shuttle working, temporary signals will be required. Manual operation of the signals at peak times would minimise delays for buses;

- Site access and egress points on the motorway have the potential to affect traffic flows on the motorway mainline. These access points will need to be co-ordinated across the Project with appropriate sight lines and signage provided to guide construction traffic and advise general motorists of the access/egress points;
- Construction may impact access to some private properties;
- Diversion routes from the motorway have the potential to affect residential areas. Where possible and practicable, non-local roads will be used for diversion of traffic; and
- Road or lane closures have the potential to affect motorists.

12.13.5.6 Sector 6 (Local roads)

The following effects have been identified which are specific to Sector 6:

- Construction may affect access to some private properties.

12.13.6 Site offices and construction access locations

Construction yards have been identified for the Project. These are set out in *Section 7.0: Construction of the Project* of this AEE. Construction traffic accessing the construction yards has the potential to generate adverse effects in the form of nuisance effects from increased traffic, congestion, queuing around the access points and increased degradation of the local road surface. Potential measures to reduce, or better manage, construction traffic numbers are set out in the draft CTMPF and include carpooling and minibuses for worker transport, active management of shift changeovers, and awareness of and planning around traffic peak periods including school hours. Mitigation measures are set out further in the sections below.

The effect of light and heavy vehicles travelling to and from site offices will be minor, and is able to be accommodated within the existing road network.

When the construction method is developed further, the exact location of construction site offices will be confirmed through the process of finalising the CTMPF. This process is discussed further in *Section 13.1: The Project Delivery Framework* of this AEE.

12.13.7 Measures to avoid, remedy or mitigate potential adverse construction traffic effects

The traffic and transport assessment set out in *Section 12.2: Traffic and transport effects* of this AEE has identified a range of significant benefits arising from the operation of the Project. During construction there will be adverse effects, primarily of a temporary nature. The following section outlines the measures which have been identified to avoid, remedy or mitigate actual and potential adverse construction traffic effects.

The general approach to mitigating adverse construction traffic effects has been to develop a Project construction methodology to avoid adverse effects as far as practicable. A summary of the actual and potential effects and the general methods to avoid, remedy or mitigate effects from construction traffic and traffic management is provided in Table 12-16. Location specific measures are provided in Table 12-17.

Table 12-16: Proposed methods to manage construction traffic effects

Project activity	Impact	Typical Mitigation Measures
Footpath closure/detour	• Inconvenience to pedestrians and residents along route • Disconnection of access to bus stops • Increased exposure of pedestrians to traffic	• Letter drops to affected residents in advance of works in the area • Provision of warning and advisory signage prior to and during the closure • Provision of pedestrian crossings and refuges or controlled crossing points • Advice to interested parties/stakeholders of closures in heavily trafficked areas • Provision of convenient pedestrian detour routes well in advance of the closure to provide safe and convenient crossing • Provision of temporary pedestrian access to property within the construction corridor
Pedestrian crossing closure	• Inconvenience to pedestrians • Reduced safety by removing access to existing crossing points	• Letter drops to affected residents in advance of works in the area • Provision of warning and advisory signage prior to and during the closure • Project ambassadors to advise of closures in heavily trafficked areas • Provision of convenient pedestrian detour routes well in advance and at the closed crossing to provide safe and convenient crossing • Installation of warning signage for road users to warn of crossing location changes where necessary
Cycle lane closures/path closures/detours	• Inconvenience to cyclists along route • Increased exposure of cyclists to traffic • Reduced safety	• Letter drops to affected residents in advance of works in the area • Provision of convenient detour routes well in advance of the closure to provide safe and convenient cycle routes • Consider temporary minor works to better support the safety of cyclists on detour routes • Install signage adjacent to the cycle lane prior to construction commencing to allow cyclists to alter their travel patterns • Install warning signage in advance of shoulder closures to alert motorists of cyclists • Install a temporary speed limit
Property access closures	• Inconvenience to residents and businesses along route	• Personal visit by Project team members to advise and discuss impacts of the closure with affected residents and businesses • Letter drops to affected residents and businesses in advance of works in the area • Provision of temporary car parking in an area within the length of the traffic control site • Provision of metal-plate crossings into properties where feasible and safe • Scheduling of works during holiday or low-demand periods of the year

Project activity	Impact	Typical Mitigation Measures
Shoulder closures	• Reduced safety • No room for incident management, breakdowns etc. • Increased severity of recurrent and non-recurrent congestion	• Install a temporary speed limit • Install signage in advance of shoulder closure
Lane closure - alternating flow operation Lane closure - contra-flow operation Lane closure - one-direction closure	• Inconvenience to road users • Reduced traffic capacity through site as a result of: • Fewer lanes than existing corridor • Increased side-friction resulting from narrowed lanes and reduced shoulders • Construction activities visible to motorists resulting in 'rubber necking' • Reduced capacity across a link due to stop-go operations • Diversion of traffic away from the closure onto inappropriate routes such as residential streets, past schools or other sensitive facilities • Disconnection of bus routes • Disconnection of access to bus stops	• Public notification in appropriate media channels, where necessary • Letter drops to residents and/or businesses (where necessary), which are located within the closure length or along detour routes • Installation of concrete/water-filled barriers along site to isolate the site from public • Installation of sight screens to reduce 'rubber necking' • Installation of secondary detour routes where necessary • Review and optimisation of traffic signals on detour and alternative routes where necessary • Use of VMS for recommending alternative routes. Where possible, alternative routes will be recommended at a cordon around the closure, well in advance, in such a way to avoid traffic following the prescribed detour route where an alternative is a more convenient route to their intended destination. Install such signage in advance of the closure (i.e. a month prior, to inform road users) • Provision of access via a temporary corridor or narrow lane within the closure for residents and businesses within construction corridor, where possible

Project activity	Impact	Typical Mitigation Measures
Road closure/detours	• Inconvenience to road users • Inconvenience to residents and businesses within closed road segment • Congestion on detour routes • Congestion on alternative routes • Diversion of traffic away from the closure onto inappropriate routes such as residential streets, past schools or other sensitive facilities • Disconnection of bus routes • Disconnection of access to bus stops	• Personal visit by Project team members to advise and discuss impacts of the closure with affected residents and businesses; • Public notification in appropriate media channels, where necessary • Advertising on radio or through internet where necessary • Letter drops to residents and/or businesses (where necessary), which are located within the closure length or along detour routes • Installation of secondary detour routes where necessary • Use of Variable Messaging Signs for recommending alternative routes. Where possible, alternative routes will be recommended at a cordon around the closure, well in advance, in such a way to avoid traffic following the prescribed detour route where an alternative is a more convenient route to their intended destination. Install such signage in advance of the closure (i.e. a month prior, to inform road users) • Scheduling of works during holiday or low-demand periods of the year • Staging of works to require night time or weekend full-closures only (with consideration of any night works restrictions identified in *Section 12.11: Noise and Vibration* of this AEE. • Consultation with the Transport Agency / Auckland Transport / Auckland Transport Operations Centre to develop detour routes and minimise bottle-necks on detours • Provision of barricades on the approaches to the closure to prevent public access and visibility to activities within the site • Extension of closures to intersections with arterial routes with access to residents only on the approaches to the works • Provision of access via a temporary corridor or narrow lane within the closure for residents and businesses within construction corridor, where possible • Review and optimisation of traffic signals on detour and alternative routes where necessary
Short term closures for installation of long-term closures / traffic control measures	• Congestion through closure as discrete closures are required for installing long-term (i.e. greater than 24 hour) closures	• Installation of long term work sites that require temporary barriers etc. to occur during night time or off-peak periods

Project activity	Impact	Typical Mitigation Measures
Site access	• Truck movements reducing traffic capacity through a closure; • Reduced traffic safety due to truck manoeuvring in or out of the closure; • Impact on capacity of access routes arising from higher proportion of trucks • Increased traffic on access routes resulting in congestion and increased travel times	• Provision of site accesses at the end of the closure only • Development and distribution of site access plans which specify permitted access movements, times and procedures • Limiting site access movements / plant deliveries to off-peak periods or night time • Avoid peak traffic flow periods where possible • Optimise intersection arrangements and signal phasing at site access points to maintain efficiency
Temporary speed limit	• Inconvenience to road users • Slower operating speeds • Potential non-compliance with speed limit	• Public notification in appropriate media channels, where necessary • Monitor and review use of Temporary Speed Limits to ensure the speed limit is appropriate for the environment • Speed controlling measures may be put in place, such as lane narrowing or introduction of horizontal curves

Table 12-17: Proposed methods to manage location specific construction traffic effects

Project activity	Impact	Mitigation Measures
Simultaneous works on both directions of Neilson Street Interchange	• Affect traffic access to and from the Onehunga area	• Consider programming the works to minimise traffic management at the interchange • If ramps are required to be closed this should occur as discrete night time closures
Simultaneous works on SH1 and SH20	• Reduced network resilience on both corridors	• Consider scheduling works to avoid works being undertaken simultaneously on SH1 and SH20
Simultaneous works at Mt Wellington Highway and Princes Street Interchange	• Inconvenience to road users	• Consider programming the works to minimise cumulative traffic management effects
Temporary changes to the intersection layout and closures of the Great South Road and Sylvia Park Road intersection	• Inconvenience to road users	• Consult with Auckland Transport and Auckland Transport Operations Centre to confirm the desired layout of this intersection during construction • Where possible, retain existing number of lanes at intersection • Provide advanced notice and publicity of closures at the intersection via a number of different methods. • Provide a pedestrian crossing across the northern arm of Great South Road
Works on Hugo Johnston Drive	• Some parking will be temporarily removed on Hugo Johnston Drive during construction	• Advanced notice will be given to businesses and motorists to make alternative arrangements.
Reconstruction of the Panama Road Bridge	• Potential affect to local access and bus movements.	• Works should be programmed and staged to retain access across the motorway at Panama

Project activity	Impact	Mitigation Measures
		Road. As a minimum, the bridge should be kept open to traffic as a single lane • Operation of any temporary signals on Panama Road should be performed manually, particularly at peak times
Site access and egress points on SH1 and SH20	• Potential to affect traffic flows on the motorway mainlines	• These access points will need to be co-ordinated across the Project with appropriate sight lines and signage provided to guide construction traffic and advise general motorists of the access/egress points • The contractor will need to confirm details of access points once the construction methodology has been developed in consultation with the Transport Agency as the road controlling authority

12.13.8 Construction Traffic Management Plan Framework

The draft CTMPF contained as Appendix A of *Technical Report 10: Construction Traffic Impact Assessment* in Volume 3 provides an outline for how the management of construction traffic effects will be developed during construction of the Project. The draft CTMPF has been prepared based on the indicative construction methodology set out in *Section 7.0: Construction of the Project* of this AEE. It details the standards to be adhered to, identifies the objectives in developing plans for specific sites or activities and the issues that must be considered, and how the effects of traffic management methods, and construction traffic on local roads could be managed during construction. Key team members' roles and responsibilities are also included. The final traffic management methodology will be determined by the contractor appointed to undertake the works, and the draft CTMPF submitted with this AEE will be reviewed, expanded and finalised to reflect the adopted methodology. The process for finalising the CTMPF (to become the Project CTMP) and the specific matters to be addressed are set out in *Section 13.1.5j: Construction Traffic Management Plan Framework* of this AEE.

During construction, the Project's CTMPF will be supported by a number of more detailed plans prepared to provide further details for specific sites or activities. The site or activity specific Traffic Management Plans (TMPs) will be produced on a case-by-case basis and approved by Auckland Transport for works on local roads and AMA for works on State highways.

The implementation of these measures through the Project CTMP and the TMPs will appropriately manage the construction traffic effects from the Project.

12.14 Social effects

Overview

The planning, construction and operation of the Project has the potential to generate both positive and adverse regional and local social effects. Overall the key regional and local effects are positive, a summary of the effects includes:

Regional effects

The key regional benefits relate to transport and accessibility, health and sustainability and growth and development of the area. Positive local social effects will arise from improved access to local facilities, improved amenity and access to the foreshore, opportunities for recreational development and impacts on health and well-being of communities.

Local effects

Particular social effects assessed as part of the construction and operation of the Project include:

- Quality of the living environment and amenity;
- Social cohesion;
- Material well-being; and
- Culture and identity.

There are both positive and adverse social effects identified during construction of the Project. The positive effects include a potential increase in local trade from construction workers, an opportunity for local residents to be employed on the Project and an opportunity for the community to be involved in delivery of Project elements. The identified adverse social effects during construction including traffic disruption, noise, dust and changes in access and will be mitigated by the implementation of measures within the CEMP, other measures included in the suite of management plans including a communications plan which will be crucial for managing potential effects.

The operation of the Project will result in a number of positive social effects including the removal of traffic on local roads, improved streetscape amenity, acoustic barriers adjoining residential properties in already noisy environments and improved access to local community facilities and public open space. Adverse social effects include reduced amenity from new road connections, loss of some community services and potential loss of jobs due to acquisition of business land and acquisition of residential housing.

Overall there are a number of recommendations proposed to avoid, remedy and mitigate potential effects and to realise the potential positive effects. These include a stakeholder management and communications plan, setting up of Community Liaison Groups (CLGs) or other groups, early property acquisition strategies, working in partnership with other groups to deliver benefits (such as a walking and cycling connection across Ōtāhuhu Creek, and new recreation facilities at Waikaraka Park) and recognising employment opportunities for the local community.

12.14.1 Introduction

This section provides an assessment of the Project in relation to social effects. An assessment of social effects focuses on the experiences (actual or anticipated, direct or indirect) of individuals, families/households or communities in response to changes brought on by the Project. There are both positive and adverse social effects of the Project on both a regional and local scale and these are experienced over the three Project phases of planning, construction and operation.

This section has been informed by *Technical Report 11: Social Impact Assessment* in Volume 3 as well as a number of relevant technical assessments and the assessment sections in other sections of Part G of this AEE.

12.14.2 Social Impact assessment framework and methodology

The social impact assessment has used the Transport Agency's Draft *Guide to Assessing Social Impact for State Highway Projects*[75] (the SIA Guide) as a basis for identifying and assessing the potential social effects of the Project. It also recognises the International Association for Impact Assessment definition and principles that should be considered when looking at social effects. The SIA Guide outlines a number of potential effects including way of life, cohesion, biophysical environment, quality of the living environment and amenity, family/social networks, health and well-being, material well-being, fears and aspirations, culture and identity and the political system. It also recognises the importance of considering social impacts from changes to transport patterns and movements for active transport, public transport and private vehicles.

The key regional and local social effects[76] related to the Project which are identified in *Technical Report 11: Social Impact Assessment* in *Volume 3* and outlined in Table 12-18 include:

Table 12-18: Regional and social effects of the Project

Social effects	Meaning
Regional	
Transport, accessibility and connectivity	The benefits through increased transport choice and connectivity to the rest of the Auckland Region.
Culture and heritage	The benefits through wider recognition of regionally significant heritage, geological and cultural features in the Project area.
Growth and development	The benefits that can be realised as part of the Project relating to growth and development, including the potential for new jobs to be created and existing ones to be retained.
Health and sustainability	The potential benefits the Project can realise in relation to the health of people through provision of active transport infrastructure.
Local	
The quality of the living environment and amenity	The 'sensory' impacts on people from construction and operation of the Project (i.e. noise, visual and air quality.;
Social cohesion	Access to community facilities and potential meeting places for locals such as public spaces or recreational transport routes. It also relates to stability of an area (e.g. a reduction/increase in crime or loss of community members) and impacts on services available to people.
Material wellbeing	Impacts on private properties, employment opportunities and access/accessibility i.e. changes to transport patterns and movements.
Culture and identity	Impacts on the distinctiveness or unique values of a place and any important cultural sites/values experienced there.

[75] Transport Agency, *Guide to Assessing Social Impact for State Highway Projects, October 2015.*

[76] It is noted there are other social effects outlined in the Transport Agency Guide and recommended in other literature / social impact assessments, however not all are relevant. These are screened in Appendix A of *Technical Report 11: Social Impact Assessment*.

The methodology used to assess the social effects for the Project is summarised in Figure 12-19. A slightly altered methodology was used for the assessment of the grade separated Great South Road Intersection. This is described in *Technical Report 11: Social Impact Assessment Supplementary Assessment.* This is described in more detailed in *Section 3* of *Technical Report 11: Social Impact Assessment* in *Volume 3*.

Figure 12-19: Methodology used to assess social effects

12.14.3 Existing social environment

A local study area has been established for the purposes of profiling the existing environment and for assessing the local social effects associated with the Project. The local study area is based on surrounding Census Area Units which are shown in Figure 12-20 below.

Figure 12-20: Local social impact study area and relevant CSU

For the purpose of assessing specific local effects, the study area has been broken down into three community areas as showing in Figure 12-20. These are discussed below.

12.14.3.1 Community Area 1: Onehunga

Community Area 1 covers the suburb of Onehunga. Onehunga is a light industrial and residential suburb located on the northern edge of the Manukau Harbour with a port and the area is 10km from the CBD. There are 4,341 occupied dwellings recorded in the community area. The majority of residential dwellings are located north of the Onehunga Town Centre with some on Onehunga Harbour Road.

Onehunga has some heritage housing, parks, a swimming pool and gym centre, community centre with library and a number of churches and schools. In recent years Onehunga has catered towards light industrial and commercial activities. Dress Smart is a notable large-scale retail outlet. Onehunga Mall, the main street, has cafes, convenience stores, retail, a police station and fire station. There are a number of recreational areas including Gloucester Park and Taumanu. The upper part of Onehunga Town Centre (north of Arthur Street) has had recent streetscape upgrades. Business interest in this area are represented by the Onehunga Business Association.

The suburb of Onehunga has a less demographically diverse community compared to the rest of the study area. The suburb is somewhat severed by SH20 (between Onehunga and Old Māngere Bridge, which used to be the local road bridge) although there is still some connectivity between these communities (e.g. the local school roll indicates students from Old Māngere Bridge go here and that people travel to Onehunga from Māngere Bridge, especially for the Countdown supermarket). Panuku Development Auckland has identified Onehunga as a ‘transformation area’ and will acquire the balance of land not needed for the Project at the Onehunga Wharf for an urban renewal project.

The land requirements that have potential social impacts include: the temporary occupation of land for construction (including an area of the Onehunga Wharf), and the permanent impact on business land (including the full purchase of land on Gloucester Park Road and Galway Street).

12.14.3.2 Community Area 2: Te Papapa, Penrose and Mt Wellington

Community Area 2 covers the suburbs of Te Papapa, Penrose and Mt Wellington (to the north of Panama Road Bridge).

Te Papapa contains a mix of residential and industrial land uses, many are located on land that was historically reclaimed from the Māngere Inlet and there are old landfills. Penrose and Mt Wellington have predominantly commercial, light and heavy industry area land uses, with a relatively small residential population compared to the rest of the study area. The Onehunga rail line runs through Te Papapa and Penrose and through to Onehunga its final station. This was the first government-funded railway line in New Zealand. The industrial and residential properties in the area are primarily accessed via Neilson Street and Church Street, which provide the existing east west movements from the state highway network. There is an active Penrose Business Association.

This part of Mt Wellington has primarily commercial and industrial uses, with some large lot sizes containing light industry/commercial uses and large format retail including Sylvia Park Shopping Centre.

Key social environments include the Manukau Foreshore Walkway and the Waikaraka Cemetery and Park. The existing Mt Wellington Interchange provides key access onto SH1 north and south and links to Sylvia Park Road and Mt Wellington Highway. The suburb of Sylvia Park, the Sylvia Park Town Centre and wider community are also serviced by the eastern train line with stations at Sylvia Park that links to Britomart to the north and Ōtāhuhu and eventually Pukekohe to the south.

The land occupation/acquisitions relevant to potential social impacts include:

- The permanent acquisition (with replacement) of recreation land which currently provides the Manukau Foreshore Walkway and a smaller area of future reserve expansion land at Waikaraka Park);
- The temporary occupation of the southern area of Waikaraka Park; and
- The temporary and permanent land requirements from Ports of Auckland (relating to the disruption to businesses and employees), and other business land (primarily along Sylvia Park Road).

12.14.3.3 Community Area 3: Mt Wellington and Ōtāhuhu

Community Area 3 includes the suburbs of Mt Wellington south and Ōtāhuhu. The area to the north is the residential area of Mt Wellington, around the Panama Road Bridge. Ōtāhuhu is a mix of industrial / commercial uses to the west and primarily residential dwellings to the east. The suburb is accessed via SH1, through the existing Princes Street Interchange. The key public reserves in the area are Bedingfield Memorial Reserve and Seaside Park. The area is zoned for Ōtāhuhu College and contains a number of other early childhood, primary, intermediate and secondary education facilities.

Ōtāhuhu has been identified as one of the 10 priority areas for development in the region in the Auckland Plan and an area that is signalled for growth in the future (e.g. it has been identified as a Special Housing Area and has been up-zoned in the AUP (OP)).

The land occupation/acquisitions with potential social impacts in Community Area 3 include*:*

- The requirement to purchase 15 residential properties in entirety;
- Partial acquisition of 47 residential properties;

12.14.4 Assessment of regional social effects

The potential regional social effects from the Project relate to:

- Transport, accessibility and connectivity;
- Culture and heritage;
- Growth and development (including population and economic growth); and
- Healthy and sustainable communities.

These regional social effects are significantly positive. The key regional effect relating to transport will be an increase in transport choice and reduce travel times, therefore making it easier for local community members to access services and facilities in the wider Auckland Region. The upgrades to existing interchanges will result in more predictable travel times for all transport modes and less congestion. *Technical Report 11: Social Impact Assessment* in Volume 3 outlines the population growth that is projected for Auckland and *Part A: Introduction and background* of the AEE outlines the importance of the local study area for its economic contribution to the region. The Project will provide for growth and development in the area (both business and residential growth) by providing more effective transport connections. In addition, the Project design does not preclude the future development of a mass transit link to the Auckland Airport.

The Project also has the potential to deliver significant benefits to the wider region through recognition of cultural, heritage and physical features within the Project area. These features include volcanic, geological and sites of cultural significance to Mana Whenua such as Te Hōpua and Anns Creek lava flow remnants. There are also potential opportunities to facilitate healthy and sustainable communities by offering good quality active transport connections and improvements to public transport options.

The Project also provides for an increased potential for community health benefits as a result of the Project as through providing improved cycling and walking facilities it will encourage the use of active modes (walking and cycling), by the provision of these facilities.

12.14.5 Assessment of local social effects

The Project is a project of national significance and a key transport project for Auckland (Directive 13.5 of the Auckland Plan), however the Project will result in some adverse social impacts in the local area, particularly during construction. The following are described as potential social effects (both positive and negative) arising from construction and operation activities:

- Quality of the living environment and amenity;
- Social cohesion;
- Material well-being; and
- Culture and identity.

The social effects are the ‘human’ experiences of other impacts, the effects of which are explained in other assessment sections and within the associated technical reports. The following section outlines the actual and potential social effects for the construction and operational phases of the Project with a particular regard to the people/communities who may experience them and cross references to the relevant section and technical report for more specific information on the effect.

12.14.5.1 Assessment of social effects during construction

The Project is of a significant scale in terms of timeframes and the size of works involved. The main effects from construction activities that are likely to have consequential social effects include (and are outlined in earlier sections of this AEE):

- Construction noise and vibration effects;
- Air quality effects;
- Traffic and access effects; and
- Landscape and visual effects.

a. **Quality of the living environment and amenity**

The potential adverse social effects on amenity values during construction include an increase in noise, dust, construction traffic and visual disruption during the construction period. This will mainly be experienced at a local scale (i.e. by surrounding residents/businesses and regular users of facilities). The construction period in this area will be significant (total time period potentially up to five years) and will therefore have a notable impact on the liveability and enjoyment of the area for people (especially near to proposed construction yards) and the health and well-being of residents. These effects relate to construction noise and vibration (see *Technical Report 8: Construction Noise and Vibration Assessment* in Volume 3) and potential changes in air quality (reported in *Technical Report 9: Air Quality Assessment* in Volume 3).

Construction of parts of the Project has the potential to occur close to indoor and outdoor living areas in residential properties adjacent to SH1 in Community Area 3, which may disrupt sleep and other daily living patterns for residents. The scale of this impact is considered greatest for residents who may be doing shift work or families with young children who sleep during the day. In addition, night works have the potential to result in potentially significant disruption to people.

Any dust generated by construction activities can create a nuisance for people in their homes, and in the surrounding environment (e.g. it may inhibit people hanging their washing outside or may dirty the exterior of houses and cars parked near the street). There are also negative social effects associated with construction in landfill areas in Community Area 2 which can pose a risk to human health.

b. **Social Cohesion**

In all areas there is the potential for benefits from construction workers in the area such as reduction in crime resulting from a sustained presence of people and passive surveillance in public areas. There is also the potential for community events put on through the construction period which could specifically involve local residents and young people (e.g. opening of areas once construction has finished).

Construction may result in adverse effects on social cohesion in each of the Community Areas across the study area through impacts on community facilities and public open space. The Project requires land from eight open spaces. The majority of land required relates to small strips on the edge of open spaces that will have nil to very low effect on the ongoing usage of, or access to, the space. Three land requirements that will have an adverse effect on the community's use of spaces are:

- Gloucester Park (North and South) – the land required from Gloucester Park North has been minimised to avoid the recreational playing field as far as possible. However, the public will be excluded from the required areas during construction and will experience a reduced open space for recreation activities. In order to mitigate the construction effects, a Gloucester Park Reinstatement Plan will be developed in consultation with Auckland Council (Parks) which will address the reinstatement of the land at the completion of construction.
- Waikaraka Park – the southern portion (to the east of Waikaraka Cemetery) is required for a construction yard. For safety reasons, the community will be entirely excluded from this area throughout construction. The area of requirement has deliberately avoided the northern part of Waikaraka Park that is used for organised sport purposes. The requirement of the southern portion covers a large area that, whilst not currently a developed recreational area, Auckland Council has plans to develop the area for sports fields. To mitigate the temporary construction effects it is proposed to develop a Waikaraka Park Reinstatement Plan in consultation with Auckland Council (Parks) which will address the reinstatement (or potentially betterment) of the land at the completion of construction.
- Waikaraka Foreshore (East and West) Walkway – the entire length of the walkway will be closed throughout construction of the foreshore area. This will remove the community's ability to access the coast and undertake walking and cycling activities away from the existing heavily congested road environment. Temporary pedestrian diversions will be considered and addressed in the CTMPF (see Section 13.1.5). During construction pedestrian and cyclist access across the Old Māngere Bridge (or replacement structure) and into Onehunga Town Centre will be maintained at all times. Upon completion of the Project there will be a walking and cycling connection along the foreshore between Taumanu, Old Māngere Bridge and Sylvia Park. In the location of the existing walkways, this includes a commuter cycleway, footpath providing direct access adjacent to the road. There is also a shared path and boardwalk/walkway meandering along the foreshore to provide access to the coast in a more naturalised coastal environment. It is also recommended that the Transport Agency work with Auckland Transport to (as far as practicable) provide a temporary commuter cycle facility.

c. **Material well-being**

Across the Project area there is a potential positive social effect from the opportunity to provide employment to locals. This applies to local residents across the Project, but especially in Community Area 3 which is part of The Southern Initiative of the Auckland Plan.

People’s material well-being may be impacted during construction due to temporary disruption of transport routes and access to private properties. The Manukau Harbour is used of water recreation including traditional watercraft. During construction, access to some areas of the Māngere Inlet will need to be temporarily restricted for safety reasons due to the dredging and reclamation activities. Restrictions to navigation will be agreed with the Harbour Master following finalisation of the construction methodology by the contractor(s) and will be publicised and appropriately signposted. The confirmed restrictions will be contained in the Coastal Work CEMP (See Section 13.1.5b for further details of the Coastal Works CEMP). In Community Area 1 disruption will be experienced for motorists using the Manukau Harbour Crossing as a result of works at the Interchange which may result in delays for people accessing places of employment and services (in particular those travelling from Māngere Bridge to Onehunga). Likewise, there will be disruption for those who walk/cycle from the Old Māngere Bridge and link into the Onehunga Town Centre. It is important that access in this area is managed appropriately due to the significance of this transport link for many people in the community and potential lack of alternatives (especially for those without a car).

In Community Area 2 there will be some disruption to services in the area such as along Sylvia Park Road during construction. Disruption to transport routes and access to private property during construction of the Project will also occur in Community Area 2. This will result in potential effects on employment (with loss of employment if businesses struggle during construction) and also access to services for the local community. In particular along Sylvia Park Road there are a number of affected properties. Further impacts on these businesses is contained in *Section 12.4: Assessment of business property, land use and disruption effects*. In Community Area 3, potential effects on material well-being will result from disruption at the Panama Road bridge (therefore reducing access) and at the Princes Street Interchange, which is an important link for Ōtāhuhu East residents accessing services (such as schools and employment) to the west. Construction traffic management measures will be in place to ensure appropriate diversions and access are in place throughout construction.

In all areas, there is the potential for local businesses to benefit from the passing trade of construction workers.

12.14.5.2 Assessment of social effects from operation

a. **Quality of the living environment and amenity**

The operation of the Project will result overall in positive social effects in relation to the quality of the living environment and amenity. In Community Areas 1 and 2 there will be improved amenity of the coastal edge for recreation use, improving public access to and along the CMA, which is seen as a positive social impact on people’s quality of life and supportive of the planned urban growth in the wider Onehunga area (i.e. improving recreation facilities to support this future population). There will also be enhanced ‘quality of life values’ for residents (aesthetics, amenity and safety) associated with the proposed landscape treatment and new open spaces (including along the foreshore of the Māngere Inlet) and urban design integration. For businesses reduced traffic and heavy vehicles on local roads will positively benefit access for customers.

There will be increased amenity and quality of life associated with installation of acoustic barriers in Community Areas 1 and 3 including along part of SH20 and for residential properties adjoining SH1, especially where there are none currently or existing barriers are not up to the appropriate standard. This is a significant positive benefit.

There will also be improvements in the quality of the road environment and therefore safety for vehicle users and in particular for pedestrians and cyclists. This is considered a positive social impact for the health and well-being of people in all community areas, but especially in Community Area 3 at the Princes Street Interchange (where there are currently safety issues for motorists, pedestrians and cyclists).

There will be potential adverse social effects relating to the quality of the living environment and amenity. These will mainly be felt in areas where there are new roads/connections built or there will be an increase in traffic. This will be particularly evident in Community Area 1 at the Galway Street connection, and at the foreshore (where there has previously been no road, therefore changing the noise and visual environment permanently for users) in Community Area 2. In Community Area 3 along SH1 the motorway will be moved closer to adjacent residents through the construction of an additional lane in each direction. The scale of the Panama Road Bridge and the Princes Street Interchange in Ōtāhuhu will also be increased, bringing the road environment closer to people's homes and therefore their living environments.

b. **Social Cohesion**

Improved connectivity to community facilities (including schools, recreational centres and reserves), and the Onehunga Town Centre and Sylvia Park Town Centre will be provided for through the provision of better quality walking and cycling networks, improved bus facilities, and pedestrian crossings and links, which are considered to have significant positive social effects on people's way of life and the social cohesion experienced across the study area.

Potential effects on specific community facilities from operation of the Project are discussed in more detail in *Technical Report 11: Social Impact Assessment* in *Volume 3,* however those of note include:

Aotea Sea Scouts Hall

In Community Area 1, there will be a change in the amenity experienced by users of the Aotea Sea Scouts Hall resulting from the change in the road environment in the surrounding area. The location of the proposed busy road outside the current location of the building is not a good outcome for the Aotea Sea Scouts Hall. The location and heritage values of the building are important to the Aotea Sea Scouts and part of their identity, and contributes to the strength of their relationship to the local Onehunga community. There have been ongoing discussions with the Aotea Sea Scouts about moving the Aotea Sea Scouts Hall which will have a potential negative social effect on users of the facility due to potentially changing the visual prominence of the building and therefore its identity for its users. Notwithstanding this the Project design will result in positive social effects in relation to social cohesion due to the decrease in noise levels anticipated to be experienced at the building, the change in traffic volumes on Orpheus Drive and change to local traffic. During construction it is recommended the Aotea Sea Scouts activities be relocated; if undertaken this will be in consultation with Aotea Sea Scouts.

Waikaraka Park

Through the development and implementation of the Waikaraka Park Reinstatement Plan, it is proposed to reinstate southern Waikaraka Park to facilitate establishment of an active open space. This is identified as a positive social impact as it will enable the accelerated delivery of Auckland Council's planned open space development for this site.

Onehunga Wharf

The local community in Community Area 1 has consistently expressed the importance of the Onehunga Wharf future development and that the Project shall not preclude this (see *Technical Report 11: Social Impact Assessment* and *Part E: Engagement of this AEE*). Following construction, the Project provides for improved capacity for future development of the Onehunga Wharf. While this is acknowledged as a consequential impact of the Project, the additional network capacity supports the aspirations of the community . This also supports the wider network improvements on Neilson Street, removing conflicts with through traffic movements which enables opportunities for the development of the Onehunga Town Centre. This is considered a key positive social effect of the Project.

In Community Area 3, the existing severed Ōtāhuhu areas (north and south of the Ōtāhuhu Creek) will benefit from a proposed pedestrian and cycle connection across the Creek. This will provide benefits for residents between these communities and potential for the wider greenways linkage for recreation and recognition of the Ōtāhuhu portage (a site of significance to Mana Whenua). This is considered a positive social effect, both in regard to quality of life and social cohesion but also in respect of recognising the cultural values of this area. There will be an adverse social effect due to the change in the road environment on SH1 (loss of vegetation, and lack of room for more landscaping mitigation), however this is considered to be of low social significance.

c. **Material well-being and quality of life**

In Community Area 1 there will be a positive effect on the community's material well-being through greater access to public transport (which will be more frequent and reliable, especially from Māngere to Onehunga), and access to new and improved walking and cycling networks between Onehunga and Sylvia Park Town Centre for both commuter and recreation use (e.g. 1.3km reduction in travel distance between these destinations). Promoting improved mode choice and enhancing recreation options for residents in this area is seen as a positive social impact on people's way of life and their material well-being, and supports the planned urban growth in the wider Onehunga area (improving recreation facilities to support this future population). In Community Area 2, remaining businesses in the Sylvia Park Road and Great South Road area will experience improved accessibility and travel time reliability, improving business operations and efficiency. Some businesses will be impacted by restrictions to, or closure of, access points (being left turn only onto Sylvia Park Road). In Community Area 3 there will also be improved walking and cycle connections east west on Panama Road, providing improved accessibility for the Panama Road community with Ōtāhuhu/Mt Wellington and between Princes Street East and Princes Street recognising this is an important connection for residents of this area to services (e.g. schools, shops and community facilities), which is considered a positive social effect for the well-being for residents and their quality of life.

Potential adverse social effects include loss of jobs from the permanent acquisition of business land, especially in Community Area 1 and Community Area 2. The option selection process for the Project has avoided acquisition of all businesses as much as possible, but especially those that employ large numbers of people. There are a number of business properties that are affected by the Project; these are generally small-medium sized businesses that employ a smaller number of people than businesses that have been avoided. In addition in Community Area 2 the existing heliport will not be able to continue in its current location during operation of the Project.

The Project will require acquisition of around 62 residential sites. Consequently, there is a loss of residential housing in Community Area 3, including some social housing. This area has a perceived lack of housing choice due to low average house prices and pressures on the housing market throughout the Auckland Region.

d. **Culture and Identity**

As noted above, a key positive social effect relating to culture will be the recognition of sites of significance to Mana Whenua and the general history of the Project area including (but not limited to):

- In Community Area 1: Te Hōpua, the Onehunga Town Centre, Gloucester Park North, Gloucester Park South and the Onehunga Wharf;
- In Community Area 2: Kāretu portage, Anns Creek and the Māngere Inlet foreshore; and
- In Community Area 3: The Ōtāhuhu portage through the connection across the Creek.

The specific impacts on cultural values are discussed in *Section 12.6: Effects on values of importance to Mana Whenua* of this AEE. There are no other notable social effects relating to culture and identity.

12.14.6 Measures to avoid, remedy or mitigate potential adverse effects on social environment

12.14.6.1 Construction

For the construction phase of the Project, a CEMP and its subsidiary plans for noise / vibration, air quality and traffic will be prepared (see *Section 13.1.5* for further details). The CEMP will be the key implementation tool to facilitate the mitigation of adverse effects identified above in relation to quality of the living environment, social cohesion, material well-being as well as culture and identity. As part of the CEMP, it will be required that contractors perform to a high level in relation to managing stakeholder and community expectation, which is an important factor in managing social effects during construction. Communication in particular will be a key tool. This will allow the Transport Agency and contractors to understand how the community feels and ascertain the most appropriate way to manage community concerns as they arise through the construction period. The Transport Agency has considerable experience with communication and engagement and effects management for large transport Projects with multiple key stakeholders and landowners (e.g. the recent Waterview Connection Project and SH16 Causeway Project).

The implementation of the following key actions will mitigate social effects from the Project:

- Establishment of CLGs to minimise potentially adverse effects during construction through awareness of activities and input to obtain community input in to elements of the detailed design;
- Mitigation of the physical effects of construction activities are set out in *Section 12.11: Noise and Vibration*, *Section 12.12: Air quality* and *Section 12.13: Construction traffic* of this AEE. In order to mitigate the effects on residents from these activities, regular communication and liaison will occur, to inform them of works and liaise/respond to specific constraints or issues that they may have. This approach will assist these residents to go on with their lives over the construction period;
- For construction that must occur at night, consideration will be given to moving sensitive residents to alternative accommodation for the duration of the works (e.g. people with young children). This will be particularly relevant for works in Community Area 3 where there is a large amount of residential properties surrounding construction works;
- Preparation of a communications plan which may include communication of construction timeframes on signs close to key community transport linkages to enable the community to plan and be aware of potential disruptions resulting from construction. This plan and engagement materials should specifically consider accessibility of materials for members of the community e.g. offering translation services and a wide range of media for access by visually and aurally impaired people;
- Nomination of a full-time contact phone number for residents to liaise with the construction team on any issues that arise during construction (as a single point of contact);
- Formalisation of a complaints and response process (and monitoring thereof) for the above communications plan;
- Communication of construction timeframes on signs close to key community transport linkages to enable the community to plan and be aware of potential disruptions resulting from construction;
- Early establishment of a recreation space (e.g. field) on the southern Waikaraka Park area to provide for ongoing recreation use and replacement open space during construction in consultation with Auckland Council and the Maungakiekie-Tāmaki Local Board, to offset areas lost and/or disrupted during construction;
- Early planting of open spaces, management of graffiti on the construction site and construction yards and maintaining adequate lighting of those areas identified for public access during construction to provide residents and the community with useable community linkages and open spaces (recognising the disruption to recreation areas during construction);
- Liaison with key businesses and community facilities in construction planning and over the construction period to discuss issues of access and their operations (e.g. traffic diversions). If access cannot be managed then consideration should be given to relocating businesses and facilities, even

temporarily. For example, the Aotea Sea Scouts Hall may need to be relocated or the Club provided temporary facilities if it cannot operate in its location during construction or operation of the Project;

- Work with Auckland Transport to as far as practicable provide a temporary commuter cycle facility;
- Key walking and cycling connections are kept open and closures only occur at night;
- The liaison with businesses to include consideration of pedestrian and vehicle access signage for those businesses whose access will be disrupted or altered by construction works (e.g. signage to provide information on how to access The Landing and motel on Onehunga Harbour Road, during construction of the EWL Trench section);
- Early engagement on the land acquisition process, particularly for properties required in full (to enable people who want to get on with their lives to do so with certainty, including consideration of opportunities for people to stay in the area until necessary (if they do not want to move straight away). This will also enable businesses to understand their options and consider relocating prior to the site being required for construction, also mitigating the potential loss of jobs in the area. Early construction of the coastal path, particularly the section between Old Māngere Bridge and the Alfred Street link to provide access to Waikaraka Park and as a recreation walkway from Onehunga (acknowledging that access to this facility is currently predominantly from the west);
- Provide and sign parking areas to users of the Manukau Foreshore Walkway for the period that the Onehunga Harbour Road parking area is lost in construction (e.g. at Waikaraka Park or in other nominated locations in discussion with Auckland Council and the Maungakiekie-Tāmaki Local Board);
- Provide weekend car parking surrounding the Waikaraka Park and community buildings (e.g. on Captain Springs Road or in the construction yard at Waikaraka Park (south)); Community engagement initiatives to include local events to showcase construction activities and inform people on progress to address potential impacts on community cohesion over the construction programme; and
- Work with The Southern Initiative to promote training and employment opportunities for young people, as per The Southern Initiative objectives. While beyond the RMA, the Agency's procurement processes could include requirements (or use such requirements as an incentive evaluation criteria) for contractors who hire a certain percentage of local people and work with the Transport Agency and The Southern Initiative.

12.14.6.2 Operation

Once the Project is operational, adverse effects will be mitigated by a variety of methods:

- To mitigate adverse effects on people's quality of life from noise and vibration on the road, acoustic barriers will be constructed near private properties as outlined in *Section 12.11: Noise and Vibration* of this AEE. In delivering this mitigation, it is important that residents are consulted both on the site specific design requirements and the implementation programme;
- To mitigate the potential adverse effects on visual amenity and the quality of the living environment there will be landscaping included along the Project. This is outlined in detail in the drawings in *Plan Set 4: Landscape* in *Volume 2.* Opportunities to enhance community outcomes (e.g. community cohesion) include input on design (through the CLG) and potentially community planting days or similar to involve them in the implementation of the Project works;
- Involvement of CLG in detailed design of certain facilities along the route including the bridge over Ōtāhuhu Creek as a walking and cycling connection and alignment with Auckland Council greenways project;
- In order to mitigate impacts on open space areas, there will be reinstatement of the construction yard at Waikaraka Park for recreation facilities in partnership with the Maungakiekie-Tāmaki Local Board and Auckland Council Parks department;

- A signage plan will be prepared for community linkages and connections between walkways and open space/recreation areas (e.g. to Old Māngere Bridge, Taumanu, Gloucester Park, Waikaraka Park, Mutukāroa-Hamlins Hill, and through to Sylvia Park Town Centre); and
- Walking and cycling connections between Panama Road and Frank Grey Place to be undertaken in consultation with the local community and residents, including consideration of design for vehicle crossings where property accessways interface with the shared path.

12.15 Erosion and sediment control

Overview

Construction of the Project will involve land disturbing activities including earthworks and vegetation removal. These activities, if not appropriately managed, have the potential to increase the risk of sediment-laden stormwater runoff being discharged to the receiving environment. The Manukau Harbour, Māngere Inlet and the Tāmaki Estuary are the receiving environments for the Project and both contain areas of ecological value.

Erosion and sediment control measures will be implemented to minimise the effects of sediment runoff and construction stormwater on these receiving environments. These measures will be based on best practice erosion and sediment control in Auckland as set out in Auckland Council and Transport Agency guidelines. Preliminary Erosion and Sediment Control drawings have been prepared to demonstrate how erosion and sediment control could be delivered for the Project. These drawings are contained in *Plan Set 10: Erosion and Sediment Control*.

This section assesses the actual and potential effects of land disturbance activities (earthworks and vegetation clearance). It includes consideration of the erosion and sediment control measures that will be used to minimise sediment discharges from construction stormwater. This assessment is supported by *Technical Report 12: Stormwater Assessment* in Volume 3 and the Erosion and Sediment Control Plans in *Plan Set 10: Erosion and Sediment Control* in Volume 3.

Further assessment of the effects of sediment generated by the Project are also considered to the extent relevant in *Section 12.19: Coastal Processes* and *Section 12.20: Ecology* of this AEE. The ecological effects of vegetation removal are addressed in *Section 12.20: Ecology* of this AEE.

In assessing the actual and potential effects of land disturbing activities, the assessment has considered the following:

- The sediment yield potential across the Project areas; and
- Implementation of appropriate erosion and sediment control measures to manage construction stormwater during land disturbance activities (based on projected sediment yield).

Best practice in Auckland is generally considered to be compliance with Auckland Council GD05 - *Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region*[77] or similar design. In addition, the Transport Agency has its own guidelines, the *Erosion and Sediment Control Guidelines for State Highway Infrastructure: Construction Stormwater Management* (September 2014). This guideline has been prepared with the intention that it will meet or exceed the GD05 guideline.

12.15.1 The receiving environment

The receiving environments for this Project are the Manukau Harbour, Māngere Inlet and the Tāmaki Estuary. They include areas of significant ecological value (which are at greater risk of effects from sediment laden runoff) and areas of degraded water quality. These receiving environments are described

[77] Though not yet operative, this is considered to be best practice. When ratified, GD05 will supersede Auckland Council Technical Publication 90.

in further detail in *Section 11.0: Description of the existing environment* and *Section 12.20: Ecology* of this AEE.

The Project also includes works within watercourses and the discharge of construction stormwater to the freshwater sections of Miami Stream, Southdown Stream, Anns Creek and Clemow Stream. The ecological values of these watercourses is discussed in *Section 12.20: Ecology* of this AEE.

12.15.2 Sediment discharges

The land disturbance activities anticipated during the construction of the Project are set out in *Section 7.0: Construction of the Project* of this AEE. In summary, these involve a number of activities that have the potential to generate sediment (including contaminant laden sediment) including:

- Earthworks, including bulk earthworks, tracking and trenching where rainfall encounters exposed earth;
- Works in and around streams (e.g. culverts, retaining walls, piles and bridges) that disturb and entrain sediment; and
- Disturbance from construction of the road embankment, landscape features and stormwater wetlands in the CMA.

A Universal Soil Loss Equation has been used to determine the potential sediment yield associated with the Project. The Universal Soil Loss Equation is used to identify those parts of a site with a higher sediment generating potential taking into account soil loss, rainfall, soil erodibility, slope length and steepness, vegetation cover and erosion control practices. The Universal Soil Loss Equation calculations are set out in Appendix E of *Technical Report 12: Stormwater Assessment* in Volume 3.

Table 12-19 provides a summary of the estimated sediment yield potential for the Project. This provides the total areas of works and the potential sediment yield assuming there is no erosion and sediment controls installed for the Project, and then the potential yield with controls.

Table 12-19: Sediment yield potential for the Project

Project contributing catchment	Construction footprint	Sediment yield (tonnes per annum)	
		With no ESC	With ESC
Manukau Harbour Catchment			
Neilson Street Interchange	6.18	20.9	7.7
Foreshore Embankment	8.66	75.8	12.9
Southdown Reserve	2.51	25.3	5.6
Anns Creek	0.92	74.5	25.0
Total	**15.6 ha**	**170.6**	**38.2**
Tāmaki Estuary Catchment			
Clemow Stream	1.63	6.6	1.8
Ōtāhuhu Creek	1.54	8.4	2.3
Frank Grey Place	2.13	0.9	0.3
Total	**5.31**	**16.0**	**4.4**

The works within the CMA involve the construction of the embankment, landscape features and stormwater wetlands. The coastal works will require specific controls to minimise the discharge of sediment to the CMA. The assessment of effects associated with work in the CMA, including the placement of material that has the potential to generate sediment. The fate of sediment when it does enter the CMA is discussed in *Section 12.19: Coastal processes* of this AEE.

The construction of the coastal features including the road embankment, stormwater treatment system and landscape features will commence with the construction of an outer mudcrete bund. This will encapsulate the area, effectively isolating it from tidal influences, and assist in reducing sediment discharges to the Manukau Harbour and the Māngere Inlet. Stormwater flows from the existing upstream catchment will be diverted around the working area through the use of diversion pipework or stabilised channels. Construction stormwater within the working area will be pumped to one or more of the sediment retention devices for treatment to ensure a dry working environment.

Section 6.3 of *Technical Report 12: Stormwater Assessment* in *Volume 3* provides a description of the relevant erosion and sediment control considerations and recommended approach for the areas of particular risk along the alignment including Anns Creek, Ōtāhuhu Creek and the Māngere Inlet foreshore.

12.15.3 Effects of sediment discharge on the receiving environment

Land disturbance activities during construction of the Project can increase the potential for erosion of disturbed earth during rainfall events which in turn leads to an increased risk of sediment-laden stormwater runoff being discharged to the receiving environment, including from contaminated land. Increased sediment in a receiving environment has the potential to have adverse effects, including:

- Damaging aquatic (marine and freshwater) habitats;
- Altering the morphology of streams and the foreshore of the CMA; and
- Reducing the clarity of the water in marine and freshwater environments.

The Manukau Harbour is a depositional environment which currently has a high suspended sediment contribution from the contributing catchments. The construction of the Project has the potential to contribute more sediment into this environment. An assessment of how sediment is transported in and around the Māngere Inlet and the Manukau Harbour is set out in *Section 12.19: Coastal Processes* of this AEE.

While a level of sediment is required for a functioning ecosystem, too much sediment can adversely affect ecosystems by smothering fish, invertebrates and shellfish species. It can also change the clarity and turbidity of the water. The effects of sediment from the Project on marine ecology are set out in *Section 12.20: Ecology* of this AEE.

Works in watercourses such as temporary and permanent diversions and the construction of culverts and other structural elements have the potential to disturb freshwater species and to increase the sedimentation of stream beds. Generally the existing watercourses in the Project area are of low ecological value, however, they still support a range of native freshwater species. The values of these watercourses is discussed in *Section 12.20: Ecology* of this AEE.

The mitigation measures for construction effects on water bodies within the vicinity of the Project are set out in *Section 12.20: Ecology* in Volume 3: *Technical Report 16 - Ecological Impact Assessment*. These includes retaining as much riparian vegetation and utilising temporary diversion measures away from waterway structure construction.

12.15.4 Measures to avoid, remedy or mitigate effects of earthworks and vegetation removal

The Project design has sought in the first instance to minimise land disturbance required during construction to minimise sediment generation. This has been achieved by:

- Reducing the overall construction footprint;

- Minimising land disturbance activities in sensitive ecological areas through the use of structures rather than reclamations, temporary staging for construction and the use of works exclusion areas; and
- Consideration of construction material and techniques particularly for coastal works.

Where land disturbance occurs during construction of the Project, both erosion control and sediment control measures can minimise the effects of construction stormwater on receiving environments. Erosion control does this by preventing sediment generation, and sediment control by managing sediment once it is generated.

Preliminary Erosion and Sediment Control drawings have been prepared to demonstrate how erosion and sediment control could be delivered for the Project. These drawings are contained in *Plan Set 10: Erosion and Sediment Control* in Volume 2.

There are a number of best practice land management techniques that can be used to reduce the amount of sediment discharged into receiving environments during land disturbance activities. This includes for discharge from disturbance of contaminated land. Both structural (physical) and non-structural (site management and staging of the works) measures will be employed with an emphasis placed on non-structural practices in the prevention of erosion in the first instance such as appropriate staging and sequencing of works.

Erosion and sediment control for the Project will likely involve the following approaches:

- Staging of the works:
  - Minimising the extent of disturbed earth required for the construction of the Project; and
  - Phasing construction operations in response to forecast and actual weather patterns.
- Installation of 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.
- Rapid and progressive stabilisation of disturbed areas to:
  - Reduce the erosion potential of disturbed areas; and
  - Reduce the level of sediment generated during construction.
- Installation of sediment control devices, being:
  - Sediment retention ponds, or alternative sediment control devices;
  - Decanting earth bunds (where there is insufficient space to use ponds);
  - Silt fences and Super Silt Fences;
  - Silt socks and; and
  - Stormwater – inlet protection.

The decanting earth bunds and sediment retention ponds will be sized based on a 3% Catchment Criteria (30 m^3 per 1,000 m^2 catchment) in accordance with Auckland Council guidelines. Chemical treatment in the form of flocculant may be used to improve the effectiveness and efficiency of sediment retention ponds and decanting earth bunds. Flocculant can improve efficiency of devices by between 15-20% depending on the particular measure. The flocculant aids in the settlement of suspended sediment by causing sediment particles to join together to form larger particles and settle much more rapidly. Flocculant dosing will be via rainfall activated flocculant sheds. The flocculant dosing regime will be informed by bench testing of soil samples from both in-situ material and imported fill to determine the most effective type and dosing rate of flocculant. The flocculant dosing rate may vary across the project due to the variance in soil conditions.

Erosion and sediment control measures must be installed prior to the commencement of land disturbance and maintained until the site is stabilised against erosion. The erosion and sediment control measures will be installed progressively, in advance of land disturbance activities and will be staged in co-ordination with planned earthworks and site preparation activities.

Once the erosion and sediment controls are in place, site monitoring by the contractor and the Transport Agency will occur to check that the proposed erosion and sediment control measures have been installed correctly and continue to function effectively for the duration of the works. In addition, water quality and visual assessments of the receiving environment will be undertaken during the works with particular attention being paid during and after periods of rainfall. Any noticeable change in water clarity in the receiving environment from that previous to the rainfall event and downstream of the earthworks activity will result in a review of the erosion and sediment control measures implemented and earthworks activity and changes made as necessary.

Where sediment retention measures capture sediment from areas of contaminated land, depending on the level of contamination, sediment removed from the sediment retention ponds and decanting earth bunds may need be disposed of to an appropriately managed facility. In the landfill areas along the foreshore (e.g. at Galway Street and the Pikes Point landfills), construction stormwater runoff from exposed landfill material will need to be discharged to the trade waste system for appropriate treatment.

The Preliminary Erosion and Sediment Control Plan drawings contained in *Plan Set 10: Erosion and Sediment Control* in Volume 2 will be finalised once the construction contractor(s) is appointed.

In addition to the Project-wide ESCP, it is expected that Construction Erosion and Sediment Control Plans (CESCPs) will be developed which will set out in detail how the construction will be carried out to meet the performance standards set out in the Transport Agency and Auckland Council guidelines. For example, Anns Creek is identified as particularly sensitive and challenging to control all discharges; therefore a CESCP will be appropriate for this location. The CESCPs will take cognisance of any requirements of the CLMP with regards to the presence of contaminants in any earthworks areas (see *Section 13.1.5g*) for further details of the CLMP).

The preparation of CESCPs prior to construction commencing will allow Auckland Council to have further input into the development of the proposed methodologies for specific sites and activities. Further details of the ESCP and the CESCP, including contents of those plans, is set out in *Section 13.1.5f* of this AEE.

The assessment of erosion and sediment control and the Preliminary Erosion and Sediment Control drawings contained in *Plan Set 10: Erosion and Sediment Control* in Volume 2, demonstrates that accepted erosion and sediment control measures and practices can be applied and acceptable sediment reductions achieved during construction of the Project.

12.16 Groundwater

Overview

The Project will have beneficial effects on groundwater flow in particular it will assist in improving the quality of groundwater and leachate from existing controls of landfills, discharging into the Māngere Inlet. This will be achieved by:

- The road embankment, landscape features and stormwater wetlands providing attenuation of contaminants (leachate) travelling in groundwater through the existing landfills;
- Improving the effectiveness of the Pikes Point leachate interception system and providing continuous on-site treatment of leachate in new stormwater wetlands; and
- The road embankment, landscape features and stormwater wetlands reducing saline ingress to existing landfills therefore contaminant flushing by creating a physical barrier.

The Project will result in a small rise upgradient (upstream) in groundwater level at the EWL Trench adjacent to Onehunga Wharf and between Galway Street and Waikaraka Cemetery. This has been addressed through design adjustments in specific localities to minimise effects. In particular, a more permeable embankment is proposed adjacent to Waikaraka Cemetery where existing groundwater levels are already very high.

Overall the Project is expected to have positive effects on groundwater (or leachate) contaminant levels and quality.

12.16.1 Introduction

This section assesses the actual and potential effects of the Project on groundwater levels and flow. A detailed description of the groundwater effects is contained in *Technical Report 13: Groundwater Assessment* in Volume 3.

Changes in groundwater levels can result in ground settlement. The effects associated with settlement from both groundwater and mechanical-related settlement are assessed in *Section 12.17: Ground Settlement* of this AEE.

The groundwater assessment involved developing a ground model and a conceptual groundwater model to provide an understanding of the ground conditions in the wider Project area. The models were informed by geological investigations and groundwater level monitoring to fill gaps in understanding of the ground conditions. The models were used to simulate existing groundwater levels and flow conditions and to investigate groundwater movement with the Project in place and particularly in and around the road embankment at the foreshore.

12.16.2 Existing environment

Within the Project area, groundwater flows:

- From elevated ground (generally volcanoes largely comprised of basalt) and discharges to the coastal areas of the Māngere Inlet as springs at the original inlet shoreline;
- From basalt flow margins into Anns Creek and Ōtāhuhu Creek; and
- Through the basalt margins offshore. Anns Creek, underlain by Tauranga Group alluvium, also drains water from Mutukāroa-Hamlins Hill (Waitematā Group sandstone and mudstone).

The Onehunga Bay and Māngere Inlet foreshore have been progressively reclaimed with landfill and engineered fill extending up to 500m inland from the present foreshore. There are four areas of landfill within the Project: the Gloucester reclamation in Te Hōpua; Galway Street Landfill; Pikes Point East; and Pikes Point West closed landfills.

The main source of groundwater recharge is rainfall infiltration, both directly as rainfall and through stormwater soakage pits. Saline water ingress to basalt occurs beneath the Galway Street closed landfill and through the overlying landfill material and Miami Stream. Groundwater is lost from the system as springs, by groundwater abstraction, discharge to the harbour, and also by leachate interception from the Pikes Point closed landfills.

There are a number of groundwater abstractions in the Onehunga area. The main abstraction of water is by Watercare for public water supply. Watercare has four production wells (although only two are currently operational) with a total consented maximum take of 30,000m^3/day (8.5 Million m^3/year). Watercare has a consent condition to maintain a minimum water level in the wells of 0.5m above sea-level, however it is understood that the average maximum combined daily take is just over 100 l/s (around 22,000m^3/day) and pumping is generally maintained at around 1.8m above sea-level. Applications for new consents to replace those existing consents have been lodged by Watercare and are being processed by Council.

There are three spring-fed streams in the wider area discharging from basalt: Miami Stream, Captain Springs and Bycroft Stream. The latter two are located in Onehunga, inland from the Project and are not affected by the Project.

A leachate interception system, owned and operated by Auckland Council, is installed through landfill on the inside of the sea walls at Pikes Point West and East landfills. Typical volumes of leachate discharged to Watercare's trade waste from the leachate interception system at Pikes Point landfill are in the order of 50,000m^3 to 70,000m^3 per year (which is 140-190m^3 per day).

There is evidence of saline intrusion and leachate in the groundwater, especially along the foreshore area. Leachate is evidenced by high concentrations of copper, zinc and ammoniacal nitrogen. The ammoniacal nitrogen in particular exceeds the acceptable marine water quality guideline values by up to 50%.

12.16.3 Effects on groundwater

12.16.3.1 Landfill leachate interception and treatment

The Project will result in positive effects for leachate interception and treatment including improved effectiveness and on-site treatment.

Investigations of existing leachate quality in groundwater showed that concentrations of copper, zinc and ammoniacal nitrogen exceeded the *Australia New Zealand Guidelines for Fresh and Marine Water Quality* 90% Marine Water Quality guideline values in the majority of bores tested, and many also exceeded the guideline for cobalt and lead. Contaminant concentrations were most elevated in groundwater samples around the Galway Street Landfill.

The construction of the road embankment, landscape features and stormwater wetlands between Galway Street and Waikaraka Cemetery has the potential to attenuate contaminants travelling in groundwater through the landfill (leachate). These might otherwise enter the basalt beneath the landfill and discharge directly to the Māngere Inlet. This will reduce the concentrations of contaminants entering the inlet. The travel time range increases from 200% up to 500% compared to at present. The construction materials for the foreshore have been selected to optimise these travel times with an inner granular (permeable) section and a toe down to tuff or basalt and outer section constructed from mudcrete or similar (a low permeability material). At times of high rainfall, groundwater levels on the landward side of the embankment may rise and will discharge directly to the stormwater wetlands on the seaward side. The lengthening of travel times would not be achieved on such occasions but treatment will occur in the wetland system.

East of Waikaraka Cemetery, the road embankment will be constructed partly on land. This means that the road embankment will sit on the Pikes Point West and East landfills and will cover the leachate interception system at the landfills, necessitating its replacement. The location of the existing leachate interception system is shown on Figure 12-21.

Figure 12-21: Location of the existing leachate interception system

The replacement leachate interception system consists of a trench excavated through the landfill down to tuff or basalt and filled in part with low permeable material on the seaward side to act as a cut-off drain and in part with gravel. The replacement leachate interception system shown on the drawings in *Plan Set 9: Stormwater* in Volume 2. A perforated pipe will take leachate from the gravel section of the trench through the embankment and discharge it into the stormwater wetlands. It is anticipated that an average of 140-190m^3/day will be collected and discharged to the foreshore wetlands. The wetlands have been sized to accommodate the groundwater from the leachate interception system. The groundwater from the leachate interception will be will be directed into the stormwater wetlands in Landform 2 at an expected rate of 40m^3/day and into Landform 3 at a rate of 100m^3/day. At these volumes, the groundwater from the leachate interception system is a small proportion of the total volume of the stormwater wetlands. Provision has been made for pumping to the Watercare wastewater system as a back-up to the gravity system if monitoring indicates pumping is needed under exceptional circumstances to reduce groundwater level in the landfill (e.g. during a prolonged period of rainfall). Confirmation of the concentrations of contaminants within the leachate will be undertaken to confirm its suitability to be discharged into the stormwater wetlands.

Provision for removal of leachate by pumping will be made so that pumps could be installed and leachate removed if monitoring indicates pumping is needed under exceptional circumstances during construction to reduce groundwater level in the landfill.

The Project will improve the effectiveness of the Pikes Point leachate interception system and provide continuous on-site treatment in new stormwater wetlands. This will reduce existing contaminant (leachate) discharge to the Manukau Harbour and Māngere Inlet and avoid the need for pumping and transfer of both leachate and (potentially) clean water for treatment off site. Investigations of existing leachate quality in groundwater suggest that the leachate can be treated with stormwater in the wetlands. If further monitoring indicates higher levels of contaminants than expected, then pre-treatment could be achieved via a treatment system which will be installed within the road embankment. The monitoring associated with this is discussed further in *Section 12.16.4* of this AEE.

The Project will reduce saline ingress to existing landfills by creating a physical barrier to prevent salt water from entering the landfills. The contaminated material beneath the road will be removed from site to an approved disposal site. The design also means that the landfill remaining beneath the road will not receive any further water as it will be essentially sealed from upgradient flow, from saline ingress and from surface ingress. This means that piles installed to support the road along this section will not form permanent pathways for leachate travel into the underlying basalt.

12.16.3.2 Changes in groundwater levels

The modelling of changes to groundwater from the Project indicate a raising or lowering of groundwater at some locations. This may have both positive and adverse effects.

A small rise in groundwater levels is expected on the upgradient side of the EWL Trench and lowering of groundwater on the down-gradient side. The structure will result in a rise in groundwater level of 250 to 350mm on the upgradient side of the trench reducing to 100mm approximately 250m inland.

There may also be a raising of the groundwater level from the road embankment where it is placed immediately adjacent to or over the Pikes Point landfills in the Māngere Inlet.. Changes in groundwater levels may result from the mounding of groundwater beneath or draining of groundwater into the proposed stormwater wetlands. These wetlands are illustrated in *Plan Set 9: Stormwater* and are:

- Wetlands in Sector 1 will be unlined and will result in small rises in groundwater levels that are not noticeable due to its location close to the coast;
- The wetland in Sector 3 will be adjacent to Hugo Johnston Drive and will not result in any changes to groundwater levels. The presence of asbestos on this site does not affect groundwater quality; and
- The wetland in Sector 5 is the enlarged existing Frank Grey Place unlined stormwater pond. The changes to groundwater levels are less than 50mm and will therefore not be distinguishable from normal groundwater level variations.

There will be a rise in groundwater levels at the Galway Street Landfill due to the EWL Trench and the controlled discharge of leachate through the embankment. This will result in a small rise in groundwater of 100mm extending 300m to 400m inland. The very small magnitude of groundwater level rise would not result in adverse effects.

Along the foreshore, there are areas that already have high existing groundwater levels. The eastern part of Waikaraka Cemetery has existing groundwater levels at less than 1m below ground level. This is likely to be due to the discharge of Captain Springs upgradient of this area and the incomplete capture of spring water in pipework. The effect of the embankment and adjacent lined stormwater wetland at this location raises the average groundwater level by 250mm to 350mm within 200m to 400m of the embankment. This brings the average groundwater level close to the ground surface. The replacement leachate interception system at the Pikes Point West landfill will help to limit the extent of this groundwater level rise, however alternative designs have been considered for the embankment to further limit this effect. These are discussed further in Section 12.16.4 of this AEE. If unmitigated, these changes in groundwater levels could result in adverse effects, particularly at Waikaraka Cemetery, however the proposed design mitigates this potential effect.

East of the Waikaraka Cemetery, the road embankment will be constructed in part over the existing Pikes Point West and East landfills, necessitating replacement of the existing leachate interception system. This results in a rise in groundwater levels of 100mm within 40m of the embankment, and 50mm at 60m to 80m inland. The very small magnitude of groundwater level rise would not result in adverse effects.

The road extension at Hugo Johnston Drive will result in consolidation of the underlying Tauranga Group sediments. This will result in less than 50mm change in groundwater which will not have a measurable effect.

At the SH1 bridge widening across Ōtāhuhu Creek, cuts required to facilitate the widening are less than 1m deep and well above groundwater level. No effect on groundwater is anticipated. Work at the Princes Street Interchange will require local cut of up to 2.5m. This cut will also be above groundwater level and therefore no effect on groundwater is anticipated.

Elsewhere, the Project will be constructed above groundwater level. Local embankments will be constructed which might result in local consolidation of sediments beneath and a small reduction in permeability, however no measurable change in groundwater level is expected.

12.16.3.3 Wetlands and Streams

The effects of the Project are largely small rises in groundwater level, rather than drawdown. The extent of groundwater level rise does not reach Bycroft Reserve, Captain Springs or Anns Creek. No effect on groundwater contributions to existing wetlands and streams is anticipated.

12.16.3.4 Groundwater Users

The Project is expected to result in small rises in groundwater level locally. The extent of effects does not reach any existing groundwater take. The Project will not impact any existing groundwater users.

12.16.4 Measures to avoid, remedy or mitigate effects on groundwater

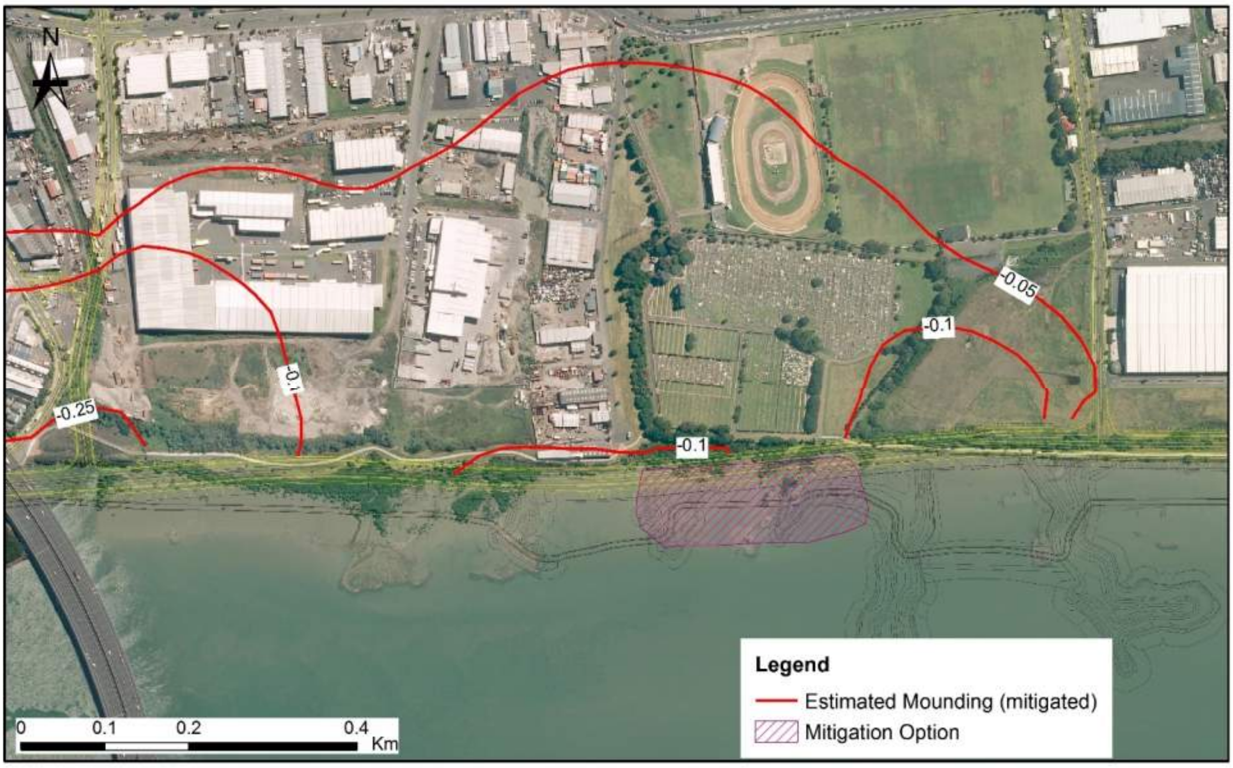
Potential effects on groundwater have been largely mitigated through the design of the Project.

The assessment indicates that the Project could result in adverse effects from the mounding of groundwater level beneath Waikaraka Cemetery due to already elevated groundwater levels in this location and the construction of the foreshore embankment.

To mitigate this, an alternative design is proposed for the embankment along this section. Marine muds proposed for the embankment will be replaced with a permeable material such as gravel over the depth of the basalt, and the stormwater wetland will be constructed above the gravel. This will allow groundwater to continue to discharge through the basalt. The magnitude of groundwater level rise can be reduced from 250mm-350mm within 200m-400m of the embankment to 100mm-150mm within a much reduced extent. The mitigated change in groundwater levels is shown in Figure 12-22.

The alternative design solution substantially avoids the groundwater level rise at Waikaraka Cemetery.

Figure 12-22: Mitigated change in groundwater levels as a result of the Project
(contours are in metres; negative number indicates groundwater level rise)



Monitoring is proposed during and following construction of the works between the Neilson Street Interchange and Anns Creek to:

- Confirm that the observed effects on groundwater levels do not exceed those modelled. If higher groundwater levels are observed, this may trigger the need for additional drainage that can be introduced following construction;
- Confirm that groundwater levels and quality in the Pikes Point East and West closed landfills are not raised in level by the installation of the embankment and replacement leachate interception system. If not then pumps installed as part of the works will be activated to remove excess leachate until groundwater is returned to a satisfactory level; and
- Confirm that the concentrations of contaminants within leachate means that it can continue to be treated in the stormwater wetlands. If not then pumps installed as part of the works will be activated to remove excess leachate until contaminants are returned to a satisfactory level.

The above measures and corresponding actions will be contained within the groundwater monitoring section of the CEMP to be implemented when undertaking the works. Further discussion of the CEMP is contained in *Section 13.1.5a* of this AEE.

12.17 Ground settlement

Overview

Construction of the Project requires cutting and filling of ground surfaces at a number of locations along the alignment. The areas surrounding these locations can experience ground settlement due to the mechanical settlement of ground from the movement of retaining walls, the consolidation of the ground due to lowering of the groundwater and consolidation or compression of the ground due to the construction of fills. This can result in total settlement and differential settlement which can affect buildings and structures, services and transport infrastructure.

Anticipated settlement has been modelled for the Project. This shows that ground settlement immediately beyond the Project footprint will typically be in the range of 0 – 10mm. This level of settlement will result in negligible effects on the structural integrity of adjacent buildings, services or transport infrastructure.

Mechanical and consolidation settlement associated with the proposed EWL Trench adjacent to Onehunga Wharf have been assessed as negligible and may extend a modest distance from the structure. Monitoring requirements will be developed and implemented for particularly sensitive infrastructure and in the vicinity of the EWL Trench. The monitoring will confirm the predicted settlement effects and allow management measures to be implemented should effects exceed those identified in this assessment.

Predicted ground settlement can be accommodated within the design of the Project or appropriate measures implemented to mitigate effects resulting in negligible residual adverse effects.

12.17.1 Introduction

This section presents the findings of investigations undertaken to determine the actual and potential effects of the Project from ground settlement. This assessment is supported by *Technical Report 14: Settlement Effects Assessment* in *Volume* 3.

The assessment of groundwater effects is set out in *Section 12.16: Groundwater* of this AEE.

12.17.2 Existing Environment

12.17.2.1 Geology

The geology of the Project area is explained in the *Section 11.0: Description of the Existing Environment* of this AEE. The features of particular relevance to the assessment of settlement effects are set out below.

The western portion of the Project area is comprised of basalt lava and tuff overlain and locally interbedded with a variable thickness of Tauranga Group alluvium, which comprises pumiceous silt, sand and gravel with muddy peat and non-welded and alluvially reworked ignimbrite and tephra.

The basalt flows are bound to the east by an uplifted block of Waitematā Group sandstone and siltstone, although some lava and tuff from Mt Wellington volcano has flowed around the block from the north east in the area of Anns Creek.

Uncemented dense to vesicular sand to gravel sized basalt fragments are mapped as underlying the area between Alfred Street and Captain Springs Road and north to Patrick Street. The ash/tuff also forms a lobe between Angle and Edinburgh Streets extending into the foreshore.

Recent marine sediments (part of the latest Tauranga Group) overlie the Manukau Lava Field and older Tauranga Group soils at the coastal margin and offshore, and partially infill at Te Hōpua (Gloucester Park).

The Onehunga Bay and Māngere Inlet foreshore have been progressively reclaimed with landfill and engineered fill extending up to 500m inland from the present foreshore.

Eastwards from Māngere Inlet, Waitematā Group rock underlies the north eastern end of Anns Creek, the southern part of Great South Road and Sylvia Park Road. Lithic tuff, comprising broken up pre-volcanic materials, basalt fragments and unconsolidated ash and lapilli, is mapped as underlying the area between Abattoir Lane and Portage Road to SH1, north towards Sylvia Park Road and south to Ōtāhuhu Creek. The tuff is thought to be sourced from the Mt Richmond and McLennan Hills craters which last erupted some 30,000 years ago. Pumiceous mud, sand and gravel with muddy peat and lignite beds, non-welded ignimbrite, tephra and alluvially reworked tephra of the Puketoka Formation (also part of the Tauranga Group) occur locally beneath part of SH1 adjacent to Sylvia Park and adjacent to Ōtāhuhu Creek.

12.17.2.2 Buildings, service and transport infrastructure

The majority of the existing building stock within the Project area can be characterised as low-rise industrial, commercial and residential buildings. A medium-rise building is currently being constructed adjacent to Te Hōpua. The building stock comprises a number of construction types, however, for the purposes of assessing susceptibility to the effects of settlement, it was considered appropriate to group them into two broad types being:

- Type A buildings are those that are expected to be susceptible to visual cracking in the event of slight differential ground movement due to cladding type (i.e. unreinforced concrete block walls, brick and mortar, glass panels, plaster or stucco); and
- Type B buildings are those that are expected to be susceptible to visual cracking in the event of slight differential ground movement (i.e. timber, steel cladding and precast reinforced concrete walls/panels).

Further detail of the existing building stock is provided in Appendix D of *Technical Report 14: Settlement Effects Assessment* in Volume 3. There are limited buildings along the Project that would be particularly sensitive to settlement due to their building type. Exceptions include The Landing and Aotea Sea Scouts Hall which have heritage value.

The Project area includes typical residential and industrial network utilities as well as major, regionally significant network utilities as described in *Section 11.0: Description of the existing environment*. The network utilities are shown on *Plan Set 12: Utilities Relocation* in *Volume 3*. Further detail regarding the existing utilities is provided in *Section 6.0: Description of the Project* and assessed in *Section 12.5: Network Utilities* of this AEE.

Transport infrastructure within the Project area is described in *Section 11.0: Description of the existing environment* and assessed in *Section 12.2: Traffic and Transport* of this AEE.

12.17.3 Assessment Methodology

12.17.3.1 3D Settlement Prediction Model

The settlement effects assessment included a desktop assessment of Auckland Council records for historic investigations that have taken place within the vicinity of the Project over the past 30 years. From this, gaps were identified for areas requiring further examination by field investigation. Information gained from the field investigation included the soil and geologic profile, the in situ strength of the material and samples for geotechnical and environmental testing. The information from the desktop assessment and the field investigation fed into a model producing 3D maps which was utilised for risk analysis of ground settlement across the Project designation and the surrounding properties. The same model was used in the groundwater assessment set out in *12.16: Groundwater* of this AEE.

This assessment considers the potential effects based on the estimated settlements that give the highest risk of damage.

12.17.3.2 Types of ground settlement

Ground settlement comprises two key measures; total settlement and differential settlement. Total settlement is the maximum amount a structure has settled with respect to its original position. Differential settlement represents the change in the ground surface slope between any two different locations that are settling at different rates. The potential for settlement to result in damage to structures depends more on differential settlement rather than total settlement. For damage to occur, a structure must be subjected to differential settlement that will result in structural distortion.

There are three potential sources of total and differential ground settlement associated with construction of the Project. These are discussed below.

Mechanical settlement of the ground due to the movement of retaining walls

This settlement results from movement of a retaining wall as it is loaded. The load is applied as material is either excavated in front of the wall or is backfilled behind it. The resulting lateral displacement of the wall most commonly translates to a vertical settlement above it, and will occur in close proximity to the rear of the wall. These settlements will occur relatively quickly, during or immediately following wall construction. Where retaining walls are used to support fill in areas of relatively weak ground there is also the potential for ground settlement to occur below and beyond the toe of the wall.

Consolidation or compression of the ground due to the construction of fills

Consolidation or compression of the ground occurs when fill is placed on weak underlying non-engineered fill, urban refuse (landfills), soft recent marine sediments and, possibly, undifferentiated Tauranga Group deposits. Consolidation settlement is time-dependant, and directly related to the nature, thickness and permeability of the underlying materials. For this project, the majority of this settlement will occur during the construction period, with ongoing secondary consolidation and creep settlements continuing at a reducing rate post construction.

Consolidation of the ground due to lowering of the groundwater

Temporary lowering of the existing groundwater level may occur during construction due to the excavation required to prepare a foundation platform. These changes in the groundwater regime are discussed in detail in *Technical Report 13: Groundwater Assessment* in Volume 3. The lowering of groundwater levels cause a reduction in pore water pressure and therefore an increase in effective overburden pressure. This will result in compression of the fill, marine sediments or Tauranga Group deposits over time. The consolidation settlements are time-dependant, and influenced by the amount of groundwater drawdown, and the nature, thickness and permeability of the underlying material and the existing seasonal variation in groundwater levels.

12.17.3.3 Severity of settlement

The Burland[78] method has been used to assess the severity of potential effects on nearby buildings. This method involves assigning a category of damage which identifies the typical damage likely to result from

[78] Burland (2012) – “*Building Response to ground movements*”, Volume I, ICE Geotechnical Manual, Institution of Civil Engineers.

settlement. The five categories range from Category 0-Negligible through to Category 5-Very Severe. The cut off for this screening is a maximum slope of 1/500 and a building settlement of 10mm (which is within the general seasonal ground movement range experienced in Auckland). These limits are considered by Burland to provide a conservative basis for identifying buildings requiring further investigation. None of the buildings considered by the assessment are identified as requiring further study. As ground settlement beyond the Project footprint is not expected to be extensive, the conservative (Category 0, Negligible) approach to identifying susceptible buildings has been utilised.

12.17.4 Assessment of ground settlement effects

The design and indicative construction methodology for the embankment and large retaining walls is set out in *Section 7.0: Construction of the Project*. Settlement in some areas will occur over the Project construction period while in some areas settlement may continue into the operational phase at reducing rates. Mechanical settlement from the construction of retaining walls will occur during the construction phase.

The assessment that follows is divided into three distinct areas: effects on building and structures, effects on services and effects on transport infrastructure.

12.17.4.1 Effects of settlement on buildings and structures

The location of the Project combined with the proposed construction methodology means that there is a negligible risk of structural damage to buildings during construction and operation of the Project. Across the Project, the predicted settlement beyond the Project footprint is less than 10mm and therefore the assessment of building damage category is “Negligible” using the Burland method.

Within Sector 1, excavation of the EWL Trench adjacent to Onehunga Wharf has the potential to cause both mechanical and consolidation settlement extending a modest distance from the structure. The effects on nearby buildings and infrastructure are still assessed as negligible (i.e. less than 10mm). There are a number of buildings, including The Landing heritage building, which are located in close proximity to the EWL Trench.

12.17.4.2 Effects of settlement on services

There are a number of existing services crossing or in close proximity to the proposed alignment that may be impacted by settlement. Close liaison with utility operators will be required through the design and the construction phase of the Project. Existing rail lines and shallow founded transmission towers will need to be monitored, utility operators consulted and some utilities may need to be relocated or protected (refer to *Section 12.5: Network Utilities*).

Predicted total settlement contours have been combined with the as-built service drawings to show the potential settlement effects on services located outside the alignment. This shows that construction of the Project will have negligible adverse effect on services along the alignment due to relatively small changes in grade and horizontal strain. The services within the Project that will need protection or relocation during construction for various reasons, including for settlement related effects, are identified on the drawings in *Plan Set 12: Utilities Relocation* in Volume 2.

12.17.4.3 Effects of settlement on transport infrastructure

Effects on transport infrastructure result from changes in road gradients as a result of settlement. The calculated level changes to roads which are not being reconstructed as part of the Project are less than 10mm which is considered negligible.

The existing rail line located south of Great South Road/Sylvia Park Road intersection has been assessed and falls outside the area of predicted settlement for the Project meaning that no settlement is expected. Settlement monitoring can be used to confirm no detectable settlements extend to the railway if deemed necessary by KiwiRail. Discussion with KiwiRail regarding potential settlement is ongoing.

12.17.5 Measures to avoid, remedy or mitigate potential adverse ground settlement

The effects of ground settlement on buildings and infrastructure outside the Project footprint are anticipated to be negligible (i.e. less than 10mm). Ground settlement monitoring will be undertaken during the construction of the EWL Trench adjacent to Onehunga Wharf to confirm the assessed settlement and to monitor effects.

The settlement monitoring associated with the EWL Trench will involve ground and building markers that are monitored at set intervals before, during and following construction to identify any settlement greater than that anticipated and to allow appropriate remedial actions to be taken. The Landing building is a listed heritage building located relatively close (approximately 30m) to the EWL Trench. In addition to building settlement markers, structural monitoring in the form of pre-and post-construction structural condition surveys is proposed and will be included in the CEMP. This is due to the building's heritage values and construction type (it is constructed of concrete and is unlikely to be reinforced). Construction methodologies will be altered to respond to vibration and settlement effects.

Some infrastructure such as rail lines and existing transmission towers on shallow spread foundations, is particularly sensitive to changes in grade due to ground settlement. Consultation with utility operators will continue during the detailed design and construction of the Project to confirm the need for any specific protection or monitoring of assets during construction (where these are not already proposed for relocation). If required, this could include pre-construction surveys and ongoing monitoring during construction to allow appropriate remedial actions to be taken. The preparation of the NUMP requires confirmation of specific protection or monitoring of assets with network utility operators and documentation of these requirements. Further discussion of the NUMP is contained in *Section 13.1: Project delivery framework*.

12.18 Contaminated land

Overview

The Project area has a large number of known (and potentially unknown) contaminated areas from a wide range of historic and current hazardous activities and industries including extensive modification of the original coastline of the Māngere Inlet.

Construction management measures are proposed to minimise effects of works in contaminated land during construction. These include measures applied generally across the whole project and specific measures for works within sensitive areas: the Galway Street Landfill, Pikes Point East and West Landfills and the asbestos contaminated site at 141-199 Hugo Johnston Drive. These measures will be documented in the final CLMP for the Project.

There will be beneficial outcomes from the Project through capture of discharges from contaminated land, including leachate from the replaced Pikes Point leachate interception system, and treatment within the new stormwater wetlands.

The Project area has a large number of known (and potentially unknown) contaminated areas, arising from a long history of industrial and commercial uses and activities, and through extensive modification of the original shoreline. This section assesses the actual and potential effects of the Project as a result of disturbance of contaminated land. These include the potential discharge of contaminants to air, land and water (surface and groundwater) where there may be an effect on the environment or an effect on human health. This assessment is supported by *Technical Report 17: Contaminated Land* in Volume 3 (which relies on *Technical Report 12: Surface Water* and *Technical Report 9: Air Quality* in Volume 3).

To identify known and potentially contaminated sites, a Preliminary Site Investigation (PSI) was undertaken within the Project area as well as the wider catchment of Onehunga, Te Papapa, Penrose and Ōtāhuhu. The PSI is contained in Appendix A of *Technical Report 17: Contaminated Land Assessment* in Volume 3.

A PSI was the chosen methodology for identifying the actual and potential contamination present in the Project area because there is so much known contaminated land present, and it is of a very wide-ranging nature. The PSI was prepared according to the Ministry for the Environment, *Contaminated Land Management Guidelines*[79].

In accordance with the NES Soil, the PSI assessed the actual and potential risks to human health posed by the Project as they relate to contaminants in soil.

For the purposes of better understanding the nature of contamination present in the area, and to inform the development of the design, soil contamination testing was performed at drilling sites completed for geotechnical and groundwater assessment purposes. The results are summarised in *Technical Report 17: Contaminated Land Assessment* in Volume 3.

A full suite of management measures will need to be employed across the site to appropriately manage the wide range of potential (and often unknown) materials present. These measures are discussed in further detail in Section 12.18.3 of this AEE.

[79] Ministry for the Environment, *Contaminated Land Management Guidelines, Number 1, Reporting on Contaminated Sites in New Zealand* (Revised 2011).

12.18.1 Existing areas of known and potentially contaminated land

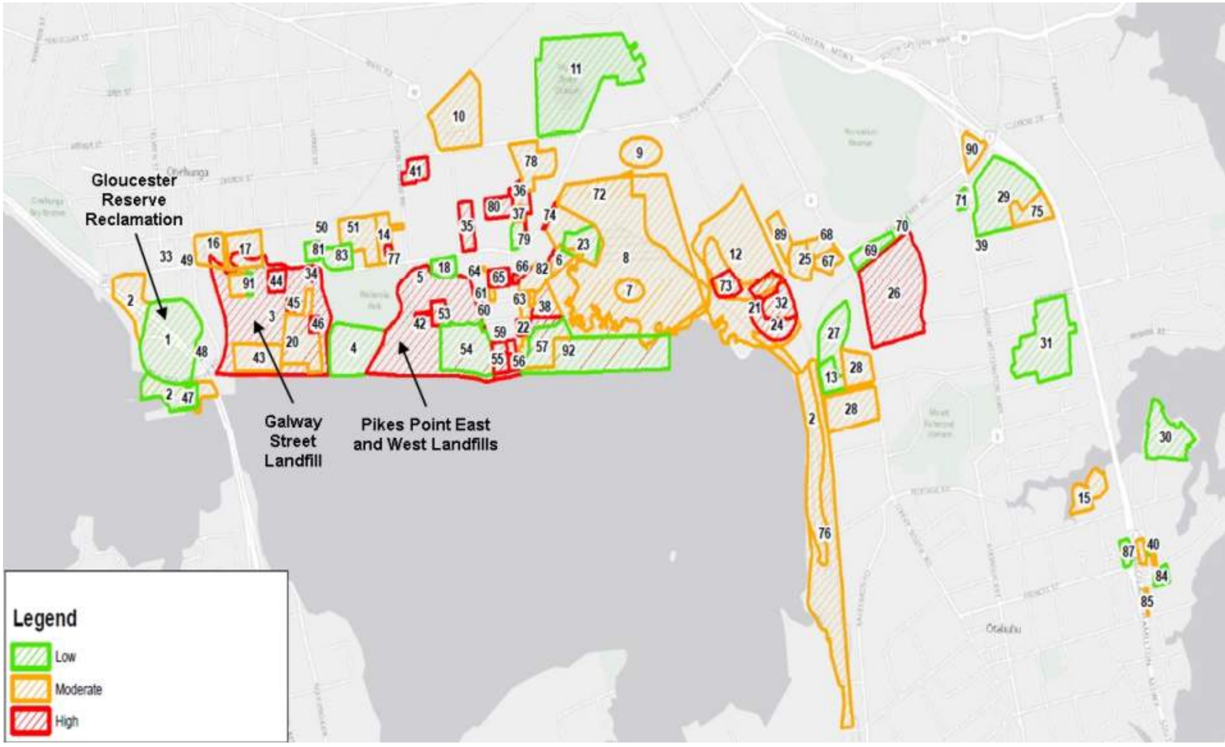
The Project area has a large number of known (and potentially unknown) contaminated areas, arising from a wide range of historic and current hazardous activities and industries including extensive modification of, and filling within, the original coastline of the Māngere Inlet. Some filling has also occurred (albeit on a much smaller scale) at Ōtāhuhu Creek.

The activities that are particularly relevant to the assessment of effects include:

- Areas where landfills received municipal solid waste continuing until the 1980's;
- Areas with uncontrolled fill;
- A range of historic hazardous activities and industrial land use activities including horticulture, industrial and commercial land uses; and
- Ongoing (current) industrial and commercial land uses.

The potentially contaminated sites are shown on Figure 12-23. The red, orange and green sites represent high, medium and low risk sites based on the potential risk posed by contamination. Further discussion of each site (identified by the numbers on the figure) is contained in the Contaminated Sites Inventory (Appendix A1 of the PSI (Appendix A) in *Technical Report 17: Contaminated Land Assessment* in Volume 3*).*

Figure 12-23: Potentially contaminated sites within the wider Project area



Included within the sites shown above are former landfill areas managed by Auckland Council as closed landfill. The most significant of these are:

- Galway Street Landfill (also referred to as the 75 Acre Reclamation) (Site 3); and
- Pikes Point East and West Landfills (Site 42).

Geotechnical investigations reviewed for the PSI have shown that these landfills to do not incorporate modern landfill design elements such as low permeability liners or caps to restrict rainfall. Therefore, the leachate from the landfill areas is likely to be contaminating the surrounding soil and groundwater. The contaminants of concern within these areas are likely to be metals, polycyclic aromatic hydrocarbons, semi volatile organic compounds, volatile organic compounds, microbiological, nutrients, asbestos and landfill gas.

On the Onehunga Foreshore there is currently a leachate interception trench operated by Auckland Council within the Pikes Point East and West landfill areas. The existing system is described in *Section 6.0: Description of the Project* of this AEE.

12.18.2 Effects of working on contaminated land

Although there are extensive areas of contaminated land with the Project area, the extent of excavation within those sites is relatively limited. The following sections assess the potential effects during construction and operation of the Project.

12.18.2.1 Construction Effects

The actual and potential construction effects from disturbance and discharge of contaminated land can impact:

- The environment from the disturbance of contaminants and associated discharge of contaminants to air, land and water (surface and groundwater) (as a matter covered by regional plans); and
- Human health – including site workers and/or the public from the discharge of contaminants (as a matter covered by the NES Soil).

a. **Effects on the environment**

The disturbance of contaminants and discharges to the environment will occur from earthworks in contaminated land. This could result in potential discharge through:

- Percolation of contaminants into groundwater;
- Overland flow (runoff) of contaminants from exposed surfaces during rain events;
- Movement of groundwater contaminants into the stormwater drainage network, which may ultimately discharge to the Māngere Inlet marine environment;
- Discharges of groundwater into the marine environment;
- Contaminated dust mobilised during dry windy conditions and/or during earthworks; and
- Discharges of landfill gas and other volatile organic compounds to air.

These discharges could have adverse effects on ecological values including terrestrial flora and fauna, biota in freshwater and biota in marine water environments.

Effects of the discharge of contaminants to air and water are assessed in *Section 12.12: Air Quality* and *Section 12.21: Surface Water* in the AEE respectively.

There will also be potential effects on groundwater from discharges resulting from disturbance of landfills.

Auckland Council holds existing resource consents for the discharge of in situ contaminants to ground and extraction of groundwater at the closed landfills on an ongoing basis (the leachate interception trench referred to above). The Project will require the relocation of the existing leachate interception trench at Pikes Point Landfill. The Transport Agency will manage the relocation of the leachate system as part of the construction phase, and the replacement system will be transferred to Auckland Council as an asset for the ongoing management of landfill discharges. The reconstruction of this leachate interception system is discussed in further detail in *Section 7.0: Construction of the Project* of this AEE.

During construction, measures will be put in place to appropriately manage potential risks to human health that arise from the disturbance of contaminated land in the existing environment. This will be done in consultation with Auckland Council as a consent holder where existing discharge consents (including for in situ discharges from landfills) are held.

b. **Effects on human health**

The exposure pathways to human receptors include:

- Inhalation (of dust, asbestos, landfill gas or volatiles);
- Ingestion (of contaminated soil or water); and
- Skin contact with contaminated soil or groundwater.

During construction, measures will be put in place to appropriately manage potential risks to human health that arise from the disturbance of existing contaminated land in the existing environment. The management measures will include specific requirements for the handling and disposal of contaminated material as set out in *Section 12.18.3* of this AEE. These measures will apply throughout the Project.

In addition there are two particularly sensitive contaminated land areas for construction activities:

- Works in the site at on 141-199 Hugo Johnston Drive where a stormwater wetland and parking/manoeuvring area is proposed. Investigations for the Project have shown that there will be significant quantities of asbestos in this area. The asbestos is likely to be a mix of asbestos containing material and free fibres within the soil. Discharges to air of asbestos fibre pose potential risks to human health. The asbestos does not pose a risk to groundwater.
- Works in the landfill areas at Galway Street and Pikes Point East and West, where the works will necessitate disturbance of landfill refuse and gas and odours may be expected. Due to the proximity of the coastal receiving environment this area has ecological sensitivity and the works will potentially affect human health. Specific health and safety controls will be required.

Additional management measures are proposed for these sites. These measures are discussed in *Section 12.18.3* of this AEE.

Overall, the effects of the Project on the environment due to construction activities in contaminated land, following implementation of the proposed management and mitigation measures will be minor.

12.18.2.2 Operational Effects

During operation of the Project, potential effects arising from ongoing activities in contaminated land, include:

- Discharge of landfill gas into subsurface utilities, posing potential health risks for maintenance workers;
- Discharge of contaminants due to disturbance of contaminated soil during periodic maintenance works along the road, including maintenance of utility services;
- Interception of contaminated groundwater and discharge through to the environment from the Pikes Point landfill leachate interception system. As noted in *Section 12.16: Groundwater* of this AEE, the performance of the system will be improved by installing a low permeability liner on the lower side of the interception trench, and through elimination of seawater by tidal control of stormwater discharges along Māngere Inlet.

Groundwater, including groundwater quality, the fate and transport of contaminants in groundwater, and the leachate interception trench at the Pikes Point East and West Landfills are assessed in *Section 12.16: Groundwater* of this AEE. This identifies that groundwater discharging from the landfill areas contains elevated levels of some contaminants.

During operation of the Project, people potentially at risk from exposure to contaminated land are maintenance workers. The concentrations of the contaminants are not likely to pose a risk to human health.

12.18.3 Measures to avoid, remedy or mitigate potential adverse effects

The Project design has been informed by contaminated land considerations, in particular:

- Specific design requirements for those locations where the Project crosses closed landfills; and
- Auckland Council's existing leachate interception trench adjacent to the Pikes Point East and Pikes Point West landfills will be replaced.

In order to manage known and unidentified contamination along the Project during construction, a CLMP will be developed. The CLMP will set out appropriate management measures for contaminated land disturbance to minimise the effects on human health and the environment. It will also set out a protocol for the testing, identification and offsite disposal (where necessary) of contaminated soil during construction. The contents and approval process for the CLMP are discussed in further detail in *Section 7.0: Construction of the Project* of this AEE.

A draft CLMP has been prepared for the Project demonstrating how the proposed contaminated land management measures could be implemented during construction of the Project. This is contained in Appendix D of *Technical Report 17: Contaminated Land Assessment* in Volume 3.

The CLMP will be finalised once a construction contractor has been appointed. The implementation of the approved CLMP will be overseen by a Suitably Qualified and Experienced Practitioner. The process for finalising the CLMP is set out in *Section 13.1.5: Management plans and other information* of this AEE.

The works within contaminated soil during construction will be managed as follows:

Matter	Management measure
Managing contaminated soil and disposal during construction.	Management and tracking of soil movements and appropriate disposal. This may involve sampling of stockpiled material to establish whether it is suitable for re-use as fill for the Project or depending on the level of contaminants, which class of landfill for disposal will be required.
Discharges of dust generated by land disturbance activities	Controlled by standard dust suppression measures. The measures to manage dust during construction are set out in Section 12.12.2: Construction air quality of this AEE.
Discharge of sediment from land disturbance activities	Controlled by standard erosion and sediment control measures designed to manage sediment during construction. These measures are set out in *Section 12.15: Erosion and sediment control* of this AEE.
Exposure to landfill gas	Monitoring of landfill gas during land disturbance activities within areas of known landfill (Galway Street and Pikes Point East and West Landfills). The potential risks from discharges of landfill gas vapours will be mitigated using active and/or passive ventilation of the work zones. The measures/ monitoring are set out in *Section 12.12: Air quality* of this AEE.
Potential human health risks for the construction work force	For the construction work force this risk will be managed through robust health and safety plans. Potential risks for the public, including residents and workers at industrial sites in the area will be controlled by exclusion of the public from works areas using fences, work site barriers and appropriate signage.

Matter	Management measure
Discharge of leachate from the Pikes Point Landfill leachate interception system	Replacing and upgrading the leachate interception system and providing treatment within the new stormwater wetland on the Māngere foreshore. The leachate interception system will be owned and operated by Auckland Council under existing consents for this system. The stormwater wetland is discussed in further detail in *Section 12.21: Surface water* of this AEE.

The specific measures for managing construction within landfill waste at Galway Street and Pikes Point will include the installation of controls, minimising the excavation zone, and isolating influences that could compromise the environmental and human health controls. The specific measures are set out in the Draft CLMP contained in *Appendix D* of *Technical Report 17: Contaminated Land Assessment* in *Volume 3*.

The specific measures for managing construction within the known asbestos site at 141-199 Hugo Johnston Drive will include controls for the excavation and handling of material containing asbestos to manage the release of respirable asbestos fibres into air. The specific measures are also set out in the draft CLMP.

Overall, the effects of contaminated land during operation of the Project will be positive with opportunities to appropriately manage contaminated stormwater and leachate discharges by treating them in new wetland and biofiltration systems. The risk posed by landfill gas for maintenance activities can be appropriately managed.

12.19 Coastal processes

Overview

The Māngere Inlet and Ōtāhuhu Creek have both been extensively modified through progressive reclamation and coastal structures.

The northern foreshore of the Māngere Inlet has been substantially modified due to reclamation of an estimated 1.8km^2 of the original 7.5km^2. The Project will involve 18.4ha of reclamation in the Māngere Inlet. The reclamation represents a 3.5% loss of area of the Inlet and 0.1% of the whole Manukau Harbour. The extent of the reclamation has been minimised to the greatest extent practicable, while still achieving the Project objectives and delivering benefits to the environment from stormwater treatment and coastal edge naturalisation. The reclamation will result in changes to the coastal processes in the Māngere Inlet.

To construct the reclamation, the current proposal is that a 15ha subtidal area within the Māngere Inlet will be dredged and a channel created between the dredging site and the construction yard at Waikaraka Park. The dredged sediment will be used for the production of mudcrete. The average release of sediment from dredging and mudcrete will be 35 tonnes/day during the construction period which is 2.5 to 5% of the natural sediment flux. The effects of sediment from the dredging and mudcrete operations will be temporary, occurring for a period of about one year. The adverse effects on coastal processes from dredging within the Māngere Inlet will be minor.

At Ōtāhuhu Creek, the three box culverts will be replaced with a bridge, a new bridge constructed to enable construction of the replacement bridge and declaiming of approximately 0.5ha of land on the southern side of the creek.

Removal of the culverts will enable a new tidal channel to be formed close to the original 1940s alignment. The new bridge structure and associated declamation will have a beneficial effect mainly as a result of re-introducing the coastal processes that relate to natural character.

Overall, with the implementation of measures outlined in this section, the adverse effects of the dredging, reclamation and coastal structures on coastal process within the Māngere Inlet and Ōtāhuhu Creek will be minor.

12.19.1 Introduction

This section assesses the actual and potential effects of the Project on coastal processes within the Māngere Inlet and Ōtāhuhu Creek from the reclamation, dredging and discharges to the CMA. Coastal processes relate to the coastal hydrodynamics (the movement of fluid), sedimentation (the supply, transport, erosion and deposition of sediment) and morphology (the natural form). The assessment is supported by *Technical Report 15: Coastal Processes Assessment* in Volume 3.

The assessment started with developing and understanding how the coastal areas have responded to historical coastal developments. Modelling of the Project in Māngere Inlet was undertaken to gain an understanding of the likely changes in the hydrodynamic and sedimentation processes. Morphological changes that relate to any encroachment into the Inlet channel and other tidal channels were also assessed. The results were analysed to determine the effect of changes to the existing environment resulting from the Project. A more detailed assessment was undertaken for the Māngere Inlet as the scale of work is much greater than at Ōtāhuhu Creek.

12.19.2 Existing Environment

The Māngere Inlet and the Ōtāhuhu Creek are described in *Section 11.0: Description of the existing environment* of this AEE. The matters that are of particular relevance to this assessment are set out below.

12.19.2.1 The Māngere Inlet

Māngere Inlet is part of the Manukau Harbour and is a semi enclosed basin composed of shallow tidal creeks, mangroves and large expanses of intertidal mudflats. It encompasses an area of approximately 5.6km^2.

The Inlet is a sediment and contaminant sink, experiencing sediment movement, particularly during windy conditions. Sediment is predominantly from redistribution around the Manukau Harbour and the Inlet rather than from catchment sources. Overall, it is assessed that the average present day sedimentation rate is 10mm/yr.

Sediments within Māngere Inlet consist of mud and fine grained sand. Core sampling indicated that sediment texture has been muddy since pre-human times. The results of the sediment sampling are contained in Appendix E to *Technical Report 15: Coastal Processes Assessment* in Volume 3.

An understanding of the historical response of the Māngere Inlet to development and reclamation can provide a better understanding of how coastal processes will respond to the Project. In 1853 the Māngere Inlet was an open basin with an entrance estimated to be 630m wide. The construction of the impervious rock causeway at the southern end of the Old Māngere Bridge reduced the width of the entrance to approximately 240m. As a result, the Māngere Inlet entrance deepened from approximately RL4.5m to RL7.7m, and wave energy entering the Māngere Inlet reduced.

The northern foreshore of the Māngere Inlet has been substantially modified due to reclamation of an estimated 1.8km^2 of the original 7.5km^2 (being a 24% change) of the Māngere Inlet. This loss is mainly as a result of landfill along the northern and eastern coastlines. Other small reclamations have occurred at the southern end of the Manukau Harbour Crossing and inside Harania Creek. This reduction in area has led to the loss of natural features and the loss of tidal prism within the Inlet.

The observed historical changes have been more pronounced with narrowing of the tidal Inlet channel than with reclamation. Changes to the Inlet due to reclamation have tended to be relatively benign as the reclamation did not encroach into the main tidal channel. Reclamation effects have probably been masked by the effects of narrowing the tidal Inlet channel and the increase in mangrove coverage (now occupying 20% of the inlet over the past 60 years). Narrowing of the tidal Inlet channel has created a coastal inlet whereas it was originally part of the wider harbour environment. This has resulted in a deepening of the main tidal channel and a reduction of wave energy entering the Inlet.

12.19.2.2 Ōtāhuhu Creek

Ōtāhuhu Creek is a tidal creek which flows into the Tāmaki Estuary. Currently the coastal area of the creek to the west of SH1 is approximately 5ha, 95% of which is covered with mangroves. The soils in this catchment are well-drained, being of volcanic origin.

In the late 1950s triple culverts were installed under SH1. The culverts comprise three 2.1 x 2.1m box culverts, 33m long, with an invert at about 0.5m above mean sea level. The culverts have adequate capacity to accommodate extreme flood events, as well as storm surges and tsunami.

Upstream and downstream of the culverts, seabed levels in the main tidal channel of the culverts are lower. This indicates that the tidal flows are sufficient to maintain a formed channel rather than for it to be infilled. Aerial photography indicates that the total area covered by mangrove forest has increased since 1940 especially upstream of the bridge. This suggests that the culverts have potentially limited the transportation of sediment out into the estuary promoting a better environment for mangrove growth.

Based on a review of the as-built drawings for the culverts, it appears that the immediate area was reclaimed with the SH1 motorway construction. The reclaimed area was in the order of 0.6ha or about 12% of the Ōtāhuhu Creek CMA.

Figure 12-24 and Figure 12-25 show the Ōtāhuhu Creek area in 1940, prior to construction of SH1, and in 2008.

Figure 12-24: Ōtāhuhu Creek 1940 (the approximately location of crossing shown)

Figure 12-25: Ōtāhuhu Creek 2008

12.19.3 Assessment of effects on coastal processes (Māngere Inlet)

The Project involves the following activities that have the potential to affect coastal processes in the Māngere Inlet:

- Reclamation of 18.4ha of the CMA (above MHWS) along the northern coastline of the Inlet and an additional area of permanent occupation (below MHWS) for the embankment, headlands and boardwalks of 5.9ha;
- Piers in the CMA for the foreshore boardwalk occupying approximately 53m^2;
- Piers in the CMA through Anns Creek occupying approximately 73m^2;
- Dredging a 15ha subtidal area and a channel within the Inlet for the production of mudcrete used in the foreshore; and
- Replacing the secondary tidal channel at the eastern end of the Inlet that will be covered over by the construction of the eastern headland.

12.19.3.1 Reclamation

Reclamation resulting in permanent loss of the CMA for construction of the foreshore has the potential to result in changes to the tidal regime, the sedimentation regime and coastal morphology.

The design of the Project to date has given particular consideration to the potential effects on coastal processes with the purpose of avoiding or minimising effects by:

- Minimising intrusive reclamation in the area near the Inlet entrance (by Galway Street up to Albert Street) as past intrusion into the Inlet entrance has resulted in more noticeable effects on the Inlet.
- Avoiding reclaiming into the tidal channels as this would alter the morphology of the channels and result in a different distribution of tidal flows and sedimentation regime. The exception is at the eastern end of the reclamation where a secondary tidal channel that feeds into Anns Creek is located

close to the northern coastline. In this location a new tidal channel has been included in the design with the same dimensions as the existing channel.

- Incorporating coastal features such as headland structures and rocky foreshore into the recreated coastline.

Discharging stormwater from the proposed treatment wetlands through the headland structures into the tidal channels to assist with dilution of that stormwater into the receiving environment. The extent of the reclamation has been minimised to the greatest extent practicable, while still achieving the Project objectives and delivering benefits to the environment from stormwater treatment and the recreated coastline.

Generally natural changes in hydrodynamics (the movement of liquid) or morphology (the form of the seabed) are slow enough that an inlet can adapt gradually. However sudden changes caused by human intervention such as from new structures and landfill will shift Māngere Inlet's equilibrium. These shifts will force a change within the Māngere Inlet until it reaches a new equilibrium. The Māngere Inlet has adjusted to morphological changes in the past by a combination of the entrance scouring and sedimentation. These processes are ongoing.

The Project has a proposed reclamation area (above MHWS) of 18.4ha (or 0.184km^2) and a coastal occupation footprint (the below MHWS) of 6.7 (or 0.067km^2), compared to the existing area of the Inlet of 5.7km^2. The Project will increase the reclamation area from 24% of the Manukau Harbour area to 27%, a relative increase of 3.5%. Table 12-20 shows the areas and reclamation of the Māngere Inlet and the Manukau Harbour from 1850's to present day.

Table 12-20: Changes to the Māngere Inlet since 1850

	1850	2016 (existing)	With Project
Māngere Inlet			
Māngere Inlet area	7.5km^2	5.7km^2	5.5km^2
Area of reclamation within the Māngere Inlet	-	1.8km^2 (24% of the original inlet)	2km^2 (27% of the original Inlet)
Māngere Inlet entrance	630m	240m	No change.
Manukau Harbour			
Manukau Harbour area	376.5km^2	368km^2	367.8km^2
Total area of reclamation within the Manukau (including the Project)	-	8.5km^2 (2.26% of the harbour)	8.7km^2 (2.31% of the Harbour)

The piers for the proposed viaduct structures through the coastal areas of Anns Creek Estuary and Anns Creek West will occupy an area of about 73 m^2 or 0.0001% of the inlet area. The viaduct surface will occupy 0.8ha of the CMA.

Reclamation reduces the footprint of the CMA and correspondingly reduces the tidal prism. The tidal prism is the volume of seawater exchanged between MHWS and MLWS upstream of a reference point (e.g. Old Māngere Bridge). The Project will reduce the tidal prism by 3.5% to 12.2 million m^3. Reducing the tidal prism reduces the tidal currents.

The entrance to the Inlet is likely to respond to this change. With a lesser tidal prism, the cross-sectional area of its entrance will reduce to reach a new equilibrium condition. Some accretion (build-up of material) could therefore be expected at the entrance, probably in the order of 35m^2 cross-sectional area or 0.25m depth. This depth is less than the normal fluctuations of the entrance. Historically the seabed has been more elevated. The entrance will continue to limit the amount of wave energy entering the Inlet.

The reclamation will result in the following additional changes compared to the existing situation:

- The maximum tidal current change occurs within the new embayments along the northern coastline with a change of 0.1 m/s in a spring tide. Away from the new land area, the maximum change in tidal currents occur offshore of the new headlands with a change of 0.1m/s. Away from these locations the maximum change is 0.05 m/s during a spring tide. These changes are not significant.
- The general circulation and extent of tidal currents will be the same as the existing regime.
- Overall there will be a slight increase in average sediment deposition within the inlet from 9.8mm to 10.5mm (7% change).
- There will be an increase in deposition within the new embayments along the recreated coastline with an increase of 5mm/year to a new level of up to 30mm/yr. Mud deposits could therefore be expected in these locations as would have occurred with the original and existing environment.
- Sedimentation will continue within the Inlet at a rate of about 10mm/yr. This has the potential to affect the discharge of stormwater as the intertidal areas in front of stormwater pipes silt up. The recreated coastline design, however, incorporates discharging the stormwater into the tidal channels which have a tendency to erode rather than accrete. This potential effect is therefore minimised.
- The tidal channels will have approximately the same level of erosion as the existing situation. These channels should therefore remain in a morphological stable condition.
- Within the area of the proposed Anns Creek viaduct over Anns Creek the peak tidal velocities are less than 0.2 m/s. As this is less that the velocity required to mobilise marine mud, no scouring of sediment around the piles is expected.

Historical developments within the Māngere Inlet have probably had a significant adverse effect on the original environment. The changes related to those effects have now become part of the existing environment against which this Project is assessed. It is considered that the changes to the existing situation from this Project will have the following effects:

- The Inlet will remain a depositional environment with minimal erosion risk to the coastline.
- Potential erosion risk of the coastline associated with this Project is low as it will be protected from inundation and wave action.
- Adverse effects associated with coastal processes within the Inlet for the foreshore works are minor.
- Adverse effects associated with coastal processes within Anns Creek for the elevated structures are negligible.
- While the reclamation associated with the recreated coastline does have adverse effects on the existing environment, the recreation of coastal features such as headlands and foreshore is beneficial in terms of the processes.
- The Project design has allowed for the effects of climate change (sea level rise and increased windiness) over 100 years, and tsunami events.

Although changes will occur with the implementation of the foreshore works, the tidal current circulation and the sedimentation patterns are similar. Overall the effects of reclamation and the permanent occupation of the seabed by new structures on the coastal processes of the Māngere Inlet are considered to be minor.

12.19.3.2 Dredging and sediment

Dredging may be undertaken to provide source sediment for the production of mudcrete to construct the reclamation for the new foreshore.

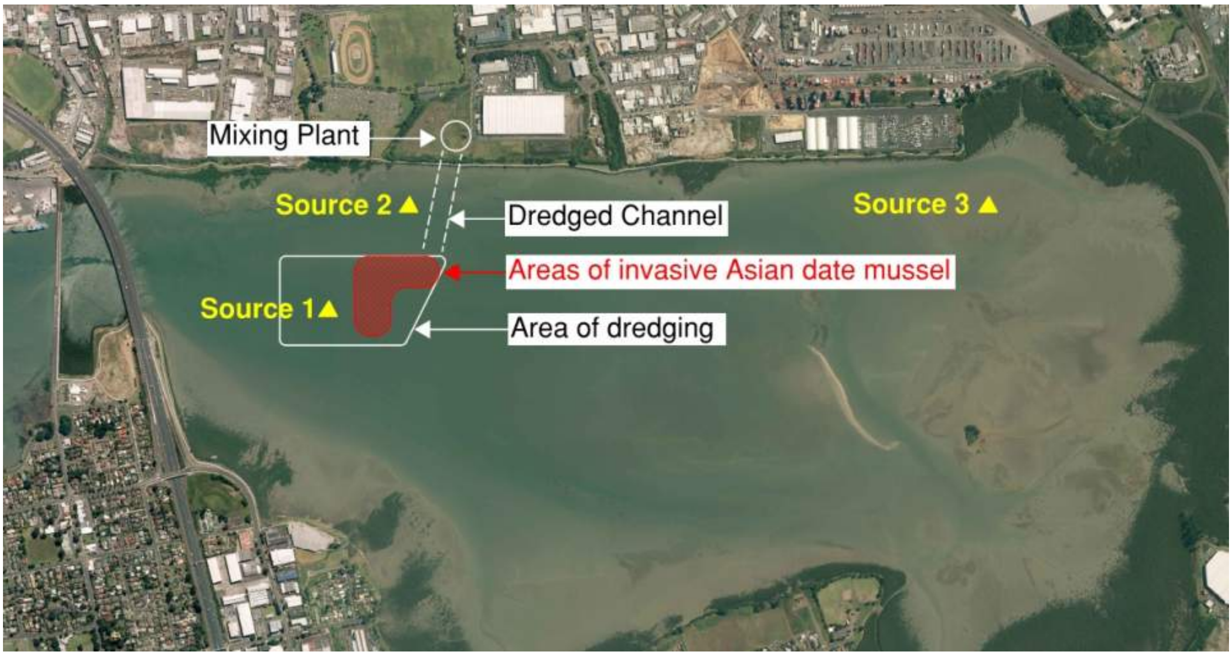
A sub-tidal area of 15ha on the north western side of the Māngere Inlet is proposed to be dredged to provide the source material for mudcrete (refer to Source 1 on Figure 12-26). The dredging will occur at an average depth below existing seabed levels of 1.5m. As part of the dredging operation an area of Asian date mussels will be removed.

To undertake the reclamation efficiently without having to rely on the tides, a temporary navigation channel of approximately -2.5m RL will also be created between the dredging site and the construction yard at Waikaraka Park (Source 2).

The construction of Headland 3 will require the relocation of the current channel in this location. A 10m wide new channel will be created around the headland with the existing channel infilled as part of the reclamation (Source 3).

A more detailed plan showing the dredging area, temporary construction channel and relocated channel around Headland 3 is contained as Figure F1 in *Technical Report 15: Coastal Processes Assessment* in *Volume 3*.

Figure 12-26: Location of dredging areas



In total, 300,000m^3 of sediment will be dredged externally to the Project with a rate of 750m^3 per day. The dredging will occur over a period of approximately one year. The dredging will be undertaken by mechanical dredging. This is considered to be an effective method in minimising the release of sediments as most of the dislodged material remains intact and falls back into the dredged area. During the dredging, the sources of sediment are from the dredger bucket and overflow from the receiving barge.

Once sediment is processed to form mudcrete, it will be placed within the CMA to form the reclamation. During the reclamation construction, approximately 75,000m^3 of mudcrete will be exposed to the tide. Mudcrete mixture is sticky, attracted to seawater and binds together rather than releasing into the water, therefore minimal sediment discharge is anticipated during construction. It is anticipated that a maximum of 2.5% of mudcrete could be dispersed into the Māngere Inlet. To minimise the discharge of sediment, the construction of the reclamation will be staged and erosion and sediment controls will be implemented to minimise total suspended solids (TSS) and deposition.

It is estimated that the average release of sediment (and mudcrete) from dredging and mudcrete will be 35 tonnes/day or 18 tonnes/tide during the construction period. This compares to the average natural flux of sediment into and out of the Inlet of 700 tonnes on a spring tide and 350 tonnes on a neap tide. The sediment release is therefore some 2.5 to 5% of the natural sediment flux. The dredged material is the native material, not an introduced source, so the water quality associated with sediment release will be similar to the native material when re-suspended.

The location of the sediment plumes will be predominantly into the Inlet as naturally occurs. The total release of sediment for the Project is about 10,500 tonnes. It is estimated that the maximum deposition away from the mixing zones will be 10mm with an average of 3mm over the whole Project. This compares to an average deposition within the inlet of 10mm/year (i.e. 43,000 tonne/year) with 25mm/year at the northern coastline.

In the context of the Manukau Harbour which is noted for having high natural levels of total suspended solids and sediment deposition, the sediment plumes from the dredging and mudcrete operation will have a minor adverse effect. It will be temporary, persisting for a period of about 1 year. The impact on marine ecology from sediment and contaminants are addressed in *Section 12.20: Ecology* of this AEE.

Modelling has indicated that following construction, while sedimentation is likely on the flanks of the 15ha dredged area, the central part of it will remain as a basin. This is likely to be a remnant feature long term but will be within the subtidal area of the Inlet. Overall the long term effect of the dredged area on coastal processes is considered to be minor.

To minimise adverse effects on the Inlet geomorphology, the dredged channel between the dredging site and the Waikaraka Park construction yard will be infilled immediately following construction. This will require filling the channel with 25,000m^3 of material. Areas which will not be infilled will, over time, act as a sink for sediment and infill themselves over time. Coastal processes will restore/reach equilibrium.

The construction of the easternmost foreshore landscape feature encroaches into an existing tidal channel in this location. This channel will be relocated by dredging a new channel a short distance from the existing channel. The new channel will have a similar geometry to the existing channel to minimise morphological changes.

Overall the effects of sediment from the dredging and mudcrete operations will be temporary, occurring for a period of about one year and with the implementation of appropriate management measures (set out below), the adverse effects on coastal process within the Māngere Inlet will be minor.

12.19.4 Assessment of effects on coastal processes (Ōtāhuhu Creek)

The Project involves the following activities that have the potential to affect coastal processes in the Ōtāhuhu Creek:

- Constructing a new bridge alongside the existing culverts for use during construction and then retained as a bridge providing pedestrian /cycle access;
- Removing the three box culverts and replacing them with an approximately 112m long bridge;
- Realigning the main tidal channel close to its 1940 historical alignment; and
- Declaiming approximately 0.5ha of land on the southern side of the creek by removing fill material.

The proposed bridge will span the original creek to effectively declaim the area. On the northern side, the abutment more-or-less follows the original landform. On the southern side the new landform will declaim about 0.5ha comprised of 20,000 m^3 of material. Complete declamation to the pre-culvert landform is not feasible as it would interfere with private property adjacent to SH1 in this location.

As a result of the culvert removal, a new tidal channel will be formed. The channel will be realigned close to the original 1940s alignment at a mid-span location. This will move the channel southwards and away from the northern abutment. The new channel will be about 3m wide and 1m deep, subject to confirming downstream dimensions. The excavated channel material may be used to fill in the existing channel.

The piers associated with the new bridge structures will occupy approximately 10m^2 or 0.02% of the upstream CMA. The bridge structure will occupy 0.12ha of the CMA.

The area has a low energy wave climate, particularly with the presence of the mangroves and this will continue with the Project in place. The tidal currents, without the culverts, will be relatively low. Tidal flows will be in the order of $5m^3/s$ at 0.5m RL. With a new channel with similar dimension to the original channel the tidal currents will be below 1m/s at 0.5m RL. Flood flows could be in the order of $30m^3/s$ for the 100 year ARI and this is easily accommodated within the new bridge opening. Based on this, the area will remain a depositional environment with minimal erosion risk to the coastline although the tidal channel will exhibit erosion from time to time.

Given the extent of mangroves, erosion of the flat intertidal area following construction of the bridge will be limited. Some erosion of the tidal channel could be expected as part of the readjustment and would be an ongoing process.

Overall the new bridge structure and associated declamation will have a beneficial effect mainly as a result of re-introducing the coastal processes that relate to natural character.

12.19.5 Measures to avoid, remedy or mitigate potential adverse effects on coastal processes

In managing the adverse effects of the coastal works during construction, the following measures are proposed:

- The construction of the reclamation in the Māngere Inlet will be staged to minimise exposed areas of the reclamation;
- The dredged channel between the dredging site in the Māngere Inlet and the Waikaraka Park construction yard will be infilled following construction to minimise adverse effects on the Māngere Inlet geomorphology;
- A deflector structure or silt fence will be established at the eastern end of the Project to limit the TSS and deposition in the Anns Creek Estuary area. The details of the measures will be set out in the CESCP for the works;
- Erosion and sediment control measures and perimeter controls will be installed for the foreshore works and bridge construction;
- One-off comprehensive water quality monitoring will be undertaken for the dredging and mudcrete operations within the Māngere Inlet for a spring and neap tide during the initial phase of the Project and confirmation of the trigger level to be established as part of the CESCP for the works;
- Weekly water quality monitoring will be undertaken for the dredging and mudcrete operations within the Māngere Inlet;
- A Contingency Plan will be in place for trigger level exceedances within the Māngere Inlet during construction which may require changes to the dredging methodology;
- Sediment deposition rates in the Māngere Inlet will be monitored at nominated locations after completion of the reclamation to confirm the modelling predictions;
- Specific measures to manage concrete dust from the removal of the Ōtāhuhu Creek box culverts to prevent this entering the creek; and
- Options for declamation in the Manukau Harbour will be investigated.

12.19.6 Conclusion

Overall, with the implementation of the measures outlined above, the adverse effects of the dredging, reclamation and coastal structures on coastal processes within the Māngere Inlet and Ōtāhuhu Creek will be minor.

12.20 Ecology

Overview

The ecological values of the majority of the Project area have been degraded by previous extent of urban and industrial development. However, the complex terrestrial, freshwater and marine ecosystems within Anns Creek and Māngere Inlet still contain high values and are identified in the AUP (OP) and the Auckland Council Regional Plan: Coastal (ARP C) for these high values.

The Project will have significant effects on some of the values in the identified areas, but includes mitigation where possible and also offers the opportunity to restore and enhance other ecological values resulting in positive effects.

The most significant effect of construction on terrestrial ecology will be impacts on the remnant lava flow vegetation along the coastal edge of Māngere Inlet and Pikes Point, and the loss of threatened ecosystems and vegetation in Anns Creek. Anns Creek is the only area remaining in the Auckland region where native herb species, including threatened species, grow together on lava. The magnitude of the adverse effect in this locality has been assessed to be high.

All of the freshwater ecosystems within the Project area are assessed as having low ecological values. The most significant effect to freshwater ecology is from the permanent loss of habitat in Miami Stream and Anns Creek. The magnitude of the adverse effect has been assessed as moderate.

The most significant effect on marine ecology is the permanent loss of intertidal mudflats along the northern Māngere Inlet from construction of the road embankment, landscape features and stormwater wetlands. The magnitude of the adverse effect is high because the effect is permanent.

The most significant effect to avifauna is the permanent loss of vegetation and habitat in Anns Creek and the loss of foraging habitat in the Inlet. The loss of habitat at Anns Creek will put the threatened species Banded rail and Bittern further at risk. The magnitude of the adverse effect is considered to be high.

The positive effects from the Project include the reduction of sediment, particulate and dissolved contaminant load to the CMA which will benefit the marine organisms and avifauna in the intertidal zone. The other positive effects are the restoration of saltmarsh habitat, enhanced habitat on along the coastal edge and in Anns Creek and an increase in habitat diversity within the stormwater wetlands which will benefit avifauna, marine and freshwater organisms.

The EIANZ Guidelines used in the ecological assessments state that very high, high and moderate levels of effect require avoidance or mitigation, whereas low and very low levels of effect are normally not of concern, but design, construction and operational care should be taken to minimise adverse effects. The design and location of the Project has avoided and minimised some effects while residual effects are addressed through a suite of measures. These measures are included in construction and operation aspects of the Project to mitigate and offset the effect on ecological values.

12.20.1 Introduction

This section presents the findings of investigations undertaken to determine the actual and potential ecological effects of the Project on terrestrial (including lizards), freshwater and marine ecology and avifauna. The assessment is supported by *Technical Report 16: Ecological Impact Assessment* in Volume 3.

The approach to identifying ecological values and effects in this section is based on the *Environment Institute of Australia and New Zealand Ecological Impact Assessment Guidelines 2015 (*the EIANZ Guidelines). The EIANZ Guidelines provide a method for assigning value to habitats for the purposes of assessing actual and potential effects of activities. In accordance with the EIANZ Guidelines, the magnitude of each adverse effect combined with the ecological value of the existing environment provides an understanding of the level of the adverse effect. Each of the effects identified in this section have been assessed in terms of this approach.

The identification of ecological values has relied on the following:

Terrestrial: Desktop investigations, literature reviews and ecological, botanical and herpetofauna field surveys of the Māngere Inlet, the coastal foreshore, Te Hōpua, Anns Creek and Ōtāhuhu Creek.

Freshwater: Desktop investigations, literature reviews, field surveys, fish and macroinvertebrate sampling in Miami Stream, Southdown Stream and Clemow Stream.

Marine: Desktop investigations, literature reviews, review of aerial photography and Auckland Council GIS layers, marine ecology and sediment data and reports, and intertidal and subtidal sediment and benthic invertebrate sampling within the Māngere Inlet.

Avifauna: Desktop investigations including aerial photography, previous avifauna surveys, published and unpublished literature, ornithological databases; land and shorebird observations and summer and autumn avifauna surveys.

A detailed discussion of the assessment methodology and the finding of investigations are contained in *Technical Report 16: Ecological Impact Assessment* in Volume 3.

12.20.2 Existing ecological environment

12.20.2.1 Existing terrestrial habitats

Terrestrial habitats are land based plant and animal communities. The Project area lies within the Tāmaki Ecological District where vegetation has been modified by urban and industrial development and by reclamation of the foreshore and intertidal areas. The ecological values of the majority of the Project has been degraded. The Project area lies within a threatened land environment where between 10 to 20% of indigenous vegetation cover remains and less than 20% of that is legally protected.

The ecological values of the coastal foreshore of Māngere Inlet and Anns Creek are strongly influenced by the volcanic history of the area and by the extent of urban and industrial development. The northern shore of Māngere Inlet has been highly modified.

The complex of terrestrial, freshwater and marine ecosystems within Anns Creek and Māngere Inlet are identified as SEA in the AUP (OP), CPA in the Auckland Council Regional Plan: Coastal, and Significant Natural Areas in the Operative Auckland Council District Plan: Isthmus Section.

The lava flow vegetation at Anns Creek and along the foreshore of the Māngere Inlet are the last remaining areas of this ecosystem type in Auckland. Volcanic boulderfields are identified as a scarce ecosystem type in Auckland and is an area identified at a national level as a naturally uncommon ecosystem type with a threat status of ‘endangered’. The substrate of the lava flows results in a unique and unusual assemblage of native plants, including threatened plant species.

Anns Creek is identified for ecological sequences from saltwater to freshwater, and for the mosaic of vegetation types present including basalt lava shrubland. Ecological gradients are present with mangroves to glasswort and bachelors button, and into marsh clubrush in the brackish areas, and then into raupo at the edge of the lava flow. Figure 12-27 and Figure 12-28 show the typical vegetation at Anns Creek.

Figure 12-27: Anns Creek East, mosaic of mangrove saltmarsh and lava shrubland

Figure 12-28: Anns Creek West, lava shrubland on pahoehoe lava

Anns Creek is the only area remaining in Auckland where native herb species, including threatened species, grow together on lava, and is the type locality for Coprosma crassifolia. These threatened species are set out in Table 12-21.

Table 12-21: Threatened species in Anns Creek and Māngere Inlet from survey reports and Auckland Museum herbarium

Name	Threat Status (de Lange *et al* 2013)	Location	Date of most recent record	Found in this survey
Geranium retrorsum	Nationally vulnerable	Anns Creek	17 Feb 2004	
Geranium solandri	At risk declining	Anns Creek	7 Feb 2004	yes
Myoporum laetum	Regional threat status: gradual decline	Māngere Inlet	23 Nov 1993	yes
Pellaea falcata	At risk declining	Anns Creek	10 Dec 1993	
Pomaderris phylicifolia	Nationally endangered	Anns Creek	27 Dec 1983	
Puccinellia stricta	Regional threat status: acutely threatened	Manukau Foreshore Walkway	12 Jan 2001	yes

Pikes Point contains basalt lava flows and shrubland ecosystems and Te Hōpua contains saltmarsh wetland. Figure 12-29 and Figure 12-30 show these areas.

Figure 12-29: Mangroves on lava at Pikes Point

Figure 12-30: Te Hōpua, glasswort herbfield and sea rush wetland

Southdown Reserve is located at 127-139 Hugo Johnson Drive. It comprises native and exotic plantings, riparian vegetation and mangroves. The reserve has been identified as a Hazardous Activities and Industries List (HAIL[80]) site contaminated with asbestos. Further discussion of the asbestos contamination is contained in *Section 12.18: Contaminated Land* of this AEE.

The Anns Creek Reserve located at 811-813 Great South Road contains a freshwater wetland.

Ōtāhuhu Creek contains mangroves and intertidal habitat for wading birds.

The areas discussed above are outlined in Table 12-22 below.

[80] Under the *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011*.

Table 12-22: Significant Ecological Areas in the Project area

Site Name	Vegetation Types criteria	Description of criteria met	SEA or ONF	AUP (OP) criteria	Overall Rating
Anns Creek East	Lava Shrubland, Marsh clubrush reedland, tall fescue grassland, mangroves, saltmarsh herbfield, raupo reedland	Contains naturally uncommon ecosystem type that is threatened. Supports threatened and at risk plant species. Indigenous vegetation within wetland. Type locality for taxon. Important as intact sequence. Indigenous vegetation extending across environmental gradient. Supports typical species richness for type.	SEA-T-5309 ONF192	Representativeness (H) Threat status and rarity (H) Uniqueness or Distinctiveness (H) Diversity (H)	Very High
Anns Creek West	Mangroves, saltmarsh ribbonwood	Contains naturally uncommon ecosystem type that is threatened.	H13-21 ONF192	Threat status and rarity (H)	High
Anns Creek Estuary (within the Māngere Inlet)	Lava shrubland, mangrove	Contains naturally uncommon ecosystem type that is threatened. Supports threatened and at risk plant species. Indigenous vegetation within wetland. Type locality for taxon. Important as intact sequence. Supports typical species richness for type.	SEA-T-5304 SEA-M1-21 ONF192	Representativeness (H) Threat status and rarity (H) Uniqueness or Distinctiveness (H) Diversity (H)	Very High
Lava flow at Pikes Point	Lava shrubland, mangroves	Contains naturally uncommon ecosystem type that is threatened. Supports threatened and at risk plant species.	SEA-T-9022 H13-23	Threat status and rarity (H)	High
Te Hōpua crater	Glasswort-sea rush-oioi rushland	Indigenous vegetation within a wetland.	SEA-T-6103	Threat status and rarity (M)	Moderate
Southdown Reserve	Mangroves, oioi saltmarsh	Indigenous vegetation within a wetland. Forms part of a network of sites.	SEA-T-6104	Threat status and rarity (M) Stepping stones, Migration Pathways and Buffers (M)	Moderate
Anns Creek Reserve Wetland	Freshwater wetland	Indigenous vegetation within a wetland.	SEA-T-5308 H13-25	Threat status and rarity (H) Stepping stones, Migration Pathways and Buffers (M)	High

The wider Project area includes a range of potential lizard habitat types including areas with replanted native vegetation (e.g. the privately owned 69 Captain Springs Road), vegetated reserve margins with refugia including piled basalt rocks and wood debris (e.g. the Manukau Foreshore Walkway) and complex grasslands that provide basking habitat and refugia (e.g. Captain Springs Road).

The majority of potential lizard habitat was classified as 'poor' quality, but small areas of 'moderate' and 'high' quality habitat were observed during field surveys. As part of the surveys, an assessment of the prevalence of herpetofauna within the Project area was undertaken[81]. Native lizards were not detected during surveys to date. Table 12-23 shows the recorded lizard sightings within 10km of the Project.

Table 12-23: Lizard records within 10km of the Project (date range 1998-2015) (DOC 2016).

Species		# records	Threat Class	Location of nearest record
Lampropholis delicata	Plague Skink	7	Unwanted Organism	Māngere
Mokopirirakau granulatus	Forest Gecko	1	At Risk - Declining	Ōrākei
Oligosoma aeneum	Copper Skink	4	Not Threatened	Ōtāhuhu
Oligosoma ornatum	Ornate Skink	1	At Risk - Declining	Ōtāhuhu

12.20.2.2 Existing freshwater habitats

Freshwater habitat is considered to be streams with permanent or intermittent flows which have the capacity to provide aquatic habitat and freshwater/brackish[82] wetlands. It does not include ephemeral streams, seepages or overland flow paths.

The Onehunga, Mt Wellington and Penrose Catchments are within Auckland Council's Maungakiekie-Tāmaki State of the Environment reporting area which covers 36km^2 and represents 0.7% of Auckland. The freshwater report card grade given to the area in 2014 (the most recent available report) was Grade F, the lowest possible grade[83]. Freshwater quality indicators used to derive this grade include water quality (Grade E), flow patterns (Grade D), nutrient cycling (Grade F), habitat quality (Grade F) and biodiversity (Grade F). Approximately 58% of the respective catchment surface area is impervious, compared with a regional average of 9%. In general, river health in Maungakiekie-Tāmaki rivers is considered to be impaired as a result of urban development. The effects of urban development include elevated water temperatures, reduced biodiversity value, changes to the natural flow patterns and increased pollution from contaminated stormwater.

The streams in the Project area were identified by field survey[84] and are:

- Miami Stream adjacent to Miami Parade (portions of which are tidal);

[81] These surveys were undertaken outside of the optimal season for detecting herpetofauna. Prior to any habitat or vegetation disturbance due to the Project, herpetofauna surveys during the summer months will be carried out with the appropriate avoidance and mitigation measures put in place should organisms be detected (in accordance with the recommendations in the AUP (OP)).

[82] Brackish/tidal areas are an overlap between freshwater and marine ecology. The ecological assessment note which areas are covered within each of the ecological disciplines.

[83] Auckland Council State of the Environment 2014 Report Card for Maungakiekie-Tāmaki.

[84] Using the Stream Classification criteria in the AUP (OP).

- Southdown Stream located in the vicinity of the Southdown Reserve;
- Anns Creek;
- Mutukāroa-Hamlins Hill stream (outside the Project footprint);
- Clemow Stream, a tributary of Tāmaki River located near Clemow Drive; and
- Ōtāhuhu Creek portage (tidal).

These streams are shown on Figure 15-2 in *Section 11.0: Description of the environment* and described in further detail in that section, and in *Technical Report 16: Ecological Impact Assessment* in Volume 3. The figures below show some of these streams.

Figure 12-31: Miami Stream freshwater reach

Figure 12-32: Upstream section of Southdown Stream

Figure 12-33: Anns Creek

Figure 12-34: Clemow Stream

A Stream Ecological Valuation (SEV) assessment[85] was undertaken at these streams to assess the overall ecological function of the aquatic ecosystems. The SEV takes into account the hydraulic, biogeochemical, habitat provision and biodiversity functions of the stream. Using the SEV, scores can range from Poor (with 0 being the lowest) through to Excellent (with 1.0 being the highest). Fish and macroinvertebrate communities in the streams were also sampled to identify the species present. Aquatic macroinvertebrates encompass a wide range of species, including many insects, crayfish and clams. The diversity, or species richness, of aquatic macroinvertebrates provides an indication of the overall quality of aquatic habitats.

The findings of the assessment of the streams is generally consistent with assessments of other waterways in the Maungakiekie-Tāmaki area. The Mutukāroa-Hamlins Hill stream was classified as Intermittent and no SEV assessment or fish or macroinvertebrate sampling was undertaken as a consequence. Of the remaining streams, three had low ecological value based on poor habitat diversity and condition, low invertebrate and fish diversity and abundance, and high (untreated) stormwater input. Anns Creek has the most evenly spread distribution of aquatic macroinvertebrates (indicating a healthy balance of different types and function of macroinvertebrates), whereas the other sites were dominated by one or two taxa which typically indicates a highly modified ecosystem. Based on these indicators, and the SEV assessment method that assesses streams based on four 'functions' (hydraulic function, biochemical function, habitat function and biodiversity function) Southdown Stream, Clemow Stream and Miami Stream were classified as 'Low' freshwater ecological value (Table 12-24).

All of the streams surveyed were short stream reaches in predominantly piped catchments, so the opportunity for migratory species to penetrate further upstream was low.

Anns Creek represents a low lying coastal estuarine sequence with nationally '*At Risk*' fish species present. The presence of large shoals of juvenile and adult inanga means that the freshwater component at Anns Creek has value as a waterway that supports the potential for spawning and juvenile rearing in an area of the Manukau Harbour where inanga spawning habitats and juvenile rearing potential has been substantially diminished. However, the remaining metrics suggest a low ecological value for Anns Creek.

Table 12-24: Freshwater ecological values based on the EIANZ 2015 classification of freshwater values[86]

Stream	Value	Criterion
Miami Stream	Low	A highly modified watercourse with poor diversity and abundance of aquatic fauna and significant water quality issues. Very high degradation.
Southdown Stream	Low	A highly modified watercourse with poor diversity and abundance of aquatic fauna and significant water quality issues. Very high.
Anns Creek East	Low	A watercourse with high ecological or conservation value but which has been modified through loss of riparian vegetation, fish barrier, and stock access or similar, to the extent it is no longer reference quality. Slight to moderate degradation.
Clemow Stream	Low	A highly modified watercourse with poor diversity and abundance of aquatic fauna and significant water quality issues. Very high degradation (e.g. modified urban stream).

[85] Undertaken using Auckland Council publication *Stream Ecological Valuation (SEV): a method for assessing the ecological functions of Auckland streams,* Technical Report 2011/009 (October 2011).

[86] For further discussion of the EIANZ classification system see *Section 3.3.5.1* of *Technical Report 16: Ecological Impact Assessment* in *Volume 3*.

Stream	Value	Criterion
Ōtāhuhu Creek	Low	A highly modified watercourse with poor diversity and abundance of aquatic fauna and significant water quality issues. Very high degradation.

12.20.2.3 Existing marine ecosystems

The marine environments within the Project area are the Māngere Inlet and tidal Ōtāhuhu Creek. The CMA boundary in these areas is shown on the various plans contained in Volume 2: Drawing Set. Mean High Water Springs was surveyed by the Project team in early 2016.

Overall, the existing marine ecological values in the Māngere Inlet and Ōtāhuhu Creek are moderate.

a. **The Māngere Inlet**

The northern shore of the Māngere Inlet has been extensively modified through reclamation, port activities, creation of landfills, roading and other infrastructure, resulting in the loss of natural embayments and establishment of a linear shoreline. Along some sections of the modified shoreline, a sea wall protects the coastal edge from erosion. There are numerous stormwater discharge points into the CMA along this shore.

Anns Creek, in the northeastern corner of the Inlet, comprises a short section of open stream, extensive mangrove stands and some areas of saltmarsh. The mangrove stands in this area have been historically severed in a number of locations by the establishment of rail corridors, with remnant stands physically isolated from the main mangrove area. The CMA boundary is adjacent to the rail corridor in this area.

The figures below show the areas referred to in the Māngere Inlet.

Figure 12-35: Northern shoreline of the Māngere Inlet

Figure 12-36: Intertidal area along the northern shoreline

To the east of the SH20 Manukau Harbour Bridge (by Galway Street) there is an area of glasswort saltmeadow.

Along the northern shore, Miami Stream discharges into the main Māngere Inlet via a culvert under the Manukau Foreshore Walkway. Upstream of the culvert the stream is tidal and lined with mangroves (for approximately 210m). Further upstream, for a short distance (approximately 40m), Miami Stream becomes more freshwater habitat dominated for a short distance prior to becoming culverted.

Māngere Bridge and the Onehunga Wharf constrict water flows between the Inlet and the wider Manukau Harbour. The Inlet is a sediment and contaminant sink, with flood flows having greater suspended sediment compared to ebb flows. Sediments and contaminants discharged via stormwater to the Inlet settle out in sheltered intertidal inlets and embayments. The subtidal area adjacent to the Onehunga Wharf is dredged periodically.

The marine ecological characteristics of the northern shore of Māngere Inlet (excluding avifauna) are summarised in Table 12-25:.

Table 12-25: Marine Ecological Values of the northern shore of Māngere Inlet

Ecological value	Characteristics
Low	• Marine sediments dominated by silt and clay grain sizes. • Habitat highly modified (in parts).
Medium	• Benthic invertebrate community typically has moderate species richness, diversity and abundance. • Benthic invertebrate community has both (organic enrichment and mud) tolerant and sensitive taxa present. • Shallow depth of oxygenated surface sediment. • Contaminant concentrations in surface sediment generally below ANZECC interim sediment quality guidelines (ISQG[87])-high or Auckland Council Environmental Response Criteria (ERC[88])-red effects threshold concentrations. • Few invasive opportunistic and disturbance tolerant species present. • Estuarine vegetation provides moderate habitat for native fauna, excluding Anns Creek which provides high habitat values.

The Māngere Inlet is identified as having degraded coastal water under Policy B7.4.2 of the AUP (OP).

The eastern shore of the Inlet was reclaimed to establish the Westfield yards, whereas the southern shore is less modified. The Harania and Tararata Creeks on the southern side remain relatively intact. Ngarango Otainui Island (also known as Nga Rango Erua o Tainui) is located in the south east of the Inlet. Dense mangroves fringe the eastern and southern shores, whereas the northern shore comprises less dense and patchy areas of mangroves.

b. Ōtāhuhu Creek

Ōtāhuhu Creek is a tidal creek which flows east to northeast into the Tāmaki Estuary. The creek is crossed by SH1, with three box culverts supporting the alignment. At the site of the Ōtāhuhu Creek Bridge, there are deep muds with a narrow incised low tide channel on the eastern side of the box culverts and the channel is wider on the western side. There are extensive mangroves, with the terrestrial environment bordered by a variety of exotic vegetation, SH1 and residential land use.

Maximum current velocities in the Tāmaki Estuary are lowest at Ōtāhuhu Creek. For this reason, intertidal mudflats are extensive in the estuary. Mangroves fringe the low tide channels and dominate the mudflats. The mangroves occupy approximately 95% of the CMA west of the existing SH1 alignment, with negligible saltmarsh present between mangroves and land around the SH1 crossing. The figures below show Ōtāhuhu Creek.

[87] ANZECC *Interim sediment quality guidelines from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, 2000.

[88] Auckland Regional Council, *Environmental Response Criteria Thresholds*, 2004.

Figure 12-37: Ōtāhuhu Creek

Figure 12-38: Ōtāhuhu Creek box culverts

The intertidal areas within the Ōtāhuhu Creek (outside the Project footprint) are recognised in the AUP (OP) as a significant ecological area as they provide extensive areas of foraging habitat for wading birds (AUP (OP) SEA-M2, 45c).

The marine ecological characteristics of the Ōtāhuhu Creek (excluding avifauna) are summarised in Table 12-26.

Table 12-26: Marine Ecological Values of the Ōtāhuhu Creek

Ecological value	Characteristics
Low	• Benthic invertebrate community dominated by organic enrichment tolerant and mud tolerant organisms with few/no sensitive taxa present. • Marine sediments dominated by silt and clay grain sizes. • Invasive, opportunistic and disturbance tolerant species dominant.
Medium	• Benthic invertebrate community typically has moderate species richness, diversity and abundance. • Shallow depth of oxygenated surface sediment. • Contaminant concentrations in surface sediment generally below ANZECC interim sediment quality guidelines (ISQG)-high or Auckland Council Environmental Response Criteria (ERC)-red effects threshold concentrations. • Estuarine vegetation provides moderate habitat for native fauna. • Habitat modification limited.

12.20.2.4 Existing avifauna

Avifauna (bird) habitat and species are present within the Māngere Inlet and the Tāmaki Inlet. Avifauna present within the Project area include coastal and shore birds, cryptic marshbirds (Banded rail and Bitten) and land birds. Ecological values have been assigned to individual species as well as features/habitat based on EIANZ impact assessment guidelines.

a. **Habitats**

A number of significant ecological areas within the wider area are identified in the AUP (OP), the Operative District Plan and the Auckland Council Regional Plan: Coastal as having values of importance to avifauna species. The marine and terrestrial ecological overlays in those documents are in recognition of these values.

The avifauna habitat features within the Project area include the Onehunga Foreshore, Māngere Inlet northern and southern coastal margins, Miami Stream, Anns Creek lava flow shrubland and wetland, and the upper Ōtāhuhu Creek arm which is part of the Tāmaki Inlet.

The wider Manukau Harbour has been identified as an important site for national and international migrant shorebirds. The Inlet above the Manukau Harbour Crossing is dominated by extensive areas of intertidal mudflats, much of which is exposed at low tide. A small island, Ngarango Otainui, is located at the eastern end of the Inlet, and has an associated small rocky reef. Other reefs, consisting either of volcanic rock or accumulations of Pacific oysters occur elsewhere in the Inlet, particularly along the northern shoreline, and are used as temporary mid-tide roosts by birds, although most are covered at high tide. There is also a small sandbank towards the western end of the Inlet and a longer shellbank towards the eastern end which are utilised by birds, though again they are covered on even neap high tides.

The Tāmaki estuary is utilised by a range of New Zealand resident and migratory shore birds, with the mid-to-lower reaches being particularly important due to the availability of roosting and feeding areas. Many shorebirds move between the Manukau and Waitematā Harbours. In the upper Ōtāhuhu Creek, there are deep muds with a narrow incised stream channel on the eastern side of the box culverts and the stream is wider on the western side. There are extensive mangroves, with the terrestrial environment bordered by a variety of exotic vegetation, SH1 and residential housing.

Table 12-27 below provides a summary of avifauna habitats and ecological values for the Project area.

Table 12-27: Summary of avifauna habitats and ecological value

Feature	Description	Ecological value	Ecological significance
Māngere Inlet	Provides important (and seasonal) foraging and roosting habitat for numerous Threatened and At Risk shorebird, including national and international migrants. The intertidal mudflats are utilised by the following species within the Māngere Inlet: New Zealand Pied oystercatcher, Eastern Bartailed godwit, Lesser knot, Wrybill, Banded and Northern New Zealand dotteral. The subtidal areas of Māngere Inlet are utilised by the following species: Tern and Shag.	Very High	SEA
Anns Creek	Mangroves in the intertidal area form part of a unique gradient. Wading bird habitat contiguous with ecological sequences from saltmarsh to freshwater wetland in Anns Creek and with mangrove ecosystems along the coastline. AUP (OP) identifies Banded rail and Bittern in the salt marsh, mangroves and the wetlands.	Very High	SEA
Pikes Point Reef	Hide tide roosting area for the Royal spoonbill.	High	
Upper Ōtāhuhu Creek	Narrow stream channel surrounded by extensive mangroves; adjacent - terrestrial habitat predominantly exotic trees. This area provides minimal habitat for avifauna.	Low	-

A review of previous surveys in the area and summer and autumn surveys carried out for the Project resulted in the findings shown in Table 12-28.

Table 12-28: Distribution of Threatened or At Risk species associated with the alignment

Species	Threat classification	Ecological value	Location
Reef heron	Nationally Endangered	Very High	Forage and roost in the Māngere Inlet, likely in the wider Tāmaki Inlet too.
Royal spoonbill	Naturally Uncommon	Moderate - High	Forage (shallow water below tideline or stream mouths) and roost in the Māngere Inlet. Favoured roost spots included the rocky reef along northern shoreline and large exotic trees on Ngarango Otainui.
Banded rail	Declining	High	Utilising mangroves along northern shoreline of Māngere Inlet, possibly into Anns Creek.
Australasian Bittern	Nationally Endangered	Very High	Identified in the AUP (OP) as present around Anns Creek.
Wrybill	Nationally Vulnerable	Very High	Forage (intertidal) and roost in the Māngere and wider Tāmaki inlet. National migrant, largely present during NZ winter.
Lesser knot	Nationally Vulnerable	Very High	Forage (intertidal) and roost in the Māngere and wider Tāmaki inlet. International migrant, largely present during NZ summer.
Eastern bar-tailed godwit	Declining	Moderate - High	Forage (intertidal) and roost in the Māngere and Tāmaki Inlets. International migrant, largely present during NZ summer.
NZ pied oystercatcher	Declining	High	Forage (intertidal) and roost in the Māngere and wider Tāmaki inlet. National migrant, largely present during NZ winter.
Northern NZ dotterel	Nationally Vulnerable	Very High	Forage and roost in the Māngere and wider Tāmaki inlet.
Variable oystercatcher	Recovering	Moderate - High	Forage and roost in the Māngere and wider Tāmaki inlet.
Pied Stilt	Declining	High	Forage (intertidal) and roost in the Māngere and wider Tāmaki inlet. National migrant, largely present during NZ winter.
Caspian tern	Nationally Vulnerable	Very High	Forage (subtidal) and roost (shell and mud-banks) in the Māngere Inlet, likely in wider Tāmaki inlet.
White-fronted tern	Declining	High	Forage (subtidal) and roost (shell and mud-banks) in the Māngere Inlet, likely in wider Tāmaki inlet.
Red-billed gull	Nationally Vulnerable	Very High	Forage (mostly stream mouths) and roost in the Māngere and wider Tāmaki inlet.
Black-billed gull	Nationally Critical	Very High	Forage (mostly stream mouths) and roost in the Māngere Inlet, likely in wider Tāmaki inlet.
Black shag	Naturally Uncommon	Moderate - High	Forage (fishing in channels and subtidal) and roost in the Māngere Inlet, likely in wider Tāmaki inlet.

Species	Threat classification	Ecological value	Location
Little black shag	Naturally Uncommon	Moderate - High	Forage (fishing in channels and subtidal) and roost in the Māngere Inlet, likely in wider Tāmaki inlet.
Little shag	Not Threatened	Moderate	Forage (fishing in channels and subtidal) and roost in the Māngere Inlet, likely in wider Tāmaki inlet.
Pied shag	Nationally Vulnerable	Very High	Forage (fishing in channels and subtidal) and roost (reefs and sandbanks) in the Māngere Inlet, likely in wider Tāmaki inlet.

Overall, the coastal and shorebird assemblage was determined to be of very high value due to the number of threatened and at risk species. The cryptic marshbird assemblage (Banded rail and Bittern) was determined to be of very high value due the threatened and at risk classifications. The land bird assemblage was determined to be of low value due to it comprising primarily introduced and also widespread and common native species.

12.20.3 Assessment of effects on ecology

12.20.3.1 Terrestrial ecology – Assessment of effects

The potential adverse effects on terrestrial ecology will include direct and indirect loss of vegetation, ecosystems and habitat along the shore of the Māngere Inlet and in the Anns Creek area. There will be adverse ecological effects on naturally uncommon ecosystem types and habitats for threatened plant species. These effects are set out in Table 12-29.

The most significant terrestrial ecology effects will be construction impacts on the remnant lava flow vegetation along the coastal edge of Māngere Inlet and Pikes Point, and the loss of threatened ecosystems and vegetation in Anns Creek.

The terrestrial areas associated with Anns Creek West have been avoided by locating the new road north of the remnant coastal vegetation in this location.

Anns Creek East contains a high diversity of habitat types, with a mosaic and ecological sequence of shrubland, mangrove and saltmarsh habitat, and sequences with freshwater. The location of the new road has been moved to the northern part of Anns Creek East (compared to earlier alignments) in order to avoid effects on the highest value areas and to minimise effects on the remaining areas. The use of bridges rather than embankments or fill/reclamation will further minimise effects in this location, however, while gaps between the bridge structures will allow moisture, the structure will shade significantly more vegetation impacting on the ecosystem. It will be difficult to completely avoid adverse effects on threatened lava shrublands and threatened plant communities in Anns Creek East from the Project. The combination of effects in the western and eastern arms of Anns Creek will lead to adverse effects on this area.

Table 12-29: Potential adverse effects on Significant Ecological Areas in East West Link alignment

Site Name	Vegetation Types	Potential Effects	Plan values	Overall Value	Magnitude of Effect	Level of Effect
Anns Creek East	Lava Shrubland, Marsh clubrush reedland, tall fescue grassland, mangroves, saltmarsh herbfield, raupo reedland	Fragmentation and reduction in size of lava shrubland, mangroves, saltmarsh through placement of viaduct piers and access staging; loss of threatened plant habitat; loss or degradation of naturally uncommon lava shrubland ecosystem; cumulative loss; increased weeds.	SEA_T_5309 ONF192	Very High	High	Very High
Anns Creek West (south of Mighty River Power Co-Generation Plant)	Mangroves, saltmarsh ribbonwood	Effects avoided through alignment on northern side.	H13-21 ONF192	High	Negligible	Low
Anns Creek Estuary (Māngere Inlet)	Lava shrubland, mangrove	Adverse effects on lava shrubland and loss of mangroves, through placement of piers and staging; potential loss of threatened plant habitat; potential loss or degradation of naturally uncommon lava shrubland ecosystem; cumulative loss; Increased weeds.	SEA_T_5304 SEA_M1_21 SEA_Mw1 ONF192	Very High	High	Very High
Lava flow Pikes Point	Lava shrubland, mangroves	Fragmentation and reduction of lava shrublands and mangroves close to coast. Avoidance of outer mangroves and lava shrublands.	SEA_T_9022 H13-23	High	Moderate	High
Lava Flows (at Waikaraka Cemetery and west)	Lava shrubland, mangroves	Loss of naturally uncommon ecosystem type that is threatened.	-	Moderate	Moderate	Low
Lava flow (Victoria St)	Mangroves	Reduction in size of mangrove ecosystems associated with lava flow.	-	Moderate	Moderate	Low
Saltmarsh at Māngere Bridge (by Galway Street)	Glasswort herbfield, mangroves	Loss of mangroves and glasswort herbfield.	-	Moderate	Moderate	Low
Te Hōpua crater	Glasswort-sea rush-oioi rushland	Avoided.	SEA_T_6103	Moderate	Negligible	Very Low
Southdown Reserve	Mangroves, oioi saltmarsh	Avoided.	SEA_T_6104	Moderate	Avoided	Avoided
Anns Creek Reserve	Freshwater wetland	Avoided.	SEA_T_5308 H13-25	High	Avoided	Avoided
Ōtāhuhu Creek	Mangroves	Replacement of culverts with bridge.	-	Moderate	Low	Low

Potential effects on lizards (if present) include mortality and injury, habitat loss and fragmentation, and displacement into unsuitable habitat. These effect are shown in Table 12-30.

Table 12-30: Assessment of ecological effects on lizards (if present)

Potential Effect	Threat class	Ecological Value	Magnitude of Effect	Level of Effect
Adverse effects				
Injury/death	Not threatened At Risk	Moderate High	Very high Very high	Very High Very High
Habitat loss/displacement	Not threatened At Risk	Moderate High	High High	Moderate Very High
Habitat fragmentation	Not threatened At Risk	Moderate High	Moderate Moderate	Low High
Positive effects				
Habitat enhancement	n/a	Moderate	Low	Low
Habitat creation	n/a	Moderate	Moderate	Low

Lizard injury and death will be avoided as far as practicable by lizard salvage during vegetation clearance activities. It is unlikely that it will be possible to capture all lizards, but the 'very high' level of effect identified in this table will be avoided in the first instance.

Native amphibians are not known to inhabit lowland streams in the area.

12.20.3.2 Freshwater habitats – Assessment of effects

The potential adverse effects and benefits on freshwater ecological values are discussed in terms of temporary (land preparation and construction effects) and permanent (i.e. permanent footprint and operational) effects. These effects are set out in Table 12-31.

Table 12-31: Assessment of Effects for Freshwater

Potential Effect	Ecological Value	Magnitude of Effect	Level of Effect	Temporal Nature
Adverse effects				
Temporary disturbance beyond the permanent occupation footprint	Low	Moderate	Very Low	Short term
Discharges from erosion and sediment control devices	Low	Low	Very Low	Short term
Permanent habitat loss in Southdown Stream	Low	Moderate	Very Low	Permanent
Permanent habitat loss in Miami Stream	Low	Very High	Moderate	Permanent
Permanent habitat loss in Anns Creek	High	Moderate	Moderate	Permanent
Discharge of treated road runoff and stormwater	Low	Low	Very Low	Permanent
Positive effects				
Reduced contaminant load discharged to streams	Low	Low	Very Low	Permanent

Potential Effect	Ecological Value	Magnitude of Effect	Level of Effect	Temporal Nature
Increased habitat diversity	Moderate	Low	Low	Permanent

The Project will involve earthworks for land preparation, road widening and construction, bridge construction and construction of stormwater treatment wetlands. The temporary adverse effects on freshwater ecological values include disturbance to freshwater habitat and fauna as a result of instream works to construct diversions and install culverts and increased sediment load from open earthworks during construction if not appropriately managed. These activities may cause an increase in sediment discharge to streams. This will result in an increase in suspended sediment concentrations and some localised sediment deposition near discharge points and estuarine depositional environments.

Erosion and sediment control measures can minimise the extent of soil erosion and sediment yield discharging to these streams during construction. The erosion and sediment control measures proposed for the Project are described in *Section 7.0: Construction of the Project* and assessed in *Section 12.15: Erosion and sediment control* of this AEE. The Project erosion and sediment control measures will be designed and established in accordance with Auckland Council's GD05 and the Transport Agency's Erosion and Sediment Control Guidelines. Implementation of these measures will minimise the effects of sediment discharge during construction.

The adverse effects of physical habitat disturbance within the freshwater environments will be minor.

The permanent works involve the installation of new culverts, extending existing structures, diverting watercourses and constructing stormwater wetlands within streams. This will result in the permanent loss in sections of streams affecting freshwater ecology.

Extending the culvert at Southdown Stream will result in the permanent loss of approximately 15% of stream habitat of the total stream length which is 130m. The adverse effects on this stream will be minor.

The new stormwater wetland within Miami Stream results in the permanent loss of approximately 20m of freshwater habitat and habitat function. This is the only open stream section of Miami Stream remaining and its ecological value in the wider catchment is marginal. The adverse effects on this stream will be moderate.

Extending the existing culvert adjacent to Great South Road for stormwater treatment will result in the permanent loss of approximately 10m (1.2%) of freshwater habitat in Anns Creek East. The adverse effects on this stream will be moderate.

Stormwater treatment is proposed for all new impervious surfaces associated with the Project. This will cater for a 1 in 10 year rainfall event and removal of 75%[89] of total suspended solids and associated contaminants prior to discharge to receiving environments. In addition, where works occur within and adjacent to areas of existing state highways, runoff from both the new and existing impermeable surfaces will be treated. The improved water quality entering streams will result in positive effects on freshwater habitats and increased habitat diversity within the stormwater wetlands which may provide habitat for common species.

12.20.3.3 Marine ecology – Assessment of Effects

The primary potential adverse effects on marine ecological values are from the permanent loss of marine habitat, temporary habitat disturbance during construction, the discharge of runoff from earthworks during construction and the discharge of treated stormwater during operation. These effects are set out in Table 12-32.

[89] Stormwater treatment will be designed to remove 75% of total suspended sediment and associated contaminants on a long term average basis.

Table 12-32: Assessment of effects for marine ecology

Potential Effect	Ecological Value	Magnitude of Effect	Level of Effect	Temporal Nature
Adverse effects				
Construction of road embankment	Moderate	High	High	Permanent
Construction of landscape features and stormwater wetlands	Moderate	High	High	Permanent
Occupation of the CMA by permanent bridge structures	Moderate	Moderate	Moderate	Permanent
Loss of estuarine vegetation at Galway Street	Moderate	Moderate	Moderate	Permanent
Loss of estuarine components of Miami Stream	Very Low	Very High	Low[90]	Permanent
Cumulative effects of permanent loss of CMA (assessed at Māngere Inlet scale)	Moderate	Low	Low	Permanent
Physical disturbance beyond the permanent occupation / reclamation footprint	Moderate	Moderate Low	Moderate Low	Short term Long term
Subtidal dredging (assessed at the Māngere Inlet scale)	Moderate	Moderate Low	Moderate Low	Short term Long Term
Disturbance to sediment contaminants during construction	Moderate	Low	Low	Short term
Noise and vibration	Moderate	Low	Low	Short term
Changes to coastal processes (assessed at the Māngere Inlet scale)	Moderate	Low Low	Low Low	Short term Permanent
Structures affecting connectivity of ecological features / habitats	Moderate	Moderate	Moderate	Permanent
Operational phase disturbance	Moderate	Negligible	Very Low	Permanent
Discharges from erosion and sediment control devices	Moderate	Low-Moderate	Moderate	Short term
Discharge of treated road runoff	Moderate	Low	Low	Permanent
Discharge of treated catchment stormwater and landfill leachate	Moderate	Low	Low	Permanent
Positive effects				
Reduced contaminant load discharged to the CMA (Assessed at the Māngere Inlet scale)	Moderate	Moderate	Moderate	Permanent
Increased habitat diversity (assessed at the Māngere Inlet scale)	Moderate	Low Moderate	Low Moderate	Short term Permanent

[90] EIANZ guidelines do not cover habitats with very low value. The assessment matrix has been modified in this instance to reflect total loss (very high magnitude) of a small habitat with very low ecological values, resulting in a permanent low level of effect.

Construction of the road embankment along the northern shore of the Māngere Inlet for the Project will involve the reclamation of 5.6ha of intertidal mudflat habitat. This represents 1% of the Māngere Inlet. Mudflat and benthic organisms within the embankment will perish during construction.

Construction of the landscape features and stormwater wetlands will involve the reclamation of 18.36ha of intertidal mudflat habitat, including low tide channels created by the numerous stormwater discharge points along the northern shore.

In the context of the northern shore of the Māngere Inlet, the magnitude of the effect of the reclamation is considered to be high, but when assessed at the wider Māngere Inlet scale the magnitude of effect is considered to be low.

Physical disturbance to marine habitat beyond the permanent occupation / reclamation footprint during construction is considered to be moderate in the short term (during construction) and minor in the long term (during operation).

Subtidal dredging for construction of the reclamation will result in a temporary increase in suspended sediment and deposited sediment due to sediment loss from the dredger bucket and barge during dredging. The effect of subtidal dredging is considered to be moderate in the short term and minor in the longer term as estuarine habitats naturally recover from disturbance over time and recolonisation by benthic invertebrate organisms occur.

The installation of the erosion and sediment controls during earthworks on land will mean that the adverse effects of the discharge of the treated construction stormwater runoff will be minor. In a large rainfall event where there is a release of sediment from open works, there is a chance that the deposition of sediment could smother benthic invertebrates. This is likely only to arise from a small area of open earthworks and the risk can be managed through regular monitoring of treatment devices to ensure they are in place/operating including checks prior to significant rainfall events.

The disturbance of marine sediments containing elevated concentrations of contaminants is considered to be low, based on the low risk to ecology described in *Technical Report 15: Coastal Processes Assessment* in Volume 3 and the temporary nature of the effect.

The effect of the changes in noise and vibration and coastal processes from the Project construction on marine ecological values is assessed as being low.

Bridge structures are planned in Anns Creek Estuary, through Anns Creek East and West and replacing the SH1 culverts at Ōtāhuhu Creek with a bridge. The area of marine environment that will be permanently removed due to the bridge structures is approximately 90 m^2. The adverse effects of permanent habitat loss from the installation of permanent bridge piers will be moderate.

The construction of the road embankment at Galway Street will result in the permanent loss of the SEA estuarine herbfield area at this location. Although this herbfield is an important habitat, it is small compared to the overall estuarine herbfield habitat within the wider Māngere Inlet. Therefore, the adverse effects of this loss will be low.

Structures associated with the Project will affect connectivity of ecological features / habitats. This has been assessed as having a moderate adverse effect.

It is estimated that approximately 190ha of marine environment has been historically reclaimed in the Māngere Inlet, primarily along the northern shore and around the Manukau Harbour Crossing abutments. The area of proposed reclamation and permanent occupation of the CMA (reclamation, landscape and stormwater features, bridges and boardwalks) in the Māngere Inlet is 25.0ha. Cumulative effects of permanent loss of CMA has been assessed as having a low level of effect.

The loss of the estuarine components within Miami Stream is considered to be very high. However in the context of loss in mangrove habitat within the wider Māngere Inlet and Manukau Harbour, the adverse level of effect has been assessed as low.

The discharge of treated leachate, catchment stormwater and road runoff stormwater will have a low level of effect on the mudflat and benthic organisms.

a. **Ecological Benefits**

Currently the main contaminant load discharging to the CMA is from contaminants in groundwater, stormwater and sewer leakage to ground and /or cross-connection with stormwater. The Project will reduce the contaminant load from these sources being discharged to the CMA. This will lead to a positive effect on marine ecological values by reducing contaminants to the marine environment. This positive effect will be moderate.

Increased habitat diversity within the foreshore stormwater treatment wetlands is expected to be low as the predominantly freshwater wetlands will attract freshwater organisms rather than marine organisms. The mudcrete landscape features to be created along the northern shore of the Inlet will encourage colonisation of hardshore organism communities such as limpets, anemones, coralline algae, mussels and chitons. If these communities develop, the sustained positive effect in the medium to long term is considered to be moderate.

12.20.3.4 Avifauna – Assessment of effects

The adverse and beneficial effects of the construction and operation of the Project on avifauna values are:

- The direct loss of foraging, roosting or breeding habitat (permanent or temporary);
- The indirect effects on food supply (availability, quality and abundance) through sedimentation and disturbance; and
- Mortalities of individual birds.

These effects are set out in Table 12-33.

Table 12-33: Assessment of effects for avifauna

Potential Effect	Avifauna assemblage	Ecological Value	Magnitude of Effect	Level of Effect	Temporal Nature
Adverse effects					
Habitat loss	Shorebirds	Very High	Low	Moderate	Permanent
	Cryptic marshbirds	Very High	Moderate	Very High	Permanent
	Landbirds	Low	Low	Very Low	Permanent
Cumulative effects of permanent loss of CMA (assessed at Māngere Inlet scale)	Shorebirds	Very High	Low	Moderate	Permanent
Disturbance – Construction	Shorebirds	Very High	Low	Moderate	Temporary
	Cryptic marshbirds	Very High	High	Very High	Temporary
	Landbirds	Low	Negligible	Very Low	Temporary

Potential Effect	Avifauna assemblage	Ecological Value	Magnitude of Effect	Level of Effect	Temporal Nature
Disturbance – Operation	Shorebirds	Very High	Low	Moderate	Permanent
	Cryptic marshbirds	Very High	High	Very High	Permanent
	Landbirds	Low	Negligible	Very Low	Permanent
Food supply – Construction	Shorebirds	Very High	Low	Moderate	Temporary
	Cryptic marshbirds (Banded rail)	Very High	Low	Moderate	Temporary
Food supply – Operation	Shorebirds	Very High	Negligible	Low	Permanent
	Cryptic marshbirds (Banded rail)	Very High	Negligible	Low	Permanent
Mortalities – Construction	Cryptic marshbirds	Very High	Very High[91]	Very High	Temporary
	Landbirds	Low	Negligible	Very Low	Temporary
Mortalities – Operation	Shorebirds	Very High	Negligible	Low	Permanent
	Cryptic marshbirds	Very High	Low	Moderate	Permanent
	Landbirds	Low	Negligible	Very Low	Permanent
Positive effects					
Reduced contaminant load discharged to the CMA	Māngere Inlet shorebirds	Very High	Moderate	Low	Permanent
Increased habitat diversity	Māngere Inlet avifauna	Moderate	Low	Low	Permanent

The adverse effects from construction noise associated with earthworks and plant movement on shorebirds populations is likely to be a negligible and of a temporary nature both at a local and population level. Around Anns Creek, construction will result in the disturbance of Banded rail and Bittern. At a wider context or population level the adverse effects on Banded rail and Bittern is likely to be moderate.

The indirect effect on food supply for shorebirds and cryptic marshbirds, at a local level, will be minor and of a temporary nature. In the wider context, and at a population level, the indirect effect on food supply due to the Project will be negligible for all species. The adverse effects from physical habitat disturbance within the freshwater environments across the Project area is considered to be minor and in the short term.

Given the relatively low numbers of Tern and Shags foraging in the Māngere Inlet, the availability of extensive similar foraging habitat elsewhere in the Manukau Harbour, and the short term and confined nature of the elevated suspended solids levels for the dredging, the adverse effects of dredging on terns

[91] If Banded rail are found to be breeding, otherwise a negligible magnitude of effect.

and shags will be minor in the context of the local environment. This effect will be negligible at a population level.

Although unlikely, there is the potential for Banded rail to be nesting along the coastal margin associated with Anns Creek Estuary during the construction period. Historically this species has been greatly impacted through the loss of habitat in Auckland. As such, there could be construction mortalities on Banded rail at a local level if they are nesting in this location. At a wider context, the magnitude of such an effect at a population level is considered to be minor.

The majority of species that may be breeding within the construction footprint include common native and introduced land birds nesting in trees and scrub. There have been no threatened or at risk land bird species recorded associated with the Project. Due to the widespread and mobile nature of these species, the effect of construction mortalities on these land birds populations is considered to be negligible.

Threatened and At Risk avifauna species recorded in association with Anns Creek include Banded rail within the intertidal mangrove stand (and possibly the estuarine rushes) and Bittern. Removal of vegetation associated with this vegetation sequence will result in the loss of habitat for these species. Historically these species have been greatly impacted through the loss of habitat in the Auckland region. The adverse effect of this permanent habitat loss is considered to be moderate.

It is estimated that approximately 190ha of marine environment has been historically reclaimed in the Māngere Inlet, primarily along the northern shore and around the Manukau Harbour Crossing abutments. The proposed reclamation is 18.4ha. The reclamation of intertidal foraging habitats adds to the incremental/cumulative effects of habitat loss for shorebird species. The effect of this habitat loss will be moderate for the shorebirds.

The operational disturbance to shorebirds populations is likely to be a negligible. The indirect effect on food supply for shorebirds and Banded rail will be negligible at both local and population levels. Operational effect on avifauna mortality is unlikely to change from current conditions, and therefore the effect is negligible. While around Anns Creek, particularly during breeding and nesting, the potential for mortality is increased and adverse effect is high for Banded rail and Bittern mortality. At a wider context or population level the effect is likely to be moderate.

a. **Ecological Benefits**

The expected ecological benefits for avifauna arise from the Project by reducing the discharge of contaminants (from groundwater, stormwater and other discharges). The reduced contaminant load being discharged to the CMA will lead to a positive effect on shorebird foraging habitat and food resource of the Māngere Inlet. The positive effects will be moderate.

Increased habitat diversity within the foreshore stormwater wetlands is expected to provide some different habitat for common native and introduced bird species such as Pukeko and waterfowl. The mudcrete platforms and headlands will encourage colonisation of hardshore organism communities, and increase biodiversity and food source for oyster catchers. The overall benefit is expected to be low due to the small scale of the habitat and uncertainty around whether hardshore organisms will naturally colonise these features.

12.20.4 Measures to avoid, remedy or mitigate potential adverse effects on ecology

Design development for the Project sought to avoid or minimise potential adverse effects on ecology (and other matters) as far as practicable. Key principles that guided design were:

- Minimising reclamation footprint to minimise the areas of permanent loss of foraging habitat;
- Minimising fragmentation and loss of significant vegetation species and ecosystems including Te Hōpua crater saltmarsh, Anns Creek East, Anns Creek Estuary and lava shrublands at Pikes Point, Waikaraka Cemetery and Victoria Street;

- Use of bridge structures rather than embankment in Anns Creek;
- Avoiding streams and ecological areas for network utility diversions;
- Providing longer bridge spans to minimise the areas of permanent loss of habitat;
- Placing bridge piers to avoid areas of higher ecological values, particularly at Anns Creek Estuary and Anns Creek East;
- Minimising the loss and disturbance to high and moderate quality lizard habitats, and opportunities to incorporate lizard habitat in landscape design; and
- Investigating opportunities for declamation.

Based on the assessment approach set out in the EIANZ guidelines, very high, high and moderate levels of effect require avoidance or mitigation, whereas low and very low levels of effect are normally not of concern, but design, construction and operational care should be taken to minimise adverse effects. The section below discusses the mitigation proposed for the construction and operation of the Project. Residual effects that have not been mitigated within the scope of the Project are also addressed below.

12.20.4.1 Particular areas for mitigation

The following mitigation has been considered for ecological effects:

- The existing saltmarsh wetland in Te Hōpua crater (Gloucester Park South) will be enhanced through weed control and buffer planting of appropriate native species (e.g. flax, manuka, taupata, cabbage tree) around the edges. Landscaping will expand the existing wetland vegetation (e.g. through planting of oioi, sea rush, glasswort, salt marsh ribbonwood).
- Saltmarsh habitat will be restored and recreated along the coastal foreshore.
- Adverse effects on the lava flow vegetation will be minimised by excluding areas from the construction footprint. The remaining basalt lava flows and lava shrubland habitats at Pikes Point and Victoria Street will be enhanced through weed control.
- The planting and restoration of coastal plant species as part of the stormwater wetlands and landscape planting along the coastal foreshore edge and potentially in other coastal locations in Crown ownership.
- Construction and pier exclusion areas with the lava flow shrublands and saltmarsh habitats in Anns Creek East, including locating the Project as close to the northern edge of Anns Creek East as possible.
- Reduce the width of the Project footprint as far as practicable by reducing the separation distance between bridge structures.
- Further refinement of bridge pier locations in Anns Creek East during detailed design to further avoid and minimise adverse effects and restrictions on construction activity within the pier exclusions areas.
- Restrictions on vegetation alteration or removal or land disturbance activities in Anns Creek East outside the construction footprint.
- Construction yards confined to the existing consented development areas in Anns Creek East.
- Weed control and pest control covering a total area of approximately 10ha.
- Legal protection and enhancement of threatened plant communities (lava shrublands) in Anns Creek East through weed control and long-term conservation management, subject to landowner arrangements.
- Rehabilitation of lava shrubland species through planting on the new coastal edge, using eco-sourced local genetic stock (e.g. Coprosma crassifolia, ngaio, akeake, saltmarsh ribbonwood, oioi, Austrostipa stipoides, Puccinellia stricta (salt grass)) and planting of threatened coastal species such as Mimulus.

- Restoration of coastal ecosystems in Ōtāhuhu Creek through declamation and restoration of fringing saltmarsh and riparian vegetation along a section of the creek.
- Identify opportunities to create, enhance and connect lizard habitats within the Project area. Habitat enhancement includes the provision of habitat elements (logs and natural debris) and pest control if deemed appropriate.
- Prior to earthworks commencing, identify lizard release sites within the wider Project area in a location that provides lizard refuge and food. This site must be sufficient to support a viable population of native lizards for all species present before development.
- Restoration planting at Anns Creek, especially enhancement of inanga spawning areas.
- Enhancing remaining waterways through riparian planting and habitat enhancements.
- Research scholarships for assessing translocation of hard shore organisms to the landward edge of the new landform features in order to facilitate colonisation and assist communities becoming self-sustaining.
- Investigate opportunities to establish new saltmarsh habitat between terrestrial and mangrove vegetation on the eastern shore of the Māngere Inlet to replace areas which will be lost under the EWL footprint and provide new habitat.
- Investigate options to increase the abundance of intertidal organisms within the Māngere Inlet (e.g. by the seeding of bivalves) and to increase the abundance of intertidal prey items within the Māngere Inlet.
- Investigate opportunities to enhance habitat at or in the vicinity of Ngarango Otainui Island, particularly the macrocarpa trees which provide roosting habitat for royal spoonbill. Given macrocarpa have a limited lifespan, more trees could be planted as future roosting habitat for this species.
- Investigate, in collaboration with DOC, potential offsets for residual adverse effects on shorebirds.
- Planting saltmarsh to replace areas which will be lost under the EWL footprint. Ideally this should be done in a location that may be utilised by Banded rail.
- Recreate the Anns Creek East raupo wetland, currently utilised by Australasian Bittern, in an appropriate location (e.g. within the Anns Creek Reserve).

These mitigation measures will be detailed in an Ecological Management Plan (ECOMP) for the Project. The ECOMP is discussed in further detail in *Section 13.1.5* of the AEE.

The proposed mitigation in land not owned by the Transport Agency will be subject to the agreement of the landowner. Initial discussions have taken place with landowners and will continue as the design progresses.

12.20.4.2 Particular areas for monitoring

The following monitoring is also recommended to further minimise potential effects and to determine the success of the proposed mitigation:

- Monitoring temporary stream diversions during construction to identify if any change to construction methodology are required to respond to monitoring;
- Prior to construction establish a framework for adaptive monitoring during earthwork / construction for elevated discharge of total suspended sediment and/or sedimentation within the CMA (also see *Section 12.19.5* of this AEE regarding monitoring of sedimentation during construction);
- Post-construction monitoring of the seaward edge of the new landforms along the northern shore to determine if they are successfully inhabited by hard shore sessile marine invertebrates;

- Post-construction monitoring of the quality of the treated stormwater from the stormwater wetlands along the northern shore to confirm the performance assumed in the Project assessments, including the marine ecology assessment; and
- Prior to construction, monitoring to determine if Banded rail and Australasian Bittern are breeding in areas of potential nesting habitat within the proposed Project footprint. This will be used to inform the construction methodology and programme.

12.21 Stormwater

Overview

All stormwater discharged from the Project will be managed for quantity and quality to minimise adverse effects on the receiving environments of the Manukau Harbour, Māngere Inlet and the Tāmaki River.

The following principles have guided the approach to stormwater management for the Project:

- Treat all stormwater from all new impervious surface (roads) associated with the Project to remove 75% of total suspended solids (TSS) on a long term annual average basis; and
- Treat all stormwater from existing impervious surfaces associated with SH20 and SH1 within the Project footprint where stormwater treatment is not currently provided. These areas will be treated to the same standards as new impervious surfaces.

This will result in an improvement in stormwater quality being discharged from these areas to the Manukau Harbour and the Tāmaki River.

In addition, the Project provides an opportunity to capture and treat stormwater from the wider Onehunga and Penrose Catchment in the proposed stormwater treatment areas on the Māngere Inlet foreshore. This will be treated using BPO principles as set out in *Section 6.5.4.2*. This will result in a significant improvement in the quality of stormwater discharging to the Māngere Inlet. Further, leachate intercepted at the Pike Point Landfill can also be treated in the foreshore stormwater treatment areas.

Overall, the stormwater discharge effects of the Project are positive. The Project will result in significant reductions in the quantity of suspended solids, metals, hydrocarbons, nitrogen and coliforms discharging via stormwater to the coastal receiving environments.

12.21.1 Introduction

This section assesses the actual and potential effects of the Project on stormwater quantity and quality. It deals with stormwater generated by impermeable surfaces associated with the new road that require treatment and the opportunity presented by the Project and incorporated in the concept design to provide additional treatment of existing stormwater and groundwater from adjacent catchments.

This assessment is supported by *Technical Report 12: Stormwater Assessment* in Volume 3. It is also closely linked to the assessment of groundwater contained in *Section 12.16: Groundwater* of this AEE due to interactions between groundwater, leachate and stormwater within the Project area.

This assessment of stormwater effects was informed by both desktop and field investigations. The desktop assessment included a review and analysis of available information and data including Auckland Council records and databases and other relevant studies that have been previously undertaken in the Project area. The field investigations included stormwater and groundwater sampling and monitoring, marine sediment sampling and biota sampling. Stormwater models informing this assessment include flood risk models undertaken previously for Auckland Council as well as project specific hydrology and hydraulics studies, water quality modelling and soil loss modelling. The discussion relating specifically to groundwater investigations is covered in more detail in *Section 12.16: Groundwater* of this AEE.

Stormwater treatment devices have been designed to achieve the treatment standards set out in Auckland Council's *Technical Publication 10 - Stormwater management devices: Design guidelines manual* (2003) (TP10). Within the manual, treatment device efficiency is expressed in terms of a percentage reduction in contaminant load within stormwater achieved through the treatment device. The typical standard applied is 75% removal of TSS on an annual average basis. TSS removal also provides a surrogate measure for reduction in other contaminants (e.g. zinc and copper).

Stormwater flow estimates have been based on the Auckland Regional Council *Technical Publication 108 - Guidelines for stormwater runoff modelling in the Auckland Region* (TP108) as well as results from flood studies carried out by Auckland Council for the surrounding areas (circa 2004). The methodology for flood risk assessment is described in further detail in Section 6 of *Technical Report 12: Stormwater Assessment* in *Volume 3.*

During construction, sediment is entrained in stormwater from earthworked areas and is managed through erosion and sediment control measures. These are discussed in *Section 12.15: Erosion and sediment control* of this AEE.

12.21.2 Existing environment

Stormwater is water that originates during rainfall events and runs off from both pervious surfaces and impervious surfaces such as roadways, roofs and hardstand areas. Stormwater quantity and quality within the Project vicinity is influenced by several factors including:

- Rainfall;
- Tidal characteristics in the coastal receiving environments;
- Existing stormwater catchments;
- Soil type; and
- Land use within the stormwater catchments affecting stormwater runoff quantity and quality.

The Project traverses two major catchments, the Manukau Harbour (including the Māngere Inlet) and the Tāmaki River.

There are several freshwater and saline watercourses along the Project. These watercourses are described in *Section 12.20: Ecology* of this AEE.

Much of the Onehunga and Penrose area drains to ground soakage rather than freshwater streams. Therefore, the receiving environments for Project stormwater are typically the existing stormwater networks, ground soakage or to the CMA.

The soils in the Project area catchments include areas of clay, volcanic soils underlain by basalt and historical fill areas. The geology of the area is described in detail in *Section 11.0: Description of the existing environment* of this AEE.

Land use is generally fully developed urban catchment with residential, commercial and industrial uses.

The existing quality within the stormwater system has been investigated as part of the Project through the review of previous studies, monitoring and testing of samples and through water quality modelling. Monitoring of the quality of stormwater events captured a range of rainfall events. The stormwater quality monitoring results are set out in detail in Appendix B of *Technical Report 12: Stormwater Assessment* in Volume 3.

In summary, the primary contaminants of concern that were identified in stormwater from the existing catchments include:

- Zinc, copper, lead and TSS (typical of stormwater contaminants;
- Faecal coliforms / E. coli; and
- Ammonical Nitrogen.

Monitoring results indicate that TSS and metal concentrations are similar to other untreated urban Auckland areas. Mean faecal coliform concentrations are an order of magnitude higher than the Auckland average. The baseflow results for faecal coliform are exhibiting extremely high faecal coliform concentrations. These concentrations (and findings of previous studies) indicate that there may be sources of untreated wastewater entering the stormwater system. Ammonical nitrogen is also present in the stormwater indicating the potential interaction with leachate from the adjacent landfills.

12.21.3 Assessment of effects

12.21.3.1 Project approach to the management of stormwater

The following principles have guided the approach to stormwater management for the Project:

- Treat all stormwater from all new impervious surface (roads) associated with the Project to achieve 75% TSS on a long term annual average basis;
- Treat all stormwater from existing impervious surfaces associated with SH20 and SH1 within the Project footprint where stormwater treatment is not currently provided. These areas will be treated to the same standard as new impervious surfaces; and
- Identify opportunities to treat stormwater from other contributing catchments where this can be achieved within the Project footprint.

Wetlands and swales are natural treatment systems which remove contaminants by sedimentation, bio-uptake and trapping of particulates by planted water bodies. These are the preferred method of treatment for the Project where there is sufficient space within the Project footprint. In addition, there are two existing stormwater treatment ponds associated with SH1 and SH20 that will be upgraded to wetlands as part of the Project to provide a more efficient treatment device for existing and new stormwater.

Treatment wetlands are proposed in the following locations within the Project:

- Converting the existing stormwater pond within the Neilson Street Interchange into a wetland;
- A new wetland at the southern end of Hill Street;
- A new wetland at Hugo Johnston Drive; and
- Converting the existing stormwater pond at Frank Grey Place (Ōtāhuhu) into a wetland.

The locations of these proposed wetlands are shown on the drawings in *Plan Set 9: Stormwater* in Volume 2 and further details are set out in Appendix D of *Technical Report 12: Stormwater.* The design of the wetland treatment system is described in further detail in *Section 6.0: Description of the Project* of this AEE.

Where space is more constrained, buried proprietary stormwater treatment systems are proposed. The devices will be similar to “stormfilters”, a proprietary stormwater treatment device approved by Auckland Council for use within Auckland. These are currently in use along sections of the existing SH20 road corridor. Stormfilters are modular, rechargeable, media-filled cartridges which absorb and retain pollutants contained within stormwater runoff including total suspended solids, hydrocarbons, nutrients, and soluble heavy metals. Approximately 29 proprietary stormwater treatment systems are proposed for the Project. The indicative location of these are shown on the stormwater drawings contained in *Plan Set 9: Stormwater* in Volume 2.

The design of the proprietary stormwater treatment devices is described in further detail in *Section 6.0: Description of the Project* of this AEE.

Along the Māngere Inlet foreshore, the location of the proposed road with respect to existing stormwater infrastructure, closed landfills and the coastal edge presents a unique set of constraints and opportunities which has resulted in a stormwater design approach for this part of the Project that differs from the general stormwater design approach. Stormwater treatment devices along the foreshore will treat runoff from some 600 ha over and above the Project area. There will be five new treatment areas located at Galway Street, Alfred Street, Captain Springs Road, Miami Stream and east of Miami Parade.

The proposed stormwater treatment method in the foreshore area is a combined wetland and biofiltration system, designed to minimise the footprint while maximising treatment. A system of pipes, underdrains and weirs will convey flow through the systems for treatment before discharge to the Māngere Inlet. Because of the existing stormwater network levels, the treatment areas will be at approximately mean sea level and will discharge through one way valves designed to avoid salt water getting into the freshwater area. The stormwater treatment areas be constructed so that they can be adapted for climate change (sea level rise) over time. The design of this system is described in further detail in *Section 6.0: Description of the Project* of this AEE and shown on the stormwater drawings contained in *Plan Set 9: Stormwater* in *Volume* 2.

12.21.3.2 Stormwater quality for road surfaces

Stormwater quality effects arise as particles from car exhausts, tyres and brakes, silt, oils and litter collect on road surfaces. Many of these small particles adhere to sediments which are washed off impervious surfaces and transported through stormwater runoff to discharge to the receiving environment.

The total Project road impermeable surface area is 47 ha. This is comprised of 22 ha of new road, and 25 ha of existing road surfaces (on SH20 and SH1).

To mitigate effects associated with stormwater, runoff from new and modified road surfaces (that is, all 47 ha) associated with the Project will be captured and passed through stormwater treatment devices. This will be achieved through constructed wetlands where practicable and, where not practicable through proprietary treatment systems.

12.21.3.3 Additional treatment for Onehunga and Penrose Catchment

A large proportion of the existing stormwater infrastructure within the Onehunga and Penrose Catchment is currently untreated and discharges straight to the CMA. The overall catchment directly discharging to the foreshore area via the stormwater pipe network is approximately 600 ha which drains to 11 existing outfalls along the foreshore.

The Onehunga and Penrose Catchment is a long established urbanised catchment where limited space and the depth of stormwater outfall pipes through landfill areas constrain opportunities for retrofitting stormwater treatment measures further upstream.

Stormwater from the Onehunga and Penrose Catchment will be captured through five new wetland/biofiltration areas along the foreshore.

The Project will result in positive effects by treating stormwater contaminants from a large part of the Onehunga and Penrose Catchment before it is discharged to the Māngere Inlet.

12.21.3.4 Stormwater quantity

Potential adverse flooding effects have been identified through review of Auckland Council records, previous flood studies and hydraulic assessment. Mitigation measures put in place that are in accordance with good practice methods. The proposed new road is set at levels above extreme flood events, high tides and storm surge, allowing for 100 years of predicted climate change effect. In some locations, including along the Māngere Inlet foreshore, this sets the road level higher than some properties upstream. Pipes, inlets and overflows are therefore designed to pass higher flows through the road embankment to avoid increasing flood risk at those properties.

There is potential for the road embankment to provide an improved level of protection to properties from coastal inundation events as a result of any sea level rise. However, there are residual flood risks associated with reliance on one-way valves and pump stations. The risk and consequence of failure of valves and pumps will have to be considered throughout the design development.

12.21.3.5 Stormwater outfalls

Stormwater from the Project will discharge to the existing stormwater network or via outfalls to the CMA and existing streams. The outfalls include existing, upgraded and new outfalls and are set out in detail in Appendix D of *Technical Report 12: Stormwater*. In summary the outfalls are:

- new coastal outfalls;
- new outfalls to streams; and
- upgraded or extended existing coastal/freshwater outfalls.

These outfalls are shown on the drawings contained in *Plan Set 9: Stormwater* in Volume 2.

The effects of stormwater discharges from these outfalls on coastal processes and ecology within the Māngere Inlet and the Ōtāhuhu Creek are assessed in *Section 12.19: Coastal processes* and *Section 12.20: Ecology* of this AEE. In summary, outfalls have been designed to minimise stream and coastal erosion. The coastal outfalls will result small channels in adjacent marine sediments particularly evident during low tide. The adverse ecological effects of discharge of treated stormwater from the Project into the receiving environments is negligible.

12.21.3.6 Leachate stormwater Interaction

In addition to the stormwater discharging from these catchment areas, groundwater from existing landfills along the foreshore contains leachate. Some of this leachate is captured through the existing Pikes Point leachate interception system and discharged to the Watercare wastewater system for treatment. The remainder discharges to the CMA. The new road embankment and foreshore landscape features provide extended travel time for contaminated groundwater which will allow additional attenuation and will significantly reduce contaminants in groundwater entering the CMA. This Project benefit is discussed in further detail in *Section 12.16: Groundwater* of this AEE.

The foreshore stormwater treatment system also provides the opportunity to treat leachate from the Pikes Point leachate interception system rather than continuing to discharge to the trade waste system. As part of the construction of the Project, the leachate interception system needs to be relocated providing an opportunity for a more efficient leachate interception system to be installed at this location. This Project benefit is discussed in further detail in *Section 12.16: Groundwater* of this AEE.

12.21.3.7 Combined project effects

Overall, the Project will result in an improvement in stormwater quality discharging to the Māngere Inlet.

The Project (including new stormwater treatment facilities for stormwater from the wider catchment) results in significant reductions to the quantity of suspended solids, metals, hydrocarbons, nitrogen and coliforms discharging via stormwater to the receiving environments. The following changes to long term annual average contaminants discharge are expected as a result of the Project:

- A reduction in total suspended solids from 870 to 210 tonnes per year (a 75% reduction);
- A reduction in total zinc from 2.67 to 1.17 tonnes per year (a 56% reduction);
- A reduction in total copper from 0.24 to 0.08 tonnes per year (a 66% reduction); and
- A reduction in total nitrogen from 19 to 10 tonnes per year (a 47% reduction).

Other predicted water quality benefits are:

- Contribution to a potential reduction in contaminants reaching the Māngere Inlet from closed landfill leachate. This is covered in further detail in *Section 12.16: Groundwater* of this AEE;
- Improved resilience to contaminant spills or contaminant dumping through containment in the stormwater treatment devices;

- New freshwater ecological environments created in constructed wetland and biofiltration systems. This is covered in further detail in *Section 12.20: Ecology* of this AEE; and
- Protection of the Māngere Inlet from wastewater discharges that may enter the stormwater system.

12.21.4 Measures to avoid, remedy or mitigate effects on stormwater

The overall benefits for stormwater quality identified in this section relies collaboration between the Transport Agency and Auckland Council and on the stormwater system being well designed, constructed, maintained and operated. This section sets out the measures to address these matters.

A concept stormwater design has been prepared for the Project and has formed the basis of the assessment of effects contained in this and other sections of the AEE. The design will be subject to further refinement during detailed design following confirmation of the designations and granting of resource consents. The following matters will need to be addressed as part of the process for finalising the design:

- All road related stormwater to be designed to achieve 75% TSS removal;
- All existing areas of SH20 and SH1 that will be treated as part of the Project will be designed to achieve the same standards of 75% TSS removal;
- The stormwater treatment system along the foreshore is to achieve the best practicable treatment standards considering the constraints. The concept design achieves 75% TSS removal overall across the five treatment areas*;*
- The use of biofiltration systems within the foreshore stormwater wetlands;
- Detailed investigations and design to address the likelihood and consequence of blockages, valve, pump and electrical failures and other extreme events with the outcomes incorporated into the final design; and
- Further Auckland Council design input into the proposed stormwater system, particularly those aspects that will become Auckland Council assets.

During operation, it is important that the stormwater system is properly operated and maintained to maintain stormwater treatment efficiency. This will be addressed in operation and maintenance plans for the stormwater treatment devices, network and pump stations. The plans will include:

- Details of routine and post-event inspection;
- Required planned maintenance programme to ensure continued levels of service; and
- Clean-up procedures for spills.

The operation and maintenance plans will also include the preparation of emergency response and action plans for the stormwater treatment devices, network and pump stations that include the details the required actions and procedures to be carried out in the event of failure of any part of the stormwater infrastructure to ensure the safety of road users and the community.

The operation and maintenance plans will be developed by the Transport Agency and implemented by the asset owner (either the Transport Agency or Auckland Council depending on the specific treatment device).

12.21.5 Conclusion

Stormwater runoff from new (22 ha) and existing (25 ha) impermeable surfaces associated with the Project will be treated before discharge to remove the majority of contaminants. This will result in an improvement in stormwater quality being discharged from these areas.

Stormwater runoff from approximately 600 ha of additional area in the Onehunga and Penrose Catchment will be captured and treated in stormwater treatment areas on the Māngere Inlet foreshore. This will result in a significant improvement in the quality of stormwater discharging to the Māngere Inlet.

Further, the foreshore embankment and treatment areas attenuate leachate from existing closed landfills, reducing contaminants reaching the inlet through groundwater. The wetlands also provide the opportunity to treat intercepted leachate rather than continuing to discharge it to the tradewaste system.

New project infrastructure will be designed to meet industry standard flood risk protection standards although there will be residual risks associated with reliance on pumps, one-way valves and piped systems.

Overall, the effects of the Project on stormwater are positive.

PART H

MANAGEMENT OF EFFECTS ON THE ENVIRONMENT

13.0 Avoiding, Remedying and Mitigating Effects

This section outlines the environmental management measures proposed to be implemented before, during and after construction, to avoid, remedy or mitigate the actual or potential effects on the environment from the Project as identified in *Part G: Assessment of effects on the environment* of this AEE.

The concept design for the Project (as reflected in this AEE and supporting drawings and assessments) has sought to avoid or mitigate adverse effects through the route selection process, design of Project elements and the proposed construction methodology. Where it has not been practicable to avoid adverse effects, the measures set out in this section are proposed to remedy or mitigate adverse effects.

The proposed project delivery framework and the measures to manage adverse effects are addressed further in the sections that follow.

13.1 The Project delivery framework

The assessment of effects in *Part G: Assessment of effects on the environment* (and summarised in *Section 12.0: Introduction and summary of effects on the environment*) identifies a wide range of positive and adverse effects on the environment expected to result from the construction and operation of the Project.

Key to the delivery of the Project, including the management of effects, is the development and implementation of a suite of measures covering detailed design, construction and operation management plans and monitoring. This is collectively referred to as the Project Delivery Framework. It addresses the need to manage areas of environmental sensitivity, recognises environmental risk issues, and identifies the mechanisms to avoid, remedy or mitigate actual and potential effects.

The key features of the Project Delivery Framework are:

- An overarching CEMP to address both designation and resource consent matters related to construction;
- A series of topic specific management plans (e.g. erosion and sediment control, contaminated land);
- Site or activity specific components of the CEMP to manage particular effects during construction (e.g. coastal works); and
- A Communications Plan and accidental discovery protocol.

It is anticipated that the Project Delivery Framework would be formalised in conditions on the designations and resource consents.

The remainder of this section provides details of the Project Delivery Framework elements.

13.1.1 Proposed conditions

Based on the mitigation and monitoring measures summarised in Section 13.2 of this AEE, a suite of designation and resource consent conditions will be developed to ensure that the potential adverse effects that might arise from the construction, operation and maintenance of the Project will be adequately avoided, remedied or mitigated.

Two condition sets will be developed: a set for the designations and a set for the resource consents. Table 13-1 identifies the topics addressed in the designations and the resource consents.

Table 13-1: Topics addressed in designations and resource consents

Designation conditions	Resource consent conditions
• Construction management including noise and vibration, trees etc; • Communication and public information; • Network utilities; • Landscape and visual; • Traffic noise and vibration (operation); • Temporary and permanent traffic and transport; • Social; and • Built heritage and archaeology.	• Construction management; • Earthworks and land disturbance activities (including vegetation clearance); • Temporary and permanent stormwater management; • Coastal works including reclamation and declamation; • Management of contaminated land; • Ground settlement • Temporary and permanent groundwater management; • Ecological management (land); and • Ecological management (coastal environment).

The conditions will relate to the pre-construction, construction and operation phases of the Project.

13.1.2 The Outline Plan process and supporting information

Section 176A of the RMA sets out the process whereby the Transport Agency submits an Outline Plan to Auckland Council. The Outline Plan process enables Auckland Council to review and provide input to the detailed design.

The Outline Plan(s) may be staged to reflect the final Project phases or construction sequencing.

The Outline Plan(s) will address the matters required under section 176A(3) of the RMA including how the Project meets the conditions of the designation. The Outline Plan(s) will also include design details to address:

- Operational traffic and transport; and
- Landscape and urban design through the Urban and Landscape Design Plans; and
- Road traffic noise (operation).

Some of the management plans set out in *Section 13.1.5* will form part of the Outline Plan documentation addressing construction related matters:

- CEMP;
- CNVMP;
- A finalised Construction Traffic Management Plan based on the CTMPF contained as Appendix A to *Technical Report 10: Construction Traffic Impact Assessment*; and
- Network Utilities Management Plan (NUMP).

Details of these plans are set out in further detail in *Section 13.1.5*.

A Communications Plan and an Accidental Discovery Protocol will also be provided to Auckland Council at the same time as the Outline Plan documentation.

The key features of the management plans under the Outline Plan process and the Communications Plan and accidental discovery protocols are discussed further below.

The purpose and intent of the various management plans and other information to be provided to Auckland Council prior to construction are discussed in the following sections.

13.1.3 Design certification for resource consents

Certification of the design will be required from Auckland Council for the following temporary and permanent elements of the Project:

- Coastal structures including stormwater outfalls, retaining walls, seawalls, viaducts, bridges and reclamation;
- Permanent stream diversions and culverts;
- Operational stormwater system including stormwater treatment wetlands and proprietary devices;
- Temporary staging in the CMA and Anns Creek East; and
- Bridge design at Ōtāhuhu Creek.

The certification will confirm that the final design is in accordance with the resource consent conditions and relevant design standards. It is anticipated that the conditions of resource consent will specify the elements requiring design certification.

13.1.4 Urban and landscape plans

The ULDF contained in Volume 2 describes and illustrates the urban and landscape concepts to integrate the Project into the surrounding landscape.

During detailed design and prior to construction, Urban and Landscape Design Plans (ULDP) will be prepared setting out in further detail how the principles of the ULDF will be implemented across the Project. The ULDPs will include:

- The design principles set out in the ULDF and the Transport Agency guidelines;
- Final landscape plans based on the draft plans contained in *Plan Set 14: Landscape*;
- Designs to achieve the sector specific outcomes set out in Section 5 of the ULDF in *Volume* 4 covering:
  - Neilson Street Interchange
  - Māngere Inlet Foreshore
  - Anns Creek
  - Sylvia Park
  - SH1
  - Local roads
- Details of landscape and visual mitigation planting;
- Appearance of structures (including bridges, acoustic barriers etc); and
- Location and concept design for highway furniture (e.g. signposts, lighting standards etc).

As part of preparing the ULDPs, the Transport Agency will consult with a variety of stakeholders including directly affected landowners, Mana Whenua, Auckland Council, cycle and pedestrian groups and, as required, the owners and occupiers of adjacent properties.

Detailed design plans suitable for construction will be based on the ULDPs. As part of preparing the detailed design plans, some elements of the Project will require input and design approval from existing and future land owners. For example, the urban and landscape elements for locals roads under the control of Auckland Transport and areas that will become park managed by Auckland Council will require specific input from the final asset owner during detailed design. The asset owner design process would also include any separate Building Consent process under the Building Act for structural elements (e.g. pedestrian bridges and boardwalks).

13.1.5 Management plans and other information

Many of the potential effects identified in *Part G: Assessment of effects on the environment* of this AEE can be managed by implementing specific measures to be set out in a management plan related to that topic area. Management plans will be prepared (or finalised if a draft has already been prepared) and submitted to Auckland Council for review or approval prior to construction commencing. Figure 13-1 shows the management plans forming part of the CEMP for the Project.

Table 13-2 sets out the proposed management plans and the proposed minimum timeframes for submission of each to Auckland Council for approval. While these timeframes are the minimum, it is expected that the Transport Agency and its contractor/s will liaise closely with the Auckland Council during the preparation of the management plans.

Figure 13-1: Management plans under the CEMP

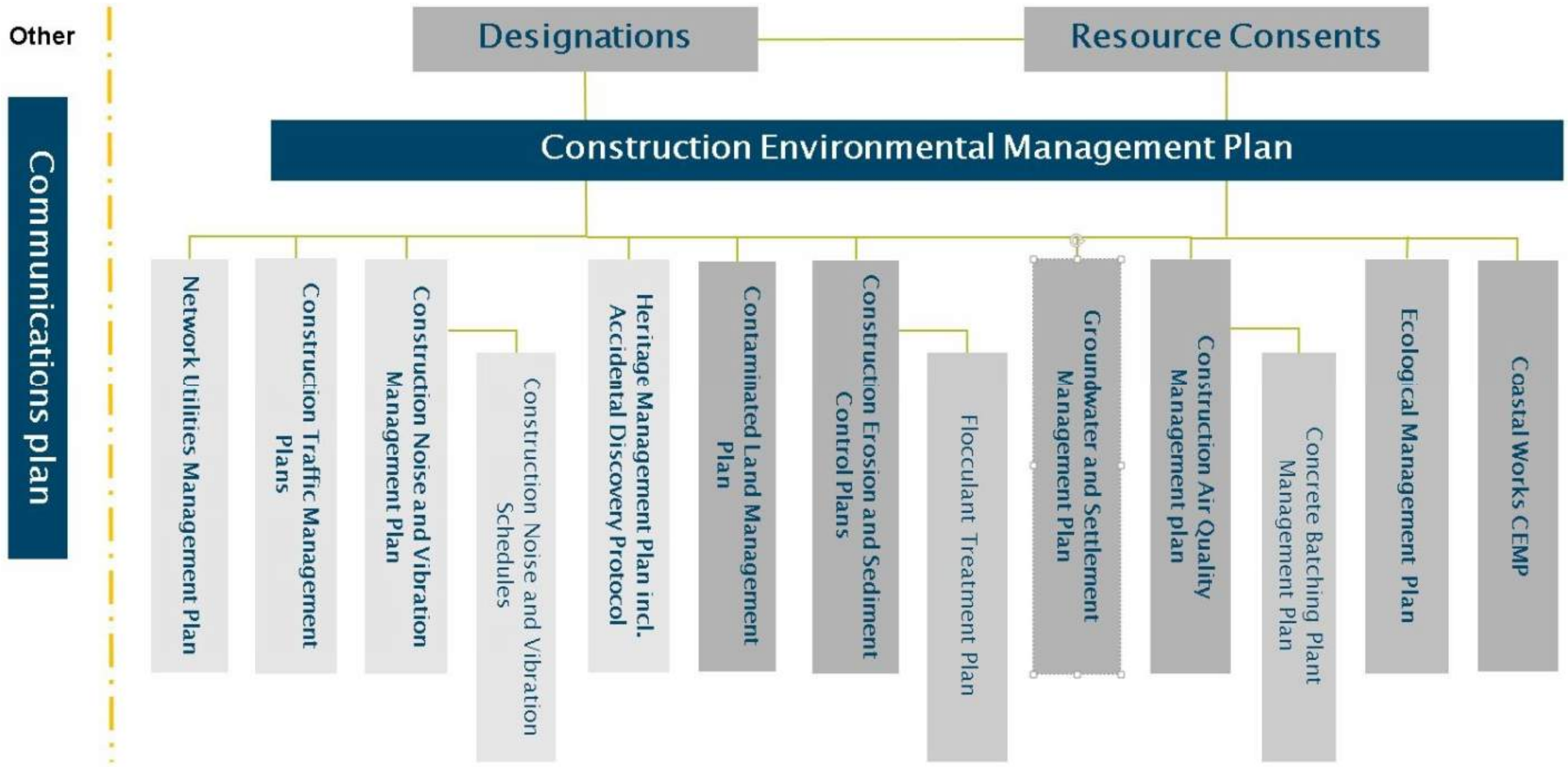


Table 13-2: Management plan submission timing

Management plan	Timing for submission to Auckland Council
Construction Environmental Management Plan	20 working days prior to construction commencing
Coastal Works CEMP	20 working days prior to construction commencing
Ecological Management Plan	20 working days prior to construction commencing
Construction Air Quality Management Plan	20 working days prior to construction commencing
Concrete Batching Management Plan	20 working days prior to construction commencing
Groundwater and Settlement Management Plan	20 working days prior to construction commencing
Construction Erosion and Sediment Control Plans	10 days prior to land disturbance activities commencing
Flocculant Treatment Plan	10 days prior to flocculant use commencing
Contaminated Land Management Plan	20 working days prior to land disturbance activities commencing
Heritage Management Plan including Accidental Discovery Protocols	20 working days prior to construction commencing
Construction Noise and Vibration Management Plan	20 working days prior to construction commencing
Site/activity specific Construction Noise and Vibration schedules	10 days prior to noise generating activity commencing
Construction Traffic Management Plan Framework	20 working days prior to construction commencing
Site/activity specific Traffic Management Plans	10 days prior to activity generating traffic management commencing
Network Utilities Management Plan	20 working days prior to construction commencing
Communications Plan	20 working days prior to construction commencing

Details of each of the management plans (as currently envisaged) including the purpose of the plan and the proposed contents is set out in the sections that follow.

a. **Construction Environmental Management Plan (CEMP)**

The CEMP is the overarching management plan which sets out the methods and tools to be implemented by the Transport Agency to manage effects during construction. It is prepared in order to meet the designation and resource consent conditions and any Transport Agency environmental objectives and guidelines. Its purpose is to ensure that construction related effects are appropriately managed during all stages of construction.

A draft table of contents for the CEMP has been prepared for the Project and is contained in Appendix A of this AEE. The CEMP will be prepared by the Project contractor(s) prior to construction of the Project to meet the requirements of the conditions. The final CEMP will be provided to Auckland Council for approval prior to construction, to allow Auckland Council to confirm that the CEMP meets the applicable requirements of the designations and resource consents. The Transport Agency will require that contractor(s) undertake all construction activities on site in accordance with the provisions of the relevant conditions and management plans as part of their contractual arrangements.

The CEMP will provide details of:

- Environmental policy;
- Staff and contractors' responsibilities;
- Training requirements for employees, sub-contractors and visitors;

- Environmental incident and emergency management;
- Environmental complaints management;
- Compliance monitoring;
- Reporting (including detail on the frequency of reporting to Auckland Council);
- Environmental auditing; and
- Corrective action.

The CEMP provides an overarching framework for the specific environmental management plans which will outline the methodology for delivering more detailed site or activity specific management plans.

The CEMP and supporting plans on specific topic areas may require review and amendment during the life of the Project to reflect changes to activities, risks, mitigation measures, responsibilities and management processes. The ability to make changes to management plans is an important aspect of continually improving the effectiveness of the management plans and the mitigation measures that they provide. It is anticipated that the proposed conditions will provide flexibility to review and modify practices according to changing circumstances.

b. **Coastal Works CEMP**

An activity specific CEMP will be prepared for the coastal works along the Māngere Inlet Foreshore. The purpose of the Coastal Works CEMP is to detail the specific measures to manage works in the CMA including dredging, reclamation, temporary works, bridges and boardwalks and other construction activities.

The additional matters to be addressed in the CEMP for the coastal works are:

- Dredging and declamation methodologies;
- Measures to minimise sediment discharge from dredging operations;
- Storage of equipment; surplus material and construction materials within the CMA;
- Navigation safety measures during construction;
- Channel dredging and infilling methodology and channel monitoring post construction;
- Methodology for the construction and removal of temporary construction staging in Anns Creek Estuary, Anns Creek West and Ōtāhuhu Creek;
- Measures to manage concrete dust entering the CMA from the removal of the Ōtāhuhu Creek box culverts;
- Procedures to respond to accidental discharges to the marine environment;
- Water quality monitoring and trigger levels;
- Monitoring of marine sediment during construction including weekly water quality monitoring;
- A Contingency Plan for trigger level exceedances;
- Monitoring of sediment deposition rates at nominated locations in the Māngere Inlet to confirm modelling predictions; and
- Reporting.

A CESCP (see further discussion in *Section 13.1.5* below) will also be prepared for the coastal works. This will include the specific erosion and sediment control measures (e.g. staging and stabilisation of foreshore areas) and the perimeter controls for the foreshore and viaduct/bridge works and other measures to limit the total suspended solid and sediment deposition.

The Coastal Works CEMP will be approved following the same process as the CEMP and will be implemented for the duration of construction and monitoring activities associated with the foreshore and viaduct/bridge works in the CMA.

c. **Ecological Management Plan (ECOMP)**

The purpose of the ECOMP is to detail the measures to manage the various ecological effects associated with the construction and operation of the Project. It will include details of the mitigation and monitoring for terrestrial, freshwater, marine and avifauna aspects.

The specific matters to be addressed in ECOMP are:

- Lizard management including survey, relocation, release sites, monitoring and habitat enhancement;
- Methodology for pruning or removal and disposal of native vegetation (including mangroves);
- Measures to protect lava flow shrubland and lava flow outcrops during construction including details of the pier exclusion area, the area to be excluded from the construction footprint, protective fencing and signage;
- Methodology for the construction and removal of temporary construction staging in Anns Creek East;
- Timing of works to minimise disturbance during bird breeding season;
- Details of protection, enhancement, rehabilitation and restoration of habitats in the Māngere Inlet, Ngarango Otainui Island, Anns Creek, Southdown Reserve and Ōtāhuhu Creek;
- Details of the salt marsh trial and restoration along the eastern edge of the Anns Creek Estuary;
- Details of the transplanting of common hard shore organisms to the landward edge of the new landform including post construction monitoring;
- Monitoring of habitats and values during construction including monitoring of avifauna and temporary stream diversions; and
- Post construction monitoring of the quality of stormwater from the stormwater wetlands.

The ECOMP will be implemented for the duration of construction and monitoring activities associated with the Project.

d. **Construction Air Quality Management Plan (CAQMP)**

The purpose of the CAQMP is to detail the dust management and emission controls to be applied by the construction contractor at the time of construction to minimise the effects of dust.

The specific matters to be addressed in CAQMP are:

- Dust suppression measures including consideration of weather conditions and procedures for the use of water sprays on stockpiles and exposed areas of the site;
- Visual monitoring of dust emissions;
- Measures to manage hazardous air pollutants from the disturbance of contaminated soils including landfills and asbestos;
- Measures to manage odour and landfill gas (including methane) from the disturbance of closed landfills;
- Measures to manage engine exhaust emissions from construction vehicles including construction vehicle maintenance; and
- Complaints investigation, monitoring and reporting.

The CAQMP will also include specific measures for the concrete batching activity as part of mudcrete operation. As part of the CAQMP, a Concrete Batching Plant Management Plan will be prepared and will provide details of:

- Equipment inspection, maintenance, monitoring and recording, including baghouse, pressure relief valves, and high level alarms; and
- Procedures for responding to process malfunctions and accidental cement discharges.

e. **Groundwater and Settlement Management Plan (GSMP)**

GSMP will be prepared to provide details of how groundwater and settlement beyond the Project designation will be managed during and following construction.

The GSMP will include details of:

- Groundwater monitoring bores including location, depth and geological unit;
- Method for bore construction and piezometer installation;
- Methods and frequency for groundwater monitoring;
- Groundwater trigger levels;
- Procedures to follow in the event of trigger levels being exceeded;
- Confirmed estimated settlements and building damage categories using the methodologies set out in *Technical Report 14: Settlement Effects Assessment*;
- Ground and building settlement markers;
- Frequency of monitoring of ground and building settlement markers prior to, during and following construction; and
- Settlement monitoring for specific network utilities as agreed with the Network Utility Operators through the NUMP.

f. **Construction Erosion and Sediment Control Plans (CESCPs)**

Prior to the commencement of works for each specific area and/or activity within the Project site, a CESCP will be prepared. As a minimum the CESCPs will demonstrate how the requirements of Auckland Council Guidelines relating to the capture and treatment of sediment laden discharges from the site will be met. The CESCP will follow the principles set out in *Technical Report 12: Stormwater Assessment* in Volume 3.

The CESCP will include:

- A risk assessment of sediment yield including slope, receiving environment, soil types and duration;
- Details of the specific erosion and sediment control measures;
- Supporting calculations and design drawings;
- Catchment boundaries for the sediment controls;
- Location of the works, and cut and fill operations;
- Details of construction methods to be employed, including timing and duration;
- Management of exposed areas, including progressive stabilisation considerations;
- Details of the flocculation treatment to be implemented (forming the Flocculation Management Plan); and
- Details of monitoring.

The CESCPs will be certified by Auckland Council prior to land disturbance activities commencing.

As part of the Project CEMP, the following specific matters relating to erosion and sediment control will also be included:

- The identification of appropriately qualified and experienced staff to manage the environmental issues on site;
- The identification of staff who have clearly defined roles and responsibilities to monitor compliance with consent conditions and CESCP;
- Provision of details of a chain of responsibility for managing environmental issues and details of responsible personnel; and
- The establishment of a sediment control team (including representatives from the contractor, Auckland Council and the Transport Agency) to meet and review erosion and sediment control on a weekly basis.

g. **Contaminated Land Management Plan (CLMP)**

The purpose of the CLMP is to detail the measures to manage health, safety, and environmental risk associated with contaminated material at the site during construction and operation.

A draft CLMP has been prepared for the Project and is contained as Appendix D of *Technical Report 17: Contaminated Land Assessment* in Volume 3. The Draft CLMP will be finalised and certified by Auckland Council prior to land disturbance activities commencing following detailed design.

The CLMP contains details of:

- Roles and responsibilities for management and implementation of the CLMP;
- Health and safety precautions including personal protective equipment to manage inhalation and dermal contact with contaminated material;
- Unexpected contamination discovery protocols;
- Risk mitigations or management measures to address human health and environmental risks associated with the contaminants of potential concern identified in this report;
- Management of risks related to exposure to landfill gas such as confined space entry requirements;
- Dewatering and disposal of liquid wastes;
- Contaminated soil management, reuse, and offsite disposal;
- Management and tracking of soil movements and appropriate disposal – this may involve sampling of stockpiled material to establish whether it is suitable for re-use as fill for the Project or depending on the level of contaminants, which class of landfill for disposal would be required. Soil containing asbestos will need to be managed and disposed of appropriately;
- Management of stockpiling, including cover to stop dust and runoff;
- Secure fencing and signage to minimise exposure to members of the public;
- Dust suppression;
- Wheel wash bays to prevent spread of contaminants and covering of trucks transporting soil off site and decontamination for equipment and personnel;
- Stormwater and erosion and sediment controls; and
- Contingency plans for spillages of contaminated media.

The CLMP will be implemented during construction under the supervision of a Suitably Qualified and Experienced Practitioner as defined by the Ministry for the Environment's guide to the NES Soil[92].

h. **Heritage Management Plan including Accidental Discovery Protocols**

The purpose of the Heritage Management Plan is to set out the specific measures to manage historic heritage during the construction and operation of the Project. The HMP will be prepared by an archaeologist and built heritage advisor and will contain details of:

- Identification of the Project archaeologist and built heritage advisors and their roles and responsibilities;
- Specific areas/features requiring supervision and the measures to be undertaken to protect and manage these;
- Whether HNZPT and/or Auckland Council heritage staff and or mana whenua supervision is required for specific areas/features;
- Accidental discovery protocols where areas are not covered by a HNZPT Archaeological Authority;
- Vibration monitoring during vibration intensive construction works in proximity to heritage features and the process to review construction methodologies to reduce vibration; and
- Methodology for pre and post construction building condition surveys of the Aotea Sea Scouts Hall and The Landing prior to works commencing to confirm the condition, context and physical features of the buildings.

The process to be followed should the monitoring indicate damage attributable to the Project:

- Monitoring of other historic heritage structures within close proximity to construction activities; and
- Documenting built heritage features to be removed (e.g. Onehunga Wharf rail structure).

As part of the Heritage Management Plan, an accidental discovery protocol will be finalised in consultation with Mana Whenua and HNZPT and will apply throughout the Project unless replaced by an archaeological authority obtained from HNZPT in accordance with the Heritage New Zealand Pouhere Taonga Act 2014.

The accidental discovery protocol will set out the process and procedures that apply following the discovery of material that could be an archaeological site, kōiwi and/or taonga.

The specific aspects which the accidental discovery protocol will deal with include:

- Actions to be taken following the discovery of material including ceasing work in the immediate area and securing the area;
- The parties to be notified of the discovery and providing guidance on management of the discovery;
- The circumstances when an archaeological authority must be obtained from HNZPT; and
- When work in the area of the discovery can recommence.

92 http://www.mfe.govt.nz/publications/rma-land-hazards/users-guide-national-environmental-standard-assessing-and-managing

i. **Construction Noise and Vibration Management Plan (CNVMP) and Schedules**

The purpose of the CNVMP is to include specific details relating to methods for the control of noise and vibration associated with all Project construction works to demonstrate (as far as practicable) compliance with NZS 6803 and the Transport Agency Noise and Vibration Guide 2013.

Specific aspects which the CNVMP will deal with include:

- Measures adopted to meet the noise criteria set out in the designation;
- Measures adopted to meet the vibration criteria set out in the designation; and
- Where either of the above cannot be met, the process that will be followed to appropriately mitigate noise and vibration effects including methods that may be applied outside the designation to achieve BPO in the form of a Construction Noise and Vibration Schedule (CNV Schedule).

The CNVMP will include the following information:

- Summary of Project criteria;
- Summary of assessments/predictions;
- General construction practices, management and mitigation;
- Liaison with potentially affected parties;
- Noise and vibration management and mitigation measures specific to sites, activities and/or receiving environments;
- Preparation of a CNV Schedule where the proposed activity cannot meet the noise and vibration limits for the Project;
- Circumstances and process for the relocation of residents during noisy activities;
- Monitoring and reporting requirements;
- Procedures for handling complaints; and
- Procedures for review of the CNVMP throughout the Project.

The preparation of this plan will be undertaken by a qualified acoustics specialist. It will outline the consultation undertaken with potential affected parties including the owners and occupiers of properties directly affected by the works.

Where a CNV Schedule is required, this will include details of specific measures that will be adopted to achieve BPO.

j. **Construction Traffic Management Plan Framework (CTMPF) and Traffic Management Plans**

A draft CTMPF has been prepared for the Project and is contained as Appendix A to *Technical Report 10: Construction Traffic Impact Assessment* in Volume 3. Following the appointment of a contractor(s), the CTMPF will be finalised.

The purpose of the CTMPF is to manage the various traffic management, safety and efficiency effects associated with construction of the Project. It is required to address Project-wide traffic management matters including the staging of works, construction yard access, methodology for detour routes and a process for the submission of site specific traffic management plans.

The finalised CTMPF will detail the methods for the delivery of temporary traffic management during the construction of the Project and will:

- Comply with the COPTTM, where practicable and include a method for situations where non-compliance or departures from the standards are required;
- Focus on leading industry standards with regard to temporary traffic management and safety;
- Minimise disruption on the state highways and local roads, wherever practicable;
- Limit, where possible, the number of construction vehicle trips on local roads and obtain access from arterial roads and state highways;
- Maintain existing flows and travel times on state highways and local roads adjacent to the work sites, where practicable;
- Minimise the impact of works on vulnerable road users such as pedestrians and cyclists;
- Minimise the effects of construction traffic on local roads used for access;
- Minimise the impact of construction parking;
- Detail the process for developing TMPs having consideration for all key stakeholders, including residents, emergency services and public transport providers;
- Identify all issues and have a planned TMP submitted and approved by Auckland Transport, and the Transport Agency's network management consultant (as relevant);
- Provide effective communication to affected parties; and
- Implement temporary traffic management.

The finalised CTMPF will be prepared in consultation with Auckland Transport roading asset managers and the Transport Agency's network operations teams. The CTMPF is required to be consistent with the Transport Agency and Auckland Transport codes of practice for temporary traffic management (as discussed in *Section 12.13.1* of this AEE).

A key feature of the CTMPF is the requirement for site or activity specific TMPs to be prepared during construction of the Project. TMPs are required to describe the measures that will be taken to manage the effects associated with construction on parts of the route prior to works being undertaken. It is likely that there will be several TMPs for the construction of the Project, which relate to the staging of the Project.

Specific aspects which the TMPs will deal with include:

- Temporary traffic management measures;
- Individual management plans for intersections;
- Access to private properties;
- Safety measures;
- Signage; and
- Detours.

Proposed physical works in transport corridors (local roads, State highways and rail corridors) are also subject to the *National Code of Practice for Utility Operators' Access to Transport Corridors*. Under that code, a Corridor Access Request must be submitted to the relevant road controlling authority (Auckland Transport or the Transport Agency) for works in roads or to KiwiRail for works in the rail corridor. This is a well-established process to ensure that all work is done safely and complies with national regulations.

k. Network Utilities Management Plan (NUMP)

The purpose of the NUMP is to ensure that the design and construction of the Project takes account of and includes measures to address the safety, integrity, protection and (where necessary) the relocation of existing network utilities.

Specific aspects which the NUMP will deal with include methods and measures to:

- Ensure that critical infrastructure can be accessed for maintenance at all reasonable times, or emergency works at all times, during and after construction activities;
- Manage the effects of dust and any other material potentially resulting from construction activities and able to cause material damage, beyond normal wear and tear, to transmission lines; and
- Ensure that no activity is undertaken during construction that would result in ground vibrations and/or ground instability (e.g. from earthworks) likely to cause material damage to network utilities.

The NUMP will include the following information:

- Protocols for liaison and information exchange between network utility providers and the Transport Agency during the detailed design phase;
- Process for network utility provider approval of proposed works on their utilities (where applicable / necessary);
- Protocols to undertake on-site works, including operating procedures and responsibilities for network utility operators' contractors and the Transport Agency's contractors;
- Protocols for utility provider design and supervision services;
- Protocols for inspection and final approval of works by network utility providers; and
- Settlement monitoring required for specific utilities as agreed with the network utility operator.

l. **Communications Plan**

A Communications Plan will be prepared and implemented by the Transport Agency prior to and during construction of the Project. The purpose of the Communications Plan is to identify the proactive and reactive communication protocols to keep the community and other stakeholders engaged and informed.

Conditions are proposed which set out the purpose and contents of the Plan. In summary, the specific aspects which the Plan will deal with include:

- Details of the site or Project Manager and the community liaison person, including their contact details;
- The stakeholders including residents and businesses who will be communicated with;
- Communication methods, including an assessment of how these methods reach the different audience/stakeholder groups, and detail of when each of these methods will be used (e.g. Regular communication or event specific methods); and
- Any stakeholder specific communication plans that are required.

A key part of the community engagement throughout the detailed design and construction phase is through the CLGs (see *Section 12.14.6.1* for further discussion). The CLGs are a mechanism to disseminate information and obtain community input into the Project. The expected terms of reference for the CLGs will be set out in the designation conditions. The Transport Agency has extensive experience and well established processes for communication and community engagement during projects.

13.2 Summary of measures to manage adverse effects

The positive effects of the Project are set out in *Section 6.0 Description of the Project* and the effects sections in *Part G: Assessment of effects on the environment*. The Project will provide greater transport capacity across and in Onehunga-Penrose by separating local traffic from through traffic helping to support significant growth identified for Auckland.

In summary, once completed the proposed works will provide the following positive effects:

- Significant benefits for the transport network including travel time reductions and improved travel time reliability, reduced traffic on local roads, improved accessibility, improved resilience of the transportation network and improved travel reliability for buses;
- Improved pedestrian and cycle connectivity and safety;
- Supporting improved business efficiency and growth through reduced congestion, notably for transport and logistics businesses;
- Landscape restoration around the northern Māngere Inlet; and
- Improved water quality for discharges to the Māngere Inlet.

A range of measures are proposed for the Project to avoid, remedy or mitigate the potential adverse effects identified in *Part G: Assessment of effects on the environment*. These measures are summarised in Table 13-3.

The measures will be implemented during further development of the Project. For example, in the development of the detailed design, prior to and during construction, and once the permanent works are completed. It is anticipated that these proposed measures will be reflected in the designation and consent conditions which will apply to the work. The figures that follow Table 13-3 show the key physical measures proposed to mitigate effects of the project.

Table 13-3: Summary of measures to avoid, remedy or mitigate the potential adverse effects

AEE Section	Topic	Measures	Mechanism to implement measures
12.2	Traffic and transport effects	• Replace parking at The Landing; provision of clearways on Captain Springs Road and off-peak parking on Galway Street; remove parking, provide u-turn facility and additional parking on Hugo Johnston Drive; access to 8 Sylvia Park Road; reinstate right turn onto Onehunga Mall from Neilson Street. • Undertake further liaison with Auckland Transport regarding the form and timing of the AMETI bus link to the Sylvia Park Town Centre.	Detailed design
12.4	Land use, property and business disruption effects	• Acquire land (where required) in accordance with the provisions of the PWA. • Engage early with affected businesses to enable business planning in response to the works and where required to facilitate business relocation (as appropriate). • Ongoing communication with affected business owners and operators. • Involve affected businesses in the preparation of construction traffic management plans and construction management. • Consult with businesses on specific access requirements during construction; temporary signage and other information to direct and inform those business owners and customers of access. • Manage potential effects on business operations sensitive to noise and vibration through liaison with key businesses (e.g. the glass bottle logistics business).	PWA process Detailed design for permanent works Communication mechanisms prior to and during construction Construction planning, methodologies and management measures
12.5	Network utilities	• Undertake detailed design in consultation with utility operator. • Incorporate responses for specific utilities into design/construction methodology in consultation with operators. • Manage construction activities near network utilities to minimise impacts (e.g. dust). • Relocate network utilities where necessary in consultation with utility operator. • Undertake settlement monitoring during construction for key utilities (e.g. high pressure gas).	Liaison with network utility operators Detailed design for temporary and permanent works Construction planning, methodologies and management measures NUMP
12.6	Cultural / Tangata Whenua	• Implement protocols for engagement and ongoing input from Mana Whenua in detailed design and construction. • Specific protocols and Te Aranga principles for the design of specific elements (e.g. structures in Te Hōpua). • Protocols for recognition of Mana Whenua and the cultural significance of the landscape in which the Project sits (e.g. undertaking blessings for construction works). • Implement protocols for cultural monitoring in significant sensitive sites (e.g. earthworks in the area of Te Apunga o Tainui, works in the vicinity of the historic coastline and works at Te Hōpua). • Develop an accidental discovery protocol for the Project in consultation with Mana Whenua and HNZPT. • Source locally grown natives for proposed landscaping. • Mana Whenua to participate in the review of monitoring reports for water quality and discharges to the CMA, reporting on ecological outcomes from the Project and in the development of any necessary contingency or response plans (e.g. if monitoring triggers are reached). • Offer cultural monitoring post construction to Mana Whenua.	Ongoing engagement through a Mana Whenua Liaison Group Detailed design for structural elements and planting Construction methodologies and monitoring Accidental Discovery Protocols Post construction monitoring
12.7	Archaeology and built heritage	• Design of landscaping and urban design elements to reduce further isolation of the Aotea Sea Scouts Hall and maintain connectivity with the wider environment. • Undertake building condition surveys of the Aotea Sea Scouts Hall and The Landing prior to works commencing to confirm the condition, context and physical features of the buildings. • Apply Accidental Archaeological Discovery Protocols for areas not covered by an HNZPT Authority during construction to ensure appropriate steps are taken in the event of archaeological discoveries. • Manage historic heritage values during construction in accordance with conditions of any HNZPT Archaeological Authority. • Identify opportunities for interpretive and commemorative material for any archaeological discoveries. • Seek Archaeological Authority(s) from HNZPT under the HNZPT Act for areas identified as having greater potential for archaeological discoveries. • Monitor specific heritage features during construction (e.g. stone walls at Waikaraka Cemetery). • Monitor vibration during vibration intensive construction works in proximity to heritage features.	Detailed design Archaeological Authority(s) under the HNZPT Act Accidental Discovery Protocols Construction monitoring HMP

AEE Section	Topic	Measures	Mechanism to implement measures
12.8	Geological heritage	• Enhance the park within Te Hōpua tuff crater to include interpretative material explaining its geological history and scientific values. • Improve the link between Gloucester Park and the proposed pathway that runs along Māngere Inlet to the east. • Establish interpretive signage in Te Hōpua and at Anns Creek which provides educational opportunities and enhances knowledge of Auckland's volcanic field. • Avoid damage to lava flows during construction by identifying an exclusion area within the Anns Creek East area within which no permanent or temporary piers are placed and by exluding areas from the construction footprint. • Increase public access to Anns Creek.	Detailed design for temporary and permanent works Construction planning, methodologies and management measures
12.9	Trees	• Undertake Arboricultural assessments prior to construction commencing to confirm the characteristics of trees with potential to be retained and to assess if any existing trees are worthy of retention and the protection measures for amenity trees adjacent to the works. • Develop tree protection measures (by an arborist) to be implemented during construction to avoid and minimise the potential effects on retained trees. • Replace planting for amenity trees removed within open space and road reserves.	Detailed design Construction methodologies and management measures CEMP
12.10	Landscape and Visual	• Treatment of structures, streetscape, landform (including the coastal edge) and landscape planting in accordance with the ULDF to: – Rehabilitate and restore the degraded landscape of Māngere Inlet; – Reconnect Onehunga with Māngere Inlet and its port; – Enhance the legibility and aesthetic qualities of Te Hōpua tuff crater; – Visually reinforce the appearance of the EWL as an arterial road; – Restore Anns Creek; and – Rehabilitate and re-open (physically and visually) Ōtāhuhu Creek.	Detailed design
12.11	Noise and Vibration – Operation	• Control traffic noise generation or effects in accordance with NZS 6806 through acoustic barriers or acoustic treatment/modification of buildings. • Ongoing road maintenance to manage operational vibration.	Detailed design Maintenance and operation
12.11	Noise and Vibration – Construction	• Compliance with Project noise limits during construction developed in accordance with NZS 6803. • Compliance with vibration criteria set out in the Noise and Vibration Guide 2013 during construction. • Compliance with underwater noise performance standards during construction in the CMA. • Use of BPO measures to avoid unreasonable noise where noise limits or vibration criteria will be exceeded.	Construction planning, methodologies and management measures CNVMP
12.12.3	Air Quality - operation	• Monitor air quality for the new sections of road as part of general state highway air quality monitoring.	Monitoring as part of existing maintenance and operation activities
12.12.2	Air Quality – construction	• Manage dust emissions from construction activities (earthworks, vehicle movements and wind entrainment from unsealed surfaces) and the disturbance of contaminated material (including asbestos) through dust suppression measures including minimising exposed areas of earthworks, consideration of weather conditions and procedures for the use of water sprays on stockpiles and exposed areas of the site. • Visually monitor dust emissions. • Manage hazardous air pollutants from the disturbance of contaminated soils including landfills and areas of asbestos through minimising exposed and worked areas and tracking and handling procedures. • Manage odour and landfill gas (including methane) from the disturbance of closed landfills through monitoring of landfill gas. • Manage engine exhaust emissions from construction vehicles through regular checks and maintenance of construction machinery.	Construction planning, methodologies and management measures CAQMP and CLMP

AEE Section	Topic	Measures	Mechanism to implement measures
13.13	Construction Traffic	• Traffic management measures during construction to manage: – Footpath closures/detours – Pedestrian crossing closures – Cycle lane closures/path closures/detours – Property access closures – Shoulder closures – Lane closure - alternating flow operation – Lane closure - contra-flow operation – Lane closure - one-direction closure – Road closures/detours – Short term closures for installation of long-term closures / traffic control measures – Site access – Temporary speed limits • Site/activity specific traffic management during construction to manage localised effects (e.g. property access requirements).	Ongoing consultation and information Liaison with local residents and businesses Construction planning, methodologies and management measures CTMP and site/activity TMPs Early advertising of road closures to the public through a variety of different measures
12.14	Social Impact	• Establish CLGs to disseminate information and obtain community input into detailed design of certain facilities along the route (e.g. cycle and pedestrian connections). • Regular communication and liaison prior to and throughout construction. • Consider moving sensitive residents to alternative accommodation for the duration of night works. • A full-time contact phone number for residents to liaise with the construction team on any issues that arise during construction. • Formalise a complaints and response process (and monitoring thereof) for the above communications plan. • Communicate construction timeframes on signs close to key community transport linkages. • Establish a recreation space early on the southern Waikaraka Park area to provide for ongoing recreation use and replacement open space during construction. • Early planting of open spaces, management of graffiti on the construction site and construction yards and maintaining adequate lighting of those areas identified for public access. • Liaise with key businesses and community facilities in construction planning and over the construction period to discuss issues of access and their operations. • Work with Auckland Transport to as far as practicable provide a temporary commuter cycle facility. • Keep key walking and cycling connections open and where no alternative access is available, closures only occur at night. • Liaise with businesses including consideration of pedestrian and vehicle access signage for those businesses whose access will be disrupted or altered by construction works. • Engage early on the land acquisition process. • Provide and sign parking areas to users of the Manukau Foreshore Walkway for the period that the Onehunga Harbour Road parking area is unavailable during construction. • Provide weekend car parking surrounding the Waikaraka Park and community buildings. • Community engagement initiatives. • Work with the The Southern Initiative to promote training and employment opportunities for young people. • Acoustic barriers constructed near private properties as outlined in *Section 12.11: Noise and Vibration* of this AEE. Consult residents on site specific design requirements and to confirm the implementation programme. • Enhance community outcomes through input on landscape design (through the CLG). • Reinstate the construction yard at Waikaraka Park for recreation facilities. • Signage plan for community linkages and connections between walkways and open space/recreation areas. • Design of walking and cycling connections between Panama Road and Frank Grey Place undertaken in consultation with the local community and residents.	Ongoing consultation and information Liaison with local residents and businesses Detailed design Construction planning, methodologies and management measures Communication Plan
12.15	Erosion and Sediment Control	• Implement erosion and sediment control measures during construction including structural (physical) and non-structural (site management and staging of the works) measures to meet Auckland Council DG05 requirements and Transport Agency guidance.	Construction planning, methodologies and management measures CESCPs

AEE Section	Topic	Measures	Mechanism to implement measures
12.16	Groundwater	• Monitor groundwater during and following construction of the works between the Neilson Street Interchange and Anns Creek. • Monitor groundwater quality of leachate prior to discharge to treatment wetlands.	Detailed design Construction monitoring Post construction monitoring GSMP
12.17	Ground Settlement	• Monitor settlement monitoring including ground and building markers during the construction of the EWL Trench adjacent to Onehunga Wharf to confirm the assessed settlement and to monitor effects. • Pre and post construction structural condition surveys for specific buildings adjacent to the Neilson Street Interchange. • Pre-construction surveys and ongoing settlement monitoring for key network utilities (as agreed with the network utility operator).	Pre, during and post construction monitoring GSMP
12.18	Contaminated Land	• Manage effects on human health and the environment from works in contaminated land by: – Managing contaminated soil and disposal during construction; – Discharges of dust generated by land disturbance activities; – Discharge of sediment from land disturbance activities; – Exposure to landfill gas; – Potential human health risks for the construction work force; – Discharge of leachate from the Pikes Point Landfill leachate interception system. • Protocols for the testing, identification and offsite disposal (where necessary) of contaminated soil during construction.	Construction planning, methodologies and management measures CLMP
12.19	Coastal Processes	• Detailed design of temporary and permanent coastal works. • Detailed construction methodology for the coastal works. • Stage the reclamation in the Māngere Inlet to minimise exposed areas. • Infill the dredged channel between the dredging site in the Māngere Inlet and the Waikaraka Park construction yard to minimise adverse effects on the Māngere Inlet geomorphology. • Erosion and sediment control measures and perimeter controls for the foreshore works and bridge construction. • Monitor water quality for the dredging and mudcrete operations within the Māngere Inlet. • Contingency planning for trigger level exceedances within the Māngere Inlet during construction which may require changes to the dredging methodology; • Monitor sediment deposition rates at nominated locations in the Māngere Inlet following construction to confirm the modelling. • Manage concrete dust from the removal of the Ōtāhuhu Creek box culverts to prevent this entering the creek • Investigate options for declamation in the Manukau Harbour.	Detailed design Construction planning, methodologies and management measures Pre, during and post construction monitoring Coastal Works CEMP

AEE Section	Topic	Measures	Mechanism to implement measures
12.20	Ecology	• Enhance the existing saltmarsh wetland in Te Hōpua crater (Gloucester Park South) through weed control and buffer planting of appropriate native species. • Restore and recreate saltmarsh habitat along the coastal foreshore. • Minimise effects on the lava flow vegetation by excluding areas from the construction footprint and pier exclusion areas within the lava flow shrublands and saltmarsh habitats in Anns Creek East. Enhance the remaining basalt lava flows and lava shrubland habitats at Pikes Point and Victoria Street through weed control. • Rehabilitate lava shrubland species through planting on the new coastal edge, using eco-sourced local genetic stock and planting of threatened coastal species. • Plant and restore coastal plant species as part of the stormwater wetlands and landscape planting along the coastal foreshore edge. • Weed control and pest control covering a total area of approximately 10ha. • Protect and enhance threatened plant communities (lava shrublands) in Anns Creek through weed control and long-term conservation management, subject to landowner agreements. • Rehabilitate lava shrubland species through planting on the new coastal edge, using eco-sourced local genetic stock. • Restore of coastal ecosystems in Ōtāhuhu Creek through declamation and restoration of fringing saltmarsh and riparian vegetation. • Identify opportunities to create, enhance and connect lizard habitats within the Project area. • Prior to earthworks, identify lizard release sites within the wider Project area. • Restoration planting at Anns Creek, especially enhancement of inanga spawning areas. • Restoration planting of inanga spawning areas. • Enhance remaining waterways through riparian planting and habitat enhancements subject to landowner agreement. • Experimental transplanting of common hard shore organisms to the landward edge of the new landform features. • Investigate opportunities to establish new saltmarsh habitat between terrestrial and mangrove vegetation on the eastern shore of the Māngere Inlet. • Investigate options to increase the abundance of intertidal organisms within the Māngere Inlet) and to increase the abundance of intertidal prey items within the Māngere Inlet. • Investigate opportunities to enhance habitat at or in the vicinity of Ngarango Otainui Island for royal spoonbill. Given macrocarpa have a limited lifespan, more trees could be planted as future roosting habitat for this species. • Plant saltmarsh to replace areas which will be lost under the Project footprint. • Recreate the Anns Creek East raupo wetland in an appropriate location (e.g. at Anns Creek Reserve). • Monitor temporary stream diversions during construction. • Establish a framework for adaptive monitoring during earthwork / construction for elevated discharge of total suspended sediment and/or sedimentation within the CMA. • Post-construction monitor the seaward edge of the new landforms along the northern shore of the Māngere Inlet. • Post-construction monitor the quality of the treated stormwater from the stormwater wetlands along the northern shore of the Māngere Inlet. • Pre-construction monitor Banded rail and Australasian Bittern to determine if they are breeding within the proposed Project footprint. • Reduce the width of the Project footprint as far as practicable by reducing the separation distance between bridge structures in Anns Creek. • Further refinement of bridge pier locations in Anns Creek East to further avoid and minimise adverse effects. • Construction yards confined to the existing consented development areas in Anns Creek East.	Detailed design Construction planning, methodologies and management measures Pre, during and post construction monitoring Operation and maintenance ECOMP
12.21	Surface water	• Detailed design of the stormwater system to incorporate: – All road related stormwater to be designed to achieve 75% TSS removal; – All existing areas of SH20 and SH1 that will be treated as part of the Project will be designed to achieve the same standards of 75% TSS removal; – The stormwater treatment system along the foreshore is to achieve the best practicable treatment standards considering the constraints; – The use of biofiltration systems within the foreshore stormwater wetlands; – Detailed investigations and design to address the likelihood and consequence of blockages, valve, pump and electrical failures and other extreme events with the outcomes incorporated into the final design; and – Further Auckland Council design input into stormwater system that will become Auckland Council assets. • Maintenance for the stormwater treatment devices, network and pump stations to maintain stormwater treatment efficiency and operation and establish emergency response and action plans.	Detailed design Operation and maintenance

Figure 13-2: Mitigation Plan (Māngere Inlet west)

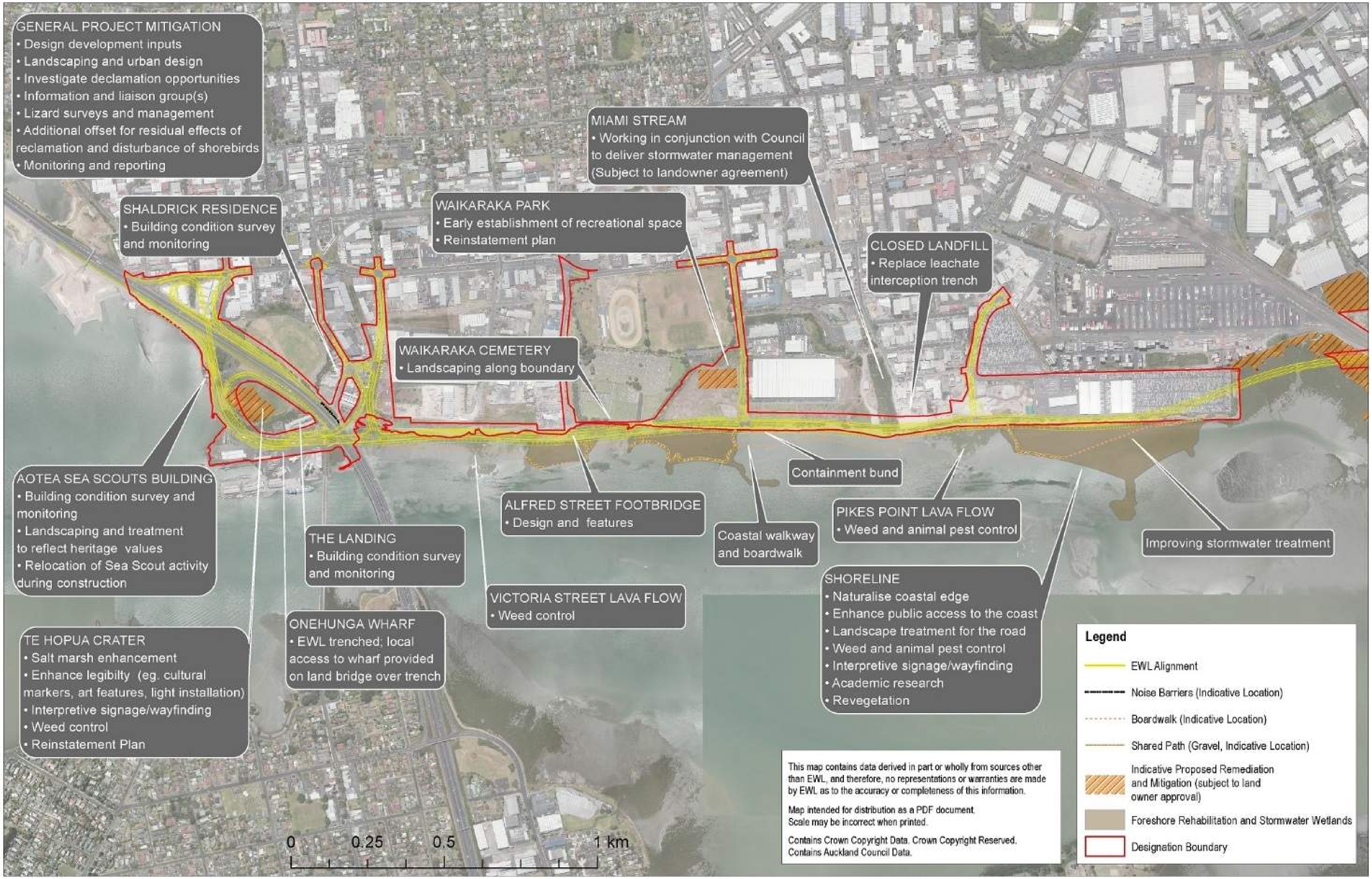
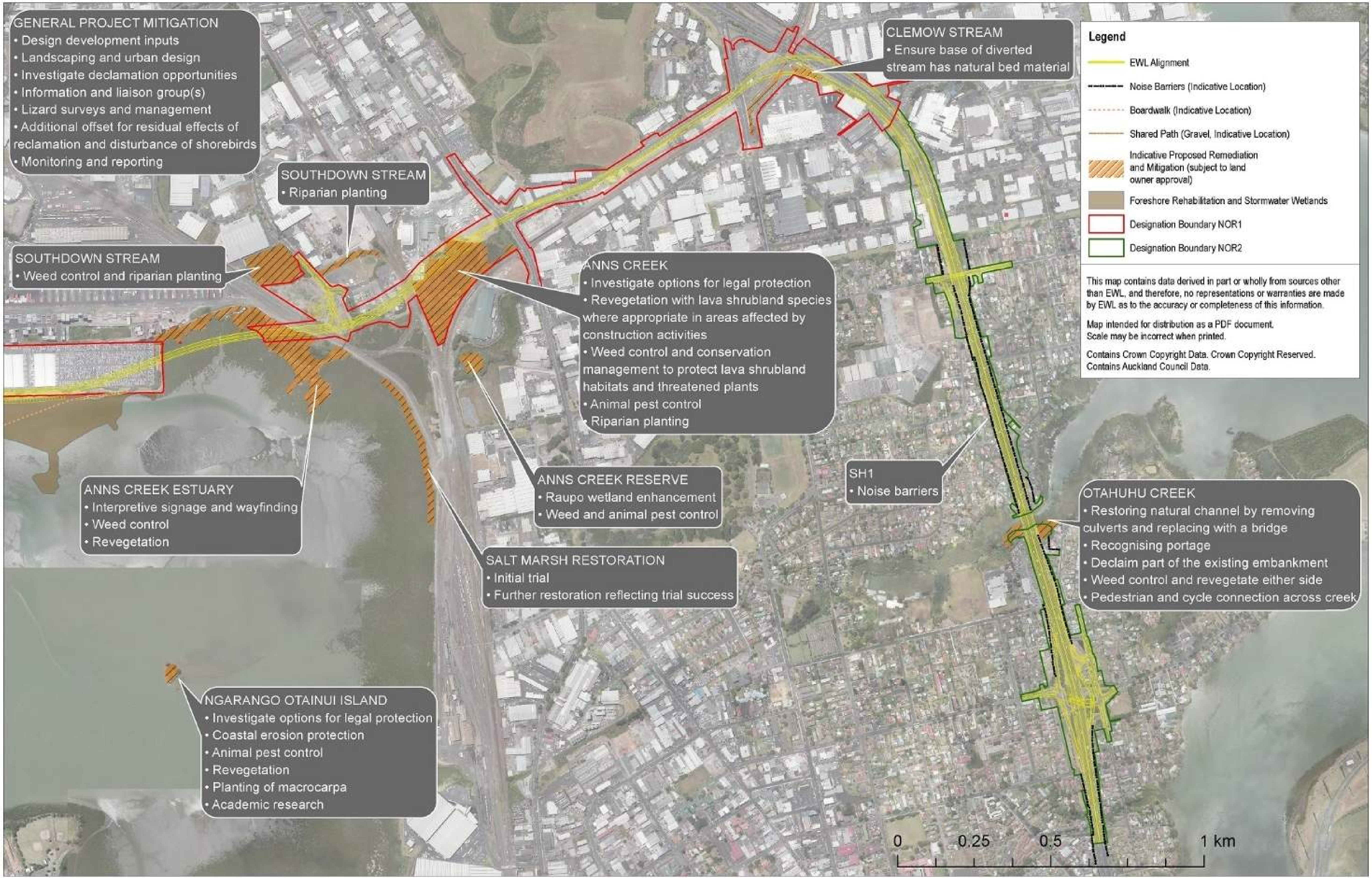


Figure 13-3: Mitigation Plan (Māngere Inlet east and SH1)



PART I

STATUTORY MATTERS

14.0 Statutory Framework

This analysis has been set out to address the requirements of sections 104 (for the resource consent applications) and 171 (for the NoRs) of the RMA.

14.1 The Transport Agency

The Transport Agency is the requiring authority and applicant for the Project. The sections below set out the objectives, principles and functions of the Transport Agency.

14.1.1 The Transport Agency – Operating Principles and Functions

The Land Transport Management Act 2003 (LTMA) provides the statutory framework for New Zealand's land transport system. It is also the statute under which the Transport Agency operates (in conjunction with the Government Roading Powers Act 1989 and the Land Transport Act 1998).

The Transport Agency's objective is set out in section 94 of the LTMA as being:

"to undertake its functions in a way that contributes to an effective, efficient and safe land transport system in the public interest."

The Transport Agency's functions are set out in section 95(1). Of specific relevance to the Project is:

(a) to contribute to an effective, efficient, and safe land transport system in the public interest:

[…]

(c) to manage the State highway system, including planning, funding, design, supervision, construction, and maintenance and operations, in accordance with this Act and the Government Roading Powers Act 1989:

The principles under which the Transport Agency must operate are set out in section 96. Of specific relevance to the Project are those in subsection (1):

"In meeting its objective and undertaking its functions, the Agency must -

(a) exhibit a sense of social and environmental responsibility, and, -

(b) use its revenue in a manner that seeks value for money, and,—

(i) if the revenue is part of the national land transport fund, in accordance with section 10(3); and

(ii) in all other cases, for the purpose for which it is collected; and

(c) ensure that its revenue and expenditure are accounted for in a transparent manner; and

(d) ensure that—

(i) it acts in a transparent manner in its decision making under this Act; and

(ii) it gives, when making decisions in respect of land transport planning and funding under subpart 1 of Part 2, the same level of scrutiny to its own proposed activities and combinations of activities as it would give to those proposed by approved organisations."

14.1.2 Power to construct and operate roads

The Government Roading Powers Act 1989 grants the Transport Agency certain powers in relation to the construction, operation and maintenance of state highways.

Section 61 of the Government Roading Powers Act sets out the powers and duties of the Transport Agency in relation to state highways. Subsection 61(2) provides the Transport Agency various powers in respect of roads granted to local authorities under the Local Government Act 1974, including the ability to construct footpaths and cycleways. Of specific relevance to the Project are those powers under subsection 61(4) which states the following:

"(4)The Agency shall have power to do all things necessary to construct and maintain in good repair any State highway, and in particular, but without limiting any power conferred on the Agency elsewhere in this Act, to do the following things:

(b) To increase or diminish the width of any State highway:

(c) To determine what part of a State highway shall be a carriageway and what part a cycle track or footpath only:

(d) To construct, erect, dig, or grow on any State highway, or remove from it, such barriers, dividing strips, guide or sign posts, pillars, or other markers, trees, hedges, lawns, gardens, and other devices, as may in the opinion of the Agency be necessary or desirable:

(e) To place or construct temporarily or permanently on any carriageway any reasonable device or thing for the purpose of controlling vehicle speeds, if it is desirable for the safety of road workers or users of the State highway, or members of the public, or to protect any part of the State highway:

(f) To place or construct, or allow to be placed or constructed, on any State highway clear of the carriageway any road-making or maintenance materials, plant and equipment, traffic weigh stations, traffic control aids, and stations, facilities, and amenities for State highway users:

(g) To alter the level of any State highway:

(h) To stop, divert, or otherwise control the traffic upon any State highway temporarily while any work or investigation is being undertaken or for the structural protection of any part of the State highway:

(i) To close to traffic any State highway, or any part of it, for such period as the Agency considers necessary to execute repairs or to remove any obstruction: …"

SH20 and SH1 are declared as motorway under section 71 of the Government Roading Powers Act. Motorway status provides particular restrictions on the use of and access to a road. For example, pedestrians are not permitted to walk on motorways, and horses cannot be ridden on motorways (sections 82 to 84 of the Act).

Under section 88 of the Government Roading Powers Act, the Transport Agency is also able to declare a state highway, or part of a state highway, a limited access road. The limited access road provisions allow the Transport Agency a higher level of control over where, and the extent to which, access to a state highway can occur. In particular, access to a limited access road is restricted to crossing places authorised by the Transport Agency.

14.1.3 Requiring Authority Status

The Transport Agency was confirmed as a Requiring Authority in accordance with section 167 of the RMA via Gazette Notices on 3 March 1994 (GO1500) and 19 November 2015 (GO6742). A copy of these gazette notices is attached to the NoR. The Transport Agency has the ability to designate, construct and operate state highways, motorways, cycleways, shared paths and directly associated works. Therefore, the Transport Agency has the authority to designate all matters relating to the NoRs.

14.2 Introduction to the statutory framework

When considering the NoRs under section 171 of the RMA and the applications for resource consent under section 104, the BoI must have regard to various matters.

Section 171(1)(a) requires <u>particular regard</u> to be had to any relevant provisions of:

- A national policy statement;
- A New Zealand coastal policy statement;
- A regional policy statement or proposed regional policy statement;
- A plan or proposed plan; and
- Any other relevant matters.

Section 104(1)(b) requires <u>regard</u> to be had to all of the same matters, as well as any relevant provisions of:

- National environmental standards; and
- Other regulations.

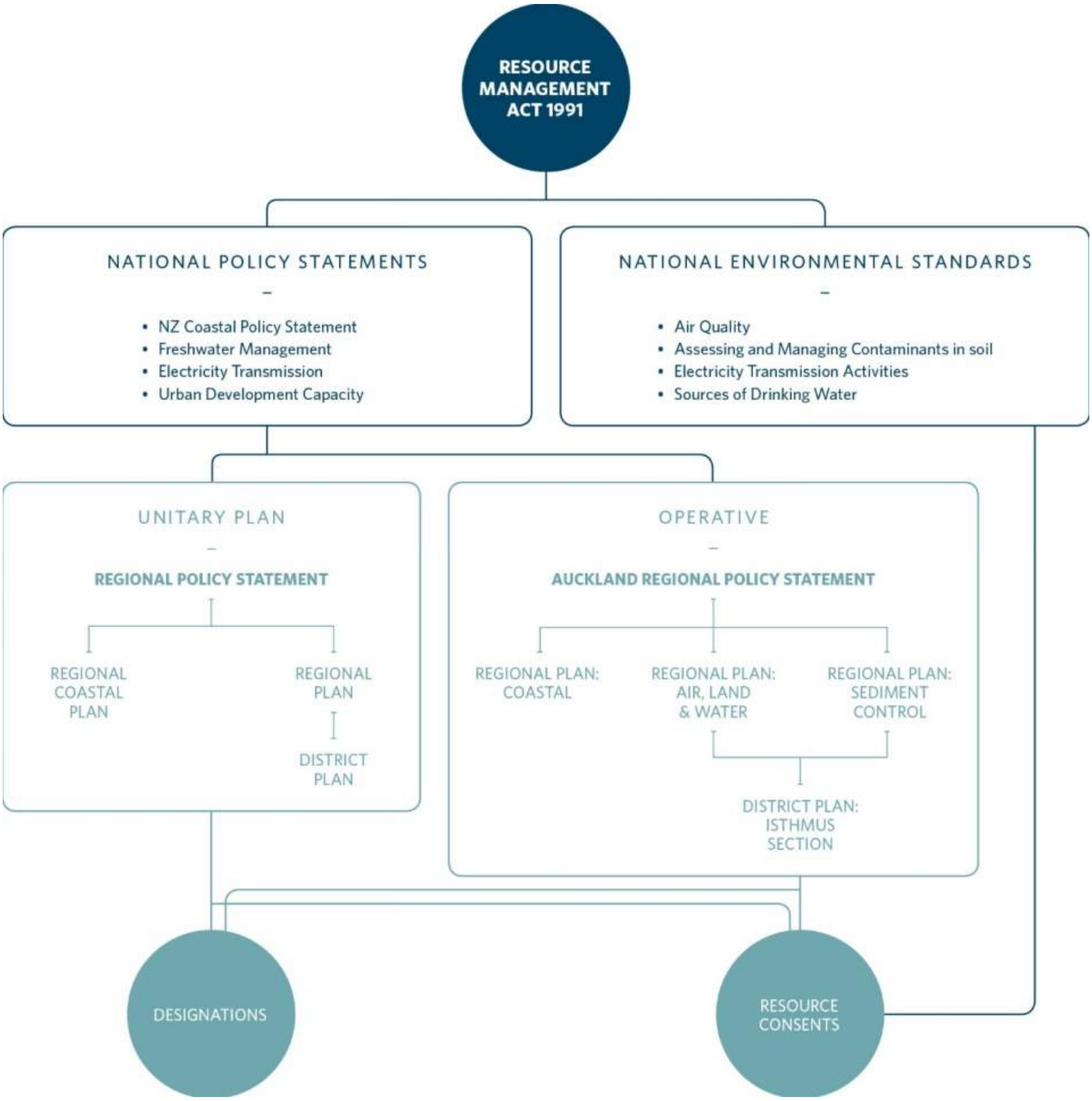
Both of these assessments are subject to Part 2 of the RMA.

Section 171(b) and (c) are addressed below. Additional matters for consents are also addressed:

- Section 104D – for non-complying activities;
- Section 107; and
- Section 105.

The full structure of the relevant provisions is contained in *Volume 3: Report 2 - Statutory Context* and summarised in Figure 14-1.

Figure 14-1: Relevant provisions



14.3 National policy statements

14.3.1 The New Zealand Coastal Policy Statement

The NZCPS came into effect on 3 December 2010 and contains objectives and policies relating to New Zealand's coastal environment. As the Project will directly impact on the coastal environment, the NZCPS must be considered.

There are seven overarching objectives of the NZCPS which set out the high level direction for management of the CMA, and the policies follow this direction. All seven objectives are considered relevant to the Project.

The objectives of the NZCPS include to safeguard and preserve the natural character of the coastal environment including its function, resilience, and sustaining ecosystems for future generations, take into account the principles of the Treaty of Waitangi, maintain public access and open space opportunities in the coastal environment, and enable people and communities to provide for their social, economic and cultural wellbeing.

14.3.2 Other National Policy Statements

The purpose of a National Policy Statement (NPS) (other than the NZCPS) is to state objectives and policies for matters of national significance that are relevant to achieving the purpose of section 45(1) of the RMA. There are three relevant operative NPS's:

- The NPS for Freshwater Management 2014 (NPSFM);
- The NPS on Electricity Transmission 2008 (NPSET);
- The NPS on Urban Development Capacity 2016 (NPSUDC); and
- The proposed NPS on Indigenous Biodiversity 2011.

The NPSUDC was gazetted on 3 November 2016 and came into effect on 1 December 2016.

14.4 National Environmental Standards

National Environmental Standards (NES) are regulations issued under Sections 43 and 44 of the RMA and apply nationally. The relevant NESs are set out in Table 14-1.

Table 14-1: Relevant National Environmental Standards

NES	Relevance
NES for Assessing and Managing Contaminants in Soil to Protect Human Health 2011	Sections of the Project area have, or are being used for hazardous activities and industries and therefore require consent under the NES Soil.
NES for Air Quality 2004	Vehicle emissions not do specifically require consent under this NES. An analysis of air quality effects has been prepared as part of the assessment of effects of the Project.
NES for Electricity Transmission Activities 2009	This NES is applicable to the Project as relocation of some transmission lines will be required. Engagement with Transpower has occurred through the development of the Project.
NES for Sources of Human Drinking Water 2007	The NES aims to reduce the risk of contamination of drinking water sources by requiring regional councils to consider the effects of certain activities on drinking water sources when granting water permits or discharge permits.

14.5 Regional Policy Statements

The relevant regional policy statements are:

- Auckland Unitary Plan (Operative in Part) 2016;
- Auckland Regional Policy Statement.

14.6 Relevant Plans and Proposed Plans

The relevant plans are:

- Auckland Unitary Plan(Operative in Part);

- Operative Auckland Regional Plan: Coastal 2004;
- Auckland Regional Plan: Air Land & Water 2013 (air quality provisions only – due to status of AUP (OP) appeals); and
- Operative Auckland City District Plan: Isthmus Section 1999 (certain zoning and other provisions)

There are no appeals on the AUP (OP) that are directly relevant to the matters in the Auckland Regional Plan: Sediment Control, and thus this Plan has not been considered further.

14.7 Other relevant matters

When considering the resource consent applications and the NoRs, the BoI must have regard to any other matter it considers relevant and reasonably necessary to determine the matter (sections 104(1)(c) and 171(1)(d) of the RMA). Other matters are set out and assessed in following sections.

15.0 Statutory Analysis

15.1 Summary

In summary, the Project has been developed specifically to respond to the direction of statutory policy and framework and meets the Section 104D(1)(b) test. The Project will not be contrary to the relevant objectives and policies of the Plan or proposed Plan. This is with reference to the AUP (OP) (Coastal and Regional Plan sections) and the legacy regional plans where relevant.

15.2 Methodology for Analysis of Relevant Statutory Planning Documents

The AUP (OP) is new, and responds to the direction of the Auckland Plan which recognises that Auckland is a growing City. As a document prepared under the Local Government (Auckland Transitional Provisions) Act 2010, the Auckland Plan is a directly relevant "other matter" that is assessed in the analysis below. It is relevant to mention here as it provides the direction and context for the AUP (OP). The Auckland Plan also recognises the East West Link project as a priority project for Auckland.

The AUP (OP) is required to give effect to "higher order" statutory planning documents including the NZCPS. The exception to this is the proposed National Policy Statement: Urban Development Capacity, which was released for consultation after the majority of the AUP (OP) hearings were completed. Careful consideration has been given to the provisions of this proposed National Policy Statement, which is not currently reflected in the AUP (OP).

In giving effect to the NZCPS, the AUP (OP)'s Regional Coastal Plan sections provide bespoke application of the NZCPS specific to the Auckland Region. These provisions seek to recognise that Auckland's coastline and coastal environment has been modified in the past through urban growth and development, that Auckland is a growing City and that infrastructure needs to be provided for as part of that growth, and that there are opportunities to restore areas of the coastal environment that have been adversely affected by past development. This needs to be balanced with protection of characteristics of the coastal environment. A detailed analysis against the NZCPS is required and has been undertaken. The bespoke AUP (OP) regional plan provisions give effect to the NZ Coastal Policy Statement whilst providing for growth specifically relevant to Auckland, thereby creating an appropriate direction in the Auckland context. It is noted this is subject to appeal. This statutory analysis has been prepared on this basis.

This analysis has been prepared specifically in relation to the requirement of the Act to, subject to Part 2, have regard, or particular regard in the case of NoRs, to specific provisions of statutory documents when assessing the Project. These statutory documents have been instrumental in the development of the Project, though noting that the Act does not require an activity to "comply with" specific provisions as though they were akin to rules. This means that were there are directive provisions (such as those policies using "avoid"), specific consideration has been given to the outcomes that are sought to be achieved. Further, the analysis seeks to balance all the relevant planning provisions and consider them as a whole, recognising that there are specific enabling provisions for infrastructure, that need to be considered along with prescriptive provisions seeking environmental protection.

This analysis has been prepared in the order set out below, providing analysis against the objective and policy frameworks in the National, Regional and District planning documents – followed by the relevant National Environmental Standards which contain limited objective and policy direction, but all have relevant provisions:

- National Policy Statements;
- Regional Policy Statements, Regional Plans and District Plans;
- National Environmental Standards; and
- Other matters.

An analysis against Sections 171, 104, 104D, 105 and 107 follows.

15.3 National Policy Statements

15.3.1 New Zealand Coastal Policy Statement

The majority of the Project is located in the coastal environment as defined in Policy 2 of the NZCPS. The NZCPS sets out issues and challenges relevant to New Zealand's coastal environment. Issues set out (in the Preamble) of particular relevance to EWL include:

- *Loss of natural character, landscape values and wild or scenic areas along extensive areas of the coast, particularly in areas closer to population centres or accessible for rural residential development;*
- *Continuing decline in species, habitats and ecosystems in the coastal environment under pressures from subdivision and use, vegetation clearance, loss of intertidal areas, plant and animal pests, poor water quality, and sedimentation in estuaries and the coastal marine area;*
- *Demand for coastal sites for infrastructure uses (including energy generation) and for aquaculture to meet the economic, social and cultural needs of people and communities;*
- *Poor and declining coastal water quality in many areas as a consequence of point and diffuse sources of contamination, including stormwater and wastewater discharges;*
- *Adverse effects of poor water quality on aquatic life and opportunities for aquaculture, mahinga kai gathering and recreational uses such as swimming and kayaking;*
- *Loss of natural, built and cultural heritage from subdivision, use, and development;*
- *Compromising of the open space and recreational values of the coastal environment, including the potential for permanent and physically accessible walking public access to and along the coastal marine area; and*
- *Continuing coastal erosion and other natural hazards that will be exacerbated by climate change and which will increasingly threaten existing infrastructure, public access and other coastal values as well as private property.*

All seven of the NZCPS objectives and the majority of the policies are relevant to the Project. Particular regard has been given to relevant NZCPS objectives and policies in the development of the Project and design. The Project has recognised the characteristics of the coastal environment, recognised and involved Mana Whenua, providing for kaitiakitanga. Particular consideration has been given where public use and enjoyment of public space is affected, and coastal hazard areas have been identified and assessed. Furthermore, the Project has been designed to avoid protected natural features. Balancing the range of issues covered by these provisions has strongly influenced the design of the Project as set out in *Section 6.0: Description of the Project* of this AEE.

15.3.2 The Coastal Environment

Relevant Provisions: Objective 1, Policy 1, 4

Objective 1 relates to safeguarding the integrity, form, function and resilience of the coastal environment and sustain its ecosystems. The objective seeks to maintain coastal water quality, enhancing it where it has deteriorated from what would otherwise be its natural condition, and including consideration of significant adverse effects on ecology and habitat as a result of water quality from discharges associated with human activity. Policy 1 addresses the extent and characteristics of the coastal environment. The majority of EWL is located in the coastal environment.

The Project has been assessed as achieving Objective 1 and Policy 1 for the following reasons. The Project maintains the biological and physical processes in the CMA, the proposed foreshore form has been specifically designed to maintain the physical coastal processes, recognising they are dynamic, complex and interdependent in nature.

While adverse effects from loss of intertidal areas will be significant, affecting New Zealand's indigenous coastal flora and fauna there will also be notable benefits through the establishment of new ecological habitat and significant improvement in water quality discharging to the coastal environment. The improvement in water quality will largely result from treatment of existing untreated water from industrial land uses and closed landfills adjoining the CMA, which currently results in a neglected coastal foreshore and also deteriorated water quality within the CMA from human activity. There are few opportunities to carry out a substantial improvement in water quality discharges from a long-established and largely impervious urban catchment, and the Project, with the support of Auckland Council as future asset owner, can deliver this through integration of transport and stormwater management solutions. At SH1, new stormwater treatment for the whole state highway will also improve quality of discharges to the Ōtāhuhu Creek.

The Project includes an integrated treatment of the Māngere Inlet coastal edge, designed to replicate the historic volcanic landforms that were once present before reclamation created an unnaturally straight edge. The Project also includes a new coastal edge planting and ecological habitat creation, and providing for public access and recreation.

All activities undertaken within the coastal environment as a result of the Project have been carefully considered and where practicable integrated and managed. Collaboration and input from Auckland Council, mana whenua, the community and the DOC has influenced the Project design. The future management and ownership of assets (where applicable) and land has been or will be determined in consultation with the above parties.

15.3.2.1 Treaty of Waitangi

Relevant Provisions: Objective 3, Policy 2

Objective 3 and Policy 2 relate to taking into account the principles of the Treaty of Waitangi and are achieved as the Project has been developed using an integrated design approach through all phases involving Mana Whenua as partners and seeking to enable a long term kaitiaki role. The process has included regular workshopping of ideas from early route options consideration, through to concept design refinement. All Mana Whenua having interest in the broad Project area have been involved in information sharing and decision-making in the development of the Project. This has enabled prioritisation of issues and understanding of issues of significance to Mana Whenua to be translated into Project design and the development of measures to avoid, remedy or mitigate actual and potential adverse effects.

A Māori world view, in particular a holistic and long term inter-generational view, has been incorporated through the Project design. The development of stormwater (and leachate) treatment solutions on the outer edge of the new road is part of a journey towards improving the health of the Māngere Inlet and treating the coast with more respect than has been afforded in the past. The design philosophy recognises long term historic associations with the area such as the Kāretu and Ōtāhuhu portages – which have been east west transport routes for hundreds of years.

15.3.2.2 Use and development

Relevant Provisions: Objective 6, Policy 6

Objective 6 relates to use and development of the coastal environment and recognises that there are some uses of activities and locations within the coastal environment that are appropriate, operational requirements of linear infrastructure being one of those uses. Policy 6 outlines activities which do not have a functional need to be located in the CMA, and generally should not be located here, whilst recognising there are activities which have a functional need to be located in the CMA. This suggests there is an exception to activities which do not have a functional need but rather an operation need to be within the CMA, such as this Project. The Project will significantly improve efficiency of freight movement in the Onehunga-Penrose area which will enable people and communities to provide for their social and economic wellbeing. The foreseeable needs of the population have been considered, determining public infrastructure is required in this location, which in turn aids the economic growth of Auckland.

The Project provides for coastal recreation and public access, whilst recognising and responding to the need of necessary infrastructure in this location. The Project would sit well within the existing built environment being largely industrial sites with low built character (such as stacked shipping containers). A change in character in this area of the CMA would therefore not be unacceptable. The Project has responded to the potential visual impact along the foreshore by restoring the headlands to their former shape as far as practicable. Public access will be provided and enhanced along the foreshore with planting, softening the Projects visual impacts.

The protection of natural character, open space, public access and the amenity values of the coastal environment has been considered through the assessment of alternatives and ultimately setting back the Project as far as practicable from the CMA, whilst providing quality public access and improving aesthetics of this part of the coastal environment.

The Project achieves these outcomes by enabling infrastructure, without compromising other values of the coastal environment. Integrated decision-making has involved inputs from different public agencies along with Mana Whenua and has resulted in the integrated development of a Project that is a transport solution, and an integrated environmental solution, and delivers significant social and environmental benefits.

15.3.2.3 Land held under other Acts

Relevant Provisions: Policy 5

Policy 5 sets out the considerations for land or waters held under various Acts and the potential effects on the land and waters in the coastal environment and having regard for the purposes for which the land or waters are held and managed. The Project recognises land held as public open space or recreation land held under other Acts such as the Reserves Act 1977 within the coastal environment such as Anns Creek, Manukau Foreshore West and East Walkways by assessing and addressing effects on their characteristics and usability for reserve purposes. It is also recognised that there are broad Treaty claims on the Manukau Harbour that are yet to be settled.

15.3.2.4 Reclamation

Relevant Provision: Policy 10

Policy 10 sets out considerations for reclamation of land in the CMA. This Policy sets the direction to generally avoid reclamation unless specific considerations are met. An extensive range of options for achieving the Project objectives have been considered, and these are summarised in the Consideration of Alternatives section of this AEE.

A key outcome of the early stages of assessment was identifying that limited land is available in this narrow part of the region that is suitable for construction of an efficient and effective transport link that supports businesses and freight, provides pedestrian and cycle links and improves public transport movements. This is because being located in an established industrial-urban environment and on a narrow isthmus means there are many existing constraints to work around. These include existing transport networks, local roads and State highways, strategic land uses, existing designated works (including strategically located rail lines and railyards), social, community and environmental constraints, an already congested transport network and a range of in-ground and above ground infrastructure networks. The area is also of great significance to Mana Whenua for many reasons, including being at portage points between the Manukau and Waitemata Harbours the site of historic transport routes. These and other cultural considerations have been integrated into the design development (as set out in *Section 12.6: Effects on values of importance to Mana Whenua* of this AEE).

Having particular regard to Policy 10(1)(a), land-based options were considered as part of the alternatives assessment process, and the resulting concept design seeks to avoid reclamation where practicable. The road carriageway, and much of the walking and cycling infrastructure along the Māngere Inlet is located either on land or on structure where it is a practicable to do so. At the western end of the foreshore, the new road is located fully within the CMA on reclamation in order to avoid the Waikaraka Cemetery and surrounding historic heritage extent of place, and achieving a geometric alignment that ties in to the Neilson Street Interchange efficiently.

Having particular regard to Policy 10(1)(b), achieving all the identified activates and associated outcomes could not be achieved in a location away from the CMA.

Having particular regard to Policy 10(1)(c), that part of the Project located within the CMA requiring reclamation has been assessed to be an effective and efficient use with the potential to deliver positive environmental outcomes that have been developed in an integrated manner. Through engagement with Mana Whenua and Auckland Council, a reclamation option was identified to be the preferred option as it enables delivery of wider benefits associated with stormwater capture and treatment, resulting in improved water quality discharges to the CMA. Furthermore, the proposed stormwater treatment located within the CMA is constrained by the existing catchment, network and topography. Mana Whenua engagement has also identified the importance of a naturalised water treatment methodology whereby water passes over and through land prior to discharge. It would not be practicable to achieve this type of treatment with a land-based option due to engineering design, space and geographical constraints, and maintaining the ability to capture flows at the “end of pipe”.

Having particular regard to Policy (1)(d), the Project responds to the policy direction by enabling significant national and regional benefits in delivering transport including active modes (walking and cycling), restoration of the foreshore, opening it up to greater public use and access, and enabling the kaitiaki function of Mana Whenua assisting to restore the mauri of the Inlet. The reclamation structure, and not only the infrastructure activity, ultimately achieves positive outcomes for the environment, in conjunction with social and economic benefits. These outcomes, in combination with an efficient transport outcome, would not be achieved effectively without using a reclamation solution.

Having regard to Policy 10(2), the reclamation has been designed to achieve a high amenity public access to the coastal edge, and landscape enhancement with responding to the previous landforms before reclamation occurred. It also enables outcomes that achieve positive cultural effects – including a being part of a long term process of environmental improvement in the harbour. The use of reclamation in this location also has other positive outcomes including being designed to accommodate sea level rise, both for the benefit of the alignment, and achieving protection of low-lying land in the area. The reclamation has been designed to achieve a naturalised look using materials consistent with the area.

Having regard to Policy 10(3), the reclamation will provide for the efficient operation of both transport and stormwater treatment infrastructure, and a coastal road, walking and cycling facilities.

15.3.2.5 Biodiversity

Relevant Provision: Policy 11

Policy 11 is about protecting indigenous biological diversity and in particular, seeks to identify and avoid adverse effects on rare and threatened species. To recognise Policy 11, the Ecology Assessment Report has identified, firstly, whether there is, or is likely to be, rare or threatened species present within the Project area, and then, methods to avoid adverse effects on indigenous biological diversity. There has been sighting of rare birds, potential identified for the presence of some rare birds that have not been sighted, and further, there are rare plants and vegetation present in and around Anns Creek, including native herbs and geranium species. The special characteristics of this area are a result of the coincidence of lava flows with rare and threatened ecosystems, the interface with freshwater and the CMA and significant indigenous taxa on the coastal fringe. Methods to avoid effects on rare and threatened species have included design refinements to avoid sensitive areas, and long term mitigation strategies to improve and enhance habitat. Such as, restoration planting of land-based and coastal fringe areas and pest management comprise part of the methods to mitigate effects.

Positive effects from the Project include the reduction of sediment, particulate and dissolved contaminant load discharging to the CMA, which will have benefits for ecology in the long term. The project in the long term provides for positive outcomes which are identified in detail in the *Ecological Impact Assessment* demonstrating how effects have been avoided long term. The *Technical Report 16: Ecological Impact Assessment* in Volume 3 identifies specific recommendations for protecting marine avifauna species, including the scheduling of certain activities outside bird breeding season.

Some adverse effects on rare and threatened species (within the scope of Policy 11(a)) cannot be completely avoided (including disruption to some bird species, loss of intertidal foraging habitat due to the reclamation and loss of unique vegetation in Anns Creek). Although individual birds may be affected there will be only a negligible impact on bird populations and on species as a whole. Similarly the majority of the assemblage of unique vegetation in Anns Creek will not be affected by the construction of the road in that area.

The Policy is responded to through careful design, construction and consideration of these rare and threatened species and mitigation measures will be implemented to minimise impacts and to enhance the quality of the environment in the long term.

15.3.2.6 Natural Character, landscape and heritage

Relevant Provisions: Objective 2, Policies 13, 14, 15

Objective 2 relates to the preservation of the natural character of the coastal environment, protection of natural features and landscapes, and the restoration of the coastal environment. Policies 13, 14, and 15 identify ways in which this can be achieved. The preservation of natural character is complemented by seeking out opportunities to restore and enhance the environment which are set out in Policy 14.

The Project alignment sits within a highly modified environment with little natural character, with the exception of the outstanding natural features. The Project will avoid adverse effects on outstanding natural features as far as practicable by the avoidance of adverse effects on the specific values identified as part of the assessment and design processes. Site investigations were undertaken in order to more specifically identify the remaining extent of the tuff ring, and intrusion into the feature is avoided by the physical works. Opportunities to restore and enhance these features, including improving visibility of them, and education and understanding have also been considered and incorporated in the design, including through engagement with Mana Whenua on opportunities to deliver positive cultural outcomes.

The Project will also achieve significant restoration outcomes as promoted by Policy 14, and is entirely consistent with all elements of Policy 14. The objectives and policies regarding natural character, landscape and heritage have strongly influenced the Project, and consequently the outcomes are generally able to be achieved.

15.3.2.7 Water Quality

Relevant Provisions: Objective 1, Policy 21, 22, 23

These provisions seek to maintain, and where possible enhance water quality and the discharge of contaminants within the CMA. For the Māngere Inlet sector of the Project, by virtue of its location on the coastal edge, the Project offers opportunity to both treat stormwater from the new and existing road alignment, and to improve stormwater quality discharging from the wider catchments. This opportunity has been particularly important in developing the concept for the Māngere Inlet foreshore, having regard to the policy direction of the NZCPS, and the partnership approach that the Transport Agency has taken in developing the design. With the support of Auckland Council as future asset owner, the Project incorporates a stormwater treatment solution that would be unlikely to have been addressed to this extent in the near future. This will also enable capture and treatment of contaminants from historic landfills. It is intended that Auckland Council will eventually own and manage the stormwater assets in the long term. A combined water treatment and recreational solution, complements the transportation functions, and provides an integrated approach to infrastructure development.

For the SH1 sector of the Project, new stormwater treatment along the existing State highway, will improve discharges to the CMA in Ōtāhuhu Creek.

15.3.2.8 Public Access, Open Space and Recreation

Relevant Provisions: Objective 4, Policy 18, 19, 20

Objective 4 and policies 18, 19 and 20 seek to maintain and enhance public open space qualities of the coastal environment including by recognising the CMA as an extensive area of open space, by maintaining and enhancing public access, and recognising coastal processes and the effects of climate change that can impact on access. The Project responds to this policy direction, particularly with respect to the northern foreshore of the Māngere Inlet, where there is access to the CMA from the existing walkway and cycleway. The Project will replace or enhance the existing walkway and associated amenity (green) space surrounding it, as a result of construction of the Project on the coastal edge.

New public recreational walking and cycling facilities will be established along the northern side of the Māngere Inlet on the newly constructed coastal edge on the seaward side of the new road. New recreational space will be developed in the moderated shoreline shape within the new headlands. The Project incorporates shared paths, a boardwalk and off-road pedestrian and cycle facilities to provide accessibility and safety for pedestrian and cycle use, and provide for safe and easy access across the new road at signalised intersections. These connections, mean that, despite the road being located along the coastal edge, it will not act as a barrier for people accessing the CMA, and is therefore consistent with responding to the objectives and policies of the NZCPS.

15.3.2.9 Natural Hazards

Relevant Provisions: Objective 5, Policy 24, 25, 26, 27

Objective 5 is about ensuring coastal hazards and climate change are managed. The Project achieves these outcomes through the design of the Māngere Inlet foreshore to accommodate predicted sea level rise as a result of climate change as set out in *Technical Report 16: Coastal Processes Assessment* in Volume 3, with the road surface being above predicted sea level rise. Policy 27 in particular is relevant to the Project because it relates to protection of significant existing development. The Project responds to Policy 27 delivering the additional benefit of acting as a defence against flooding and inundation for low lying properties in the Onehunga and Penrose areas, including the Waikaraka Cemetery and historic landfills, and thereby providing additional protection for flooding and inundation.

15.3.3 Hauraki Gulf Marine Park Act 2000

For the coastal environment of the Hauraki Gulf, the Hauraki Gulf Marine Park Act 2000 (HGMPA) requires that Sections 7 and 8 of that Act must be treated as a New Zealand coastal policy statement issued under the Act. Section 7 requires the recognition of the Hauraki Gulf, its islands and catchments and its interrelationship to sustain life supporting capacity of its environment are consideration as matters of national significance. Section 8 outlines the objectives of the management of the Hauraki Gulf, islands and catchments. The SH1 portion of the Project is located within the coastal environment of the Hauraki Gulf as the upper reaches of the Tāmaki River and Ōtāhuhu Creek drain to the Gulf. The Project meets Sections 7 and 8 of the HGMPA through directly responding to Section 7 which recognises the national significance of the Hauraki Gulf, by contributing to the life supporting capacity through improvement in stormwater quality discharging to the Ōtāhuhu Creek; and directly recognising, in particular, Section 8(d) which is to recognise the protection of the cultural and historic associations of people and communities, by the opening up and enhanced recognition of the Ōtāhuhu portage and its long history as a transport route and the narrowest part of the North Island.

15.3.4 National Policy Statement – Freshwater Management

The NPSFM aims to drive national consistency in local RMA planning and decision-making in regards to freshwater management. The NPSFM contains five groups of objectives and policies which include:

- Water quality (A);
- Water quantity (B);
- Integrated management (C);
- Tangata Whenua roles and interests (D); and
- Progressive implementation programme (E).

As the Project will have actual and potential effects on watercourses, wetland areas and will also require the use of groundwater during construction and the temporary diversion of streams, the NPSFM is relevant to the consideration of the Project. The Project responds to the Policy direction in the NPSFM through the development of innovative solutions to reduce long term discharge of contaminants to the environment.

The Project is assessed against the relevant objectives and policies in Table 15-1 below.

Table 15-1: NPS FM Assessment

Topic area	Assessment
Water quality (A) Water quantity (B)	Technical Reports assessing effects on Surface Water and Groundwater have assessed the existing values and effect of the Project (on freshwater and groundwater). While effects will be avoided and minimised as far as practicable, the construction works will have some adverse effects on water courses. Following construction, the rehabilitation, replanting and restoration works will overall improve the freshwater resources in the Project area. In the long term, the project will achieve positive outcomes for surface water. The stormwater treatment proposed alignment-wide will treat both new road surfaces, and significantly, existing State Highway surfaces plus the wider Onehunga-Penrose urban catchment. This means this transport project delivers both transport benefits, as well as realises the opportunity for achieving positive water quality benefits – improving discharge quality.
Integrated management (C)	A multi-party approach has been taken bringing together inputs from the Auckland Council, mana whenua, Auckland Transport, local stakeholders and the wider community (business and local). This has resulted in the identification of key issues in the integrated development of the Project that while a transport project also provides significant environmental benefits. The Project demonstrates the integrated management of natural and physical resources as it is a transport project seeking positive environmental outcomes which are not necessary alone for the achievement of the Project objectives.
Tangata Whenua roles and interests (D)	A partnership approach has been undertaken to the development of the Project with mana whenua. This has allowed the incorporation of mana whenua values and expression of kaitiakitanga in the alternatives assessment process, and concept design development.

15.3.5 National Policy Statement – Electricity Transmission

The National Policy Statement on Electricity Transmission (NPSET) sets out the objective and policies for managing the electricity transmission network under the Act and seeks to achieve efficient transmission of electricity whilst managing adverse effects. Whilst the Project has sought to minimise impact on transmission assets, the design may require the relocation of some towers and lines. Having particular regard to the NPSET, the Transport Agency and Transpower have been working closely together to develop a solution for modification and relocation of transmission lines and towers affected by the Project whilst appropriately managing adverse effects and maintaining security of supply.

15.3.6 National Policy Statement – Urban Development capacity

The NPSUDC was gazetted on 3 November and came into effect from 1 December 2016.

Particularly Relevant Provisions include: Objectives OA1, OA2, OA3, OC1, OC2, OD1 and OD2; and Policies PA1, PA2, PA3, PA4, PD1, PD2, PD3 and PD4

The NPSUDC provides direction to decision-makers under the RMA to provide for sufficient development capacity for housing and businesses to enable urban areas to grow and change in response to the needs of communities. In the proposed NPSUDC, development capacity is defined as: the capacity of land intended for urban development based on: the zoning, objectives, policies, rules and overlays that apply to the land; and the provision of adequate infrastructure to support the development of the land. This is directly relevant to the Project because it has a core function of improving transport access for freight in and around the Onehunga – Penrose area (Project Objective 1) and securing the long term usability of the land as a major employment centre and contributor to Auckland's GDP.

The key matters addressed by the NPSUDC relevant to the Project include providing for sufficient residential and business development capacity and integrated planning and development *(Objective C1)*. The NPSUDC requires Councils to provide for development capacity and recognises the need for this to be facilitated by infrastructure provision. The Project achieves the outcomes of the NPSUDC by supporting growth and development, jobs and economic wellbeing.

The EWL will support achieving the outcomes of the NPSUDC through:

- Maximising the usability of significant areas of existing industrial and commercially zoned land in Auckland which is entirely consistent with the NPSUDC direction of providing for sufficient business land to accommodate growth.
- Supporting the growth of businesses located in and around the Heavy and Light Industry zoned land in the Onehunga and Penrose areas, which currently experience high traffic congestion. This existing industrial zoned land and transport improvements to support it, in turn provides for significant economic growth and employment opportunity to be realised (refer to *Report No. 3 Economic Assessment.)*
- Supporting more efficient use of the existing local and State highway transport networks, and in particular, the rail freight network that serves Southdown and the upper north island.
- Improving vehicle, pedestrian and cycle access to residential areas in the Ōtāhuhu area that are zoned for higher density development, including to the east of SH1 in the Panama Road and Princes Street East areas.
- Infrastructure development in an integrated cross-agency manner that supports the social, economic, cultural and environmental well-being of people, communities and future generations.
- Effective and efficient urban environments where transport and other infrastructure facilities are integrated and good recreation, environmental and community outcomes can be achieved.

15.3.7 Proposed National Policy Statement – Indigenous Biodiversity

The Proposed National Policy Statement on Biodiversity was issued in 2011 for consultation, though has not been finalised. The Proposed National Policy Statement on Biodiversity is relevant for activities that impact on indigenous biological diversity (which includes naturally uncommon ecosystems, indigenous vegetation or habitats associated with wetlands).

- The Project alignment has been carefully considered to avoid, where practicable, and otherwise minimise adverse effects on areas identified to have significant indigenous biodiversity. Specific areas where construction and operation activities are to be excluded have been identified to respond to the presence of specific ecological values. There will be some adverse effects that cannot be avoided, remedied or mitigated.

- Areas of indigenous vegetation will be required to be removed during construction. This will include the mangrove areas and lava shrublands around the coastal fringe and vegetation in Anns Creek East. Replanting will be undertaken post construction to mitigate the effect of this.
- The replanting and habitat restoration works following construction will in the long term enhance the biodiversity values of the area.

The effect of the Project on indigenous biological diversity is addressed further in the RPS and regional plan assessment.

15.4 Auckland Unitary Plan (Operative in Part)

This section is structured as follows:

1. Regional Policy Statement;
2. Regional Coastal Plan;
3. Regional Plan; and
4. District Plan and Zoning.

15.4.1 AUP (OP) – Regional Policy Statement

The RPS sets out issues of regional significance in Section B1 of the AUP (OP). All issues are of direct relevance to the EWL other than (8) the rural environment. The RPS addresses inter-regional and cross-boundary issues which are population growth, transport linkages, economic development and natural environment. These are all directly relevant to the Project, particularly given the Project has a key function in supporting growth and development, and transport linkages, including the road and rail networks, are a critical part of that.

All RPS issues will be considered together as a whole.

15.4.1.1 Urban growth and form – B2

Relevant Provisions: B2.2, B2.5, B2.7 Objectives and B2.2.2, B2.5.2, B2.7.2 Policies

The RPS recognises that Auckland's growing population increases demand for housing, employment, business, infrastructure, social facilities and services, and the Project is a critical part of responding to that demand.

Objectives and policies B2.2 seek to ensure quality compact urban form, including greater productivity, economic growth and efficient provision of new infrastructure. The Project will support a high quality compact urban form by providing improved access to town centres and businesses, and improving integrated land uses.

Objectives and policies B2.5 seek to address commercial and industrial growth and recognise the importance of employment, and that these areas are enabled, well planned and efficient. The Project achieves these objectives and policies through supporting the efficient function of the Onehunga-Penrose industrial area, a significant employment area. The RPS also recognises the particular locational requirements of some activities, including the inland ports and proximity to the railway, and the efficiencies gained by co-location of other land uses that complement and support – such as logistics, warehousing, storage and manufacturing operations. The RPS recognises the importance of maintaining large strategic industrial land holdings (e.g. B2.5.2.7 and 8) and EWL supports this through minimising land severance and improving access. The Project also supports the function and growth of town centres at Onehunga and Sylvia Park by improving accessibility for transport modes including walking, cycling and public transport, and for residents on the eastern side of SH1 through improved connectivity across SH1 at Panama Road and Princes Street.

Objectives and policies B2.7 seek to ensure recreational need, public access to the coast and promotion of the physical connection between open spaces are provided for. The Project achieves these objectives and policies by providing greater interconnectivity between existing public open spaces and communities. Furthermore, public access along the CMA is expanded and enhanced.

15.4.1.2 Infrastructure Transport and Energy – B3

Relevant Provisions: B3.2.1, B3.3 Objectives and B3.2.2, B3.3.2 Policies

The RPS recognises the importance of infrastructure in realising Auckland's full economic potential, including, of particular relevance to EWL, integrating the provision of infrastructure with urban growth, traffic management, avoiding incompatible land uses and increasing resilience.

The policies seek to enable the development and operation of infrastructure, including in areas that are scheduled in the Plan in relation to natural heritage, the coastal environment and historic heritage, while avoiding adverse effects where practicable. The Project achieves these policies.

There are specific provisions for transport infrastructure that recognise the importance of the transport network in movement of people, goods and services, urban form, enabling growth, and providing choices. The Project does all these things and achieves these objectives and policies through: supporting movement of people, goods and services to, in and around the Onehunga-Penrose area, supports the continued use of the area for industrial land uses, and ongoing efficient economic growth of this area and associated employment. It also integrates road, rail and active transport modes. New local connections at Princes Street and Panama Road improve network resilience for residents by providing more capacity and safer walking and cycling facilities.

15.4.1.3 Natural Heritage – B4

Relevant Provisions: B4.2.1, B4.3.1 Objectives and B4.2.2, B4.3.2 Policies

The RPS recognises and protects natural heritage, including outstanding natural features and the ancestral relationships of Mana Whenua to these features and (at B4.3) significant viewshafts.

The policies of Chapter B4.2 list factors that have been used to identify the features with outstanding natural feature values. The policies are also to identify, evaluate and schedule outstanding natural features, to protect the physical and visual integrity of those features from inappropriate subdivision use, and development, and, where practicable and appropriate, to enhance outstanding natural features.

The volcanic heritage of Auckland is a particularly notable feature across the region. The Project area includes volcanic features in the form of remnant lava flows along the shoreline and the Hōpua Tuff Crater at the Neilson Street Interchange, though all have been modified by past urban development. The Project has had regard to protected view shafts and significant views from public places to the coastal environment and of remaining areas where volcanic heritage is present and visible. Effects on viewshafts are avoided. The Project will improve the visual amenity of this area of the CMA compared to its existing appearance (being industrial and largely neglected), particularly from existing public views. Landscaping will soften and enhance the amenity of the Project, providing a greener more natural looking space, and enhancing the legibility of remnant volcanic heritage features. The proposed educational signage and interpretation information will provide more information for people about the volcanic formation of Auckland and this is a positive outcome consistent with the policy direction.

The Project achieves these objectives and policies by recognising the presence of volcanic features, identifying them on the ground, mapping and then developing the design to avoid them as far as practicable, whilst also highlighting their presence, enhancing their legibility and providing for information sharing. Acknowledged important views and view shafts are not adversely affected by the Project, through careful design and recognising their presence.

15.4.1.4 Built heritage and character – B5

Relevant Provisions: B5.2.1 Objectives and B5.2.2 Policies

The RPS recognises the importance of heritage to the identity of Auckland, and the importance of active stewardship to protect it from inappropriate subdivision use and development. In particular, the objectives and policies require the identification and evaluation of historic heritage according to eight factors. The provisions also seek to avoid significant adverse effects on scheduled historic heritage, where practicable, and to encourage new development to have due regard to significant historic heritage.

The Aotea Sea Scouts building, and the Waikaraka Cemetery are the identified heritage places that may be affected by the Project. Other places have been identified that are located adjacent and in the wider environs of the Project, including the Landing hotel, woollen mill in Neilson Street, and the grouping of older buildings of Onehunga town centre – plus the Onehunga wharf itself and Mutukāroa-Hamlins Hill. The alignment and design avoids any physical works on these heritage features (Aotea Sea Scouts Hall and Waikaraka Cemetery) and any potential vibration and settlement effects can be managed during construction, including through monitoring of effects at key stages.

There are potential adverse effects impacts on the context of both places and the link between the historic Onehunga Port area and the Onehunga Town centre. Design features will improve connectivity and amenity of the street environment. The Project has had regard to the protection and conservation of historic heritage values as far as practicable, through design and avoidance of direct effects. As stated above, the presence of the Waikaraka Cemetery was a key driver for choosing a wider reclamation, in order to avoid impacts on the cemetery. Construction within or through the cemetery was not assessed as being a reasonably practicable alternative to reclamation.

The route traverses close to the edge of the Mutukāroa-Hamlins Hill extent of place at the intersection of Great South Road and Sylvia Park Road. The area is currently a paved walkway and the technical assessment has shown that the works on this area will have no adverse effects at all on the values of the heritage place.

15.4.1.5 Issues of significance to mana whenua – B6

Relevant Provisions: B6.2.1, B6.3.1, B6.4.1, B6.5.1 Objectives and B6.2.2, B6.3.2, B6.4.2, B6.5.2 Policies; AUP (OP) Notified Version only: E5.2 Sites and Places of value to Mana Whenua

The RPS requires recognition of and provision for the principles of Te Tiriti o Waitangi, in particular through Mana Whenua participation in resource management processes. Recognition of Te Tiriti o Waitangi partnerships is inextricably embedded in the Project through the Transport Agency being an agent of the Crown, taking responsibility for that partnership commitment. The Project achieves these objectives through Mana Whenua having been involved from early concept design through to the development of the design for consenting, identification of opportunities for mitigation, and representation of cultural features in the landscape such as the portages and their significance for both transport and economic function.

The principles of the Te Tiriti o Waitangi are recognised and provided for in the sustainable management of natural and physical resources, wāhi tapu and other taonga. The Project through design has generally sought to avoid wāhi tapu and other taonga. The philosophy of a long term (inter-generational) view of the environment has underpinned the development of the concept for the Māngere Inlet foreshore which has as its fundamental goal, restoring the mauri of the Inlet and enabling the kaitiaki role. During the course of the Project Mana Whenua have been involved as project partners throughout development of the early concepts, through alternatives assessment and identification of the preferred option. This aligns closely with the RPS' long term view, which is also represented in the commitment to ongoing development of the Project post-consenting phase.

The Project has recognised Mana Whenua cultural values, particularly with regards to the mauri of, and the relationships of Mana Whenua with natural and physical resources including freshwater, land, air and coastal resources. The Project provides for a significant improvement of the water quality entering the Māngere Inlet catchment by providing natural wetland treatment, a preferred water treatment method. Early Mana Whenua involvement within the Project has influenced the design by identifying their values, taonga, freshwater, biodiversity and historic heritage places and areas. The Project has responded to these through design and provided for them by improving the long term water quality into the Māngere Inlet, including reducing uncontrolled leachate levels, removing culverts at Ōtāhuhu Creek reinstating natural flows and providing for waka access (tidal dependent). Accidental discovery protocols will be followed during construction of the Project and will be developed in consultation with Mana Whenua. Appropriate actions will be taken ensuring tikanga Maori is adhered to particularly where any kōiwi are accidentally discovered.

It is noted the Sites and Places of Value to Mana Whenua previously contained within the AUP (OP) Notified Version, has been removed from the AUP (OP) Decisions Version, this is the subject of an appeal and therefore relevant, because sites of value were formerly mapped in the vicinity of the Project, at Gloucester Park, Mutukāroa and George Bourke Drive. The Project has responded to the policies and objectives contained E5.2 of the AUP (OP) Notified Version which sought to ensure the tangible and intangible values of sites and places to value Mana Whenua are protected and enhanced.

15.4.1.6 Natural resources – B7

Relevant Provisions: B7.2.1, B7.3.1, B7.4.1, B7.5.1 Objectives and B7.2.2, B7.3.2, B7.4.2, B7.5.2 Policies

The RPS recognises that increased pressure on natural resources comes with growth, and seeks to manage effects on biodiversity, fresh and coastal waters, air and mineral resources. The Māngere Inlet is classified as “degraded 1” in Figure B7.4.2.1 which annotates areas of degraded water quality. The Project responds to these RPS outcomes through recognising and providing for improvement of water quality discharging to the coastal environment. The zoning in a large part of the Project area is intended to facilitate the future efficient use of heavy industrial zoned land and the recognition of a lower standard of air quality than the Plan otherwise provides for. This zoning is important to allow industry to operate efficiently, and the Project supports that outcome.

Part B7 of the RPS seeks to avoid adverse effects on SEAs. The Project will have adverse effects on a terrestrial SEA in Anns Creek East, through clearance of vegetation to enable construction of the Project, and on the marine SEA in the Māngere Inlet, through reclamation and permanent loss of intertidal foraging habitat for birds. The bridge structure over the SEA-M1 in Anns Creek estuary will have temporary adverse effects through construction but will have minimal adverse long term impact on particular values of this SEA.

The Project will achieve improved stormwater treatment for the wider catchment area of Māngere Inlet, thereby improving water quality of discharges to this environment.

The construction of the Project will generate dust, this will be mitigated by construction roads being well metalled and regularly watered during dry periods and excavated surfaces can be watered and stabilised immediately after works.

Operational air pollutants arising from vehicle traffic are predicted to slightly exceed the Nitrogen Dioxide guideline level in one sector of the Project, both with and without the Project. Overall the effects of transport operations on air quality are improved as a result of the Project. Reduced general traffic and heavy vehicles on key arterials and local roads will be beneficial for local air quality.

15.4.1.7 The coastal environment – B8

Relevant Provisions: B8.2.1, B8.3.1, B8.4.1, B8.5.1 Objectives and B8.2.2, B8.3.2, B8.4.2, B8.5.2 Policies

The RPS seeks to preserve natural character, including opportunities to rehabilitate or restore areas of degraded natural character, avoid inappropriate use and development, provide for public access and open space, and achieve the outcomes of the HGMPA.

The Project, is restoring and rehabilitating the Māngere Inlet where the natural character has been degraded. Particularly where the Industrial properties adjoining the CMA has been neglected. The environment in which the Project sits has been heavily modified and does not exhibit high natural character.

The Project has been designed in order to minimise CMA occupation, and takes into account the range of uses and values of the coastal environment within appropriate limits. The Project is constrained by the existing heavily built up environment in conjunction with the limited land availability as determined by the alternatives assessment. The reclamation of the CMA achieves positive outcomes to the social, economic and cultural well-being of people and communities. Areas with natural and physical resources as scheduled in the AUP (OP) in relation to Mana Whenua, natural resources, and historic heritage have been recognised by avoiding these areas where practicable.

Public access to and along the CMA is maintained and enhanced by providing improved safety and access in the long term which is sensitive to the use and values of the adjoining area. Furthermore, improved interconnectivity is provided through public access between key destinations such as Māngere, Onehunga Town Centre and Sylvia Park Town Centre.

The coastal environment is addressed above under the NZCPS and below in relation to the Regional Coastal Plan, and these assessments conclude that appropriate regard has been had to these provisions in determining methods to avoid, remedy and mitigate adverse effects, and that there are significant potential positive outcomes for the coastal environment.

15.4.1.8 Environmental risk – B10

Relevant Provisions: B10.2, B10.4.1 Objectives and B10.2.2, B10.4.2 Policies

The RPS sets out objectives and policies for coastal and natural hazards, and for contaminated land. The Project achieves these provisions through recognising coastal hazard risk in the design, providing an opportunity to provide climate change protection with the construction of the Māngere Inlet foreshore alignment and providing an important opportunity to better manage discharges from urban stormwater runoff and historic land contamination.

15.4.1.9 Auckland Unitary Plan (Operative in Part) – Regional Coastal Plan

This section provides an analysis against relevant provisions of the AUP (OP) and the relevant provisions of the Operative ARP: C. In the AUP (OP), relevant coastal provisions are found throughout the Plan, including in Sections D, E and F. The following assessment has had regard to all the relevant provisions, regardless of whether they are specifically referenced, as well as in analysis against the regional and district plan provisions.

This assessment has been prepared on the basis of the AUP (OP) provisions having a high weighting given the limited scope of appeals, and the likelihood of the AUP (OP) being made operative in a form that is consistent with the Council's decision version. The regional coastal plan provisions have been developed to give effect to the NZCPS and naturally address similar topics, though the AUP (OP) provides more specificity for the Auckland environment and recognises that, for example, there are situations where activities in the coastal environment can be appropriate. The AUP (OP) also synthesises the various parts of the NZCPS. Wording of the provisions is consequently more nuanced in some instances. The regional coastal plan provides the framework to promote the integrated and sustainable management of Auckland's coastal environment. As discussed above, the Project provides positive effects in relation to water quality, public access and recreation, and is reflected in the NZCPS analysis. A number of coastal permits are required for the Project, relating to reclamation, temporary and permanent occupation, activities and structures in the CMA, discharges and the taking, use and diversion of coastal waters. This section assesses the Project against the relevant objectives and policies.

15.4.1.10 Natural Character of the Coastal Environment

Relevant provisions include: E18.2 Objectives and E18.3 Policies

The AUP (OP) seeks to maintain the natural characteristics and qualities that contribute to the coastal environment whilst providing for subdivision and development, and also restoring and rehabilitating the natural character values. The natural characteristics and qualities of the northern foreshore of the inlet and the area around the Port of Onehunga have been compromised and degraded through reclamation and previous development. The area is not assessed as having high natural character, though notable elements of natural character remain. Whilst the Project reclaims a portion of the CMA thereby affecting the existing natural character, the Project also seeks to restore the natural character of the Māngere Inlet by recreating the shapes of the original volcanic headlands as far as practicable, taking into account the natural movements of the sediment and water within the Māngere Inlet, positive ecological outcomes, water treatment and the new headland forms. New landscape planting also compliments the foreshore treatment and proposed headlands, and seeks to contribute to positive ecological outcomes.

The Project achieves these objectives and policies, particularly through promoting outcomes that will enhance natural character values in the northern part of the Māngere Inlet where natural character is present, though has been compromised, and through opening of the portage at Ōtāhuhu Creek underneath SH1.

The opening up of the portage, and recognition through the elevated shared path (the Kāretu portage shared path), will improve legibility of this historic transport route and site of significance to Mana Whenua, and improve natural character of the environment at the narrowest point of the North Island. An holistic view of the design for the Māngere Inlet foreshore is explained in *Technical Report 6: Landscape and Visual Assessment* in Volume 3, with the outcomes being: providing amenity and public access, recreating references to the historic rocky volcanic edge, maintaining coastal processes by avoiding work in main channels, and seeking opportunities to improve water quality and discharges and provide ecological habitat.

15.4.1.11 Natural features and landscapes

Relevant Provisions include: D10.2 Objectives and 10.3 Policies; E19.2 Objectives and E19.3 Policies

The provisions of Chapter D10 give effect to policy 15(a) of the NZCPS and Chapter B4.2 of the RPS. Of particular relevance to the Project are objectives (1) and policy (3), which seek to protect outstanding natural features from inappropriate subdivision, use and development, and to recognise and provide for the relationships of mana whenua with those features. Policy 4 specifies matters to be taken into account in protecting outstanding natural features, including: the particular values of the feature in its context; the extent of anthropogenic changes to the feature; the presence or absence of structures or infrastructure; and the functional or operational need of any proposed infrastructure to be located within the outstanding natural feature.

The AUP (OP) has identified two outstanding natural features in the vicinity of the Project (being Te Hōpua tuff crater and pahoehoe lava flows in and around Anns Creek), and one outstanding natural feature adjacent (Mutukāroa-Hamlins Hill).

The relevant objectives and policies are also taken account of through the recognition and incorporation of the identified natural features and landscapes in the design of the Project. This includes avoiding effects on the characteristics of the features that contribute to the values for which they are deemed to be outstanding, and through enhancing the features including legibility and understanding of the features through mitigation measures. Mana Whenua involvement in the design has reiterated the cultural values of outstanding natural features from a cultural perspective, and cultural values have been embedded in the design and option selection process, and will continue to be recognised into the future with mitigation measures to enhance these features. In particular:

- Site investigations were undertaken in order to more specifically define the remaining extent of Te Hōpua tuff ring geological feature through site walkover and geotechnical testing. The proposed Neilson Street Interchange design avoids works that affect the geology as far as practicable. From a landscape perspective, mitigation measures are proposed to improve legibility of the already compromised feature; and
- The pahoehoe lava flows and remnant features on the Māngere Inlet foreshore have been verified on the ground by experts, and the design of the proposed viaduct and Great South Road intersection has been developed so that they are avoided as far as practicable, particularly where coincident with rare vegetation types. There is opportunity for mitigation through weed clearance, and exposing hidden lava features, as well as educational signage to enhance understanding of the areas geological history.

15.4.1.12 Historic Heritage

Relevant Provisions: D17.2 Objectives and D17.3 Policies

The provisions seek to recognise and enable protection of historic heritage. There is recognition of the functional or operational need, in some instances, for infrastructure to be developed in the vicinity of historic heritage features.

The Project is consistent with these provisions because the alignment has generally avoided direct impact on mapped historic heritage extent place, there is no reasonable practicable alternative and the Project provides significant public benefits.

The historic heritage extent of place and the specific heritage features have, for example, strongly influenced the alignment being located within the CMA in order to avoid the Waikaraka Cemetery surrounds. In this instance, reclamation avoids compromising this area.

15.4.1.13 Drainage, reclamation and declamation

Relevant Provisions include: F2.2.2 Objective 1, 2, 3 F2.2.3 Policy 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

The reclamation objectives and policies recognise that reclamation can have significant and often irreversible adverse effects on natural character, ecological values, coastal processes public amenity and Mana Whenua values. The objectives and policies seek to avoid inappropriate reclamation and to avoid, remedy or mitigate the adverse effects of reclamation and drainage, and to provide for restoration and declamation of the CMA. An appropriate reclamation is one that meets the criteria identified in the policies. These key themes are responded to below.

Inappropriate reclamation

The Project incorporates 18.4ha of reclamation in the CMA.

The AUP (OP) contains a number of policies regarding reclamation. The suite of policies give effect, in the Auckland context, to the NZCPS Policy 10 and other parts of the NZCPS regarding use and development in the CMA.

Policy 1 of F2.2.3 states that the reclamation is avoided except where all of the following apply:

- *The reclamation will provide significant regional or national benefit;*
- *There are no practicable alternative ways of providing for the activity including locating it on land outside the CMA;*

- *Efficient use will be made of the CMA area by using the minimum area necessary to provide for the proposed use, or to enable drainage; and*
- *Significant adverse effects on sites scheduled in the D17 Historic Heritage (d) Overlay or D21 Sites and Places of Significance to Mana Whenua Overlay are avoided or mitigated.*

In addition, under Policy 2 reclamation and works are provided for if they are necessary to enable the construction and/or efficient operation of infrastructure, including roads, or to create or enhance habitat for indigenous species. Policy 4 requires proposals for reclamation to mitigate effects through the form and design of reclamation.

The reclamation associated with the Project has the following features:

- Allows for the best transport outcomes that can deliver enduring transport benefits for the network;
- Maximises use of the existing modified land edge where practicable for the road alignment;
- Enables development of a barrier along the foreshore around the edge of historic reclamations which will improve management of contaminated groundwater flows (i.e. leachate from landfills) towards the coast;
- Enables development of new naturalised stormwater treatment areas to collect and treat runoff from the Onehunga-Penrose urban catchment;
- The use of naturalised stormwater treatment is a preferred methodology by Mana Whenua, enabling water to travel through and over land for treatment before discharge;
- The required CMA reclamation area has efficiently used the minimum area necessary to accommodate the Project through developing innovative stormwater treatment methods that deliver high quality treatment in a smaller land area, and using boardwalks to provide public access instead of reclamation, and including cultural principles in the design;
- Creates a more naturalised shoreline, reflecting the original rocky volcanic shoreline of the area which existed prior to the historic reclamations. The Project will result in changes to the existing coastal edge, and this is assessed as achieving positive outcomes in the long term. The new graduated coastline on the northern shore of the Māngere Inlet with headlands designed to mirror the original rocky coastline, pebbled banks, and ecological enhancements that are proposed, will improve the existing coastal margin in the area;
- Maintains and enhances public access to and along the coast; and
- Incorporates landscape amenity features and planting to enhance the coastal edge.

Having regard to Policy 1:

- The Project has a range of significant regional and national benefits, as described in other parts of the AEE;
- A wide range of alternatives have been considered for the Project. Practicable alternative ways of providing for the activity are highly constrained as set out in the assessment of alternatives section of this AEE;
- As far as practicable, the new road is located landward of the existing coastal edge, whilst also avoiding key on-land constraints including the Neilson Street Interchange, Waikaraka Cemetery, and avoiding coastal features including Pikes Point remnant lava flow (which is also SEA-land). The reclamation has been designed to recreate natural character of the coastal environment, and the footprint has been minimised to what is necessary to make sense, from a landscape and visual perspective, and to achieve the environmental opportunities identified in partnership with Mana Whenua and Auckland Council. In short, where land is reasonably available, the new road is located on land;

- The proposed wetlands and stormwater treatment ponds need to be located at the lowest point in the catchment to function efficiently and effectively, and thus land availability to locate those ponds is constrained;
- The reclamation comprising new coastal landscape, headlands, wetlands and public access will result in the loss of intertidal habitat. However none of the species or assemblages that are within the proposed footprint of the reclamation are assessed as being rare or unique and the quality of the environment is assessed as being low-moderate in quality; and
- The Project will not have any significant effects on any identified Site of Significance to Mana Whenua and physical impacts on the Waikaraka Cemetery (a scheduled historic heritage extent of place) will be minimal.

The Project will achieve Policy F2.2.3(2) of the Plan as the reclamation is required to enable the construction and efficient operation of the transport network, will enhance public access and linkages to the CMA, will carry out rehabilitation works, including improving the stormwater network, and will create habitat in a degraded environment.

Objective 2 of F2.2.2 states that ecological values of the CMA should not be adversely affected by the reclamation.

Restoration and declamation

The Project will achieve Policy F2.2.3(4) through the incorporation of design features and development of a comprehensive and integrated mitigation package. This will respond to the loss of intertidal habitat including creation of new wetland habitat, new saltmarsh establishment on the eastern edge of the Māngere Inlet, rehabilitation of Ngarango Otainui Island (subject to landowner agreement) and creation of new coastal access and education measures that will allow people to better appreciate the significance of the birdlife in the Inlet. The Project also includes mitigation with the removal of an existing triple box culvert at the SH1 crossing of Ōtāhuhu Creek and declamation of areas around this crossing. This will achieve significant positive cultural benefits through the restoration of Ōtāhuhu portage, and through declamation and restoration of natural character.

The Project responds to policies F2.2.3 (5, 6, 7, 10 and 12) by undertaking the following: public access is provided and enhanced along the Māngere Inlet foreshore, in conjunction with some environmental enhancement such as improved water quality and wetland areas. The Project has been designed to accommodate the potential effects of climate change and has benefits of protecting land, including sea level rise. Contaminated materials will not be used in the reclamation area and the Project provides for the efficient operation of nationally significant and regionally significant infrastructure.

15.4.1.14 Depositing and disposal of material

Relevant Provisions: F2.3.2 Objectives and F2.3.3 Policies

The AUP (OP) seeks to manage the effects of the placement of sand, shell, shingle or other natural material in the CMA where the intended design purpose is associated with a beneficial end use. The Project involves the placement of new materials as part of the construction of the foreshore form, materials required for the reclamation and salt marsh area. The materials will not be contaminated and will not impinge navigational channels. The Project avoids the disposal of material in the D17 Historic Heritage Overlay or D21 Sites and Places of Significance to Mana Whenua Overlay. The depositing of materials, including for the salt marsh, will not contain contaminants resulting in adverse water quality, sediment quality or ecological effects. Similarly, the material to be deposited will not contain aquatic organisms deemed to be harmful to the Project works area. The sensitivity of the receiving environment with regards the deposition of material and its relationship with the receiving environments natural character and ecological values has been considered by the Project, through mimicking the natural headland shape and recognising and avoiding (where practicable) the locations of the most sensitive ecological areas within the Māngere Inlet. The Project provides for public use of the area and improves connectivity. Alternative deposition methods are not practicable, given the location of the Project.

Mitigation measures proposed to address adverse ecological effects in the marine environment involve creating new salt marsh habitat through depositing material.

15.4.1.15 Dredging

Relevant Provisions: F2.4.2 Objectives and F2.4.3 Policies

The dredging objectives and policies seek to enable dredging and to manage dredging activities to avoid, remedy and mitigate adverse effects on the environment. The Project is considered to be consistent with these provisions because careful site selection for potential dredging activities can minimise ecological effects, maximise the opportunity for the dredged area to re-establish once works are complete, and achieve positive environmental outcomes.

Specifically, dredging is proposed within the sub-tidal zone of the Māngere Inlet to source material for the construction of the Project (using mudcrete). This is consistent with the direction of the Plan because it can be undertaken with minimal adverse effects on coastal processes, and reduces traffic disruption on the transport network through use of imported materials. Positive environmental outcomes can be achieved including through removal of an area of invasive species (Asian date mussels) which have smothered most native organisms. The proposed dredging location is in the sub-tidal area, instead of the inter-tidal area.

Consent is being sought to enable dredging, but import of material may also be considered by the contractor.

15.4.1.16 Disturbance of the foreshore and seabed

Relevant Provisions: F2.5 disturbance of the foreshore and seabed and F2.7 Mangrove Management

These objectives and policies seek to enable use and development where the impacts are minor and short term and to avoid, remedy or mitigate adverse effects of activities that have long-term impacts on the CMA or more than minor level of disturbance. The Project will have short term and long term adverse effects on the CMA.

As discussed above, the area of disturbance (including reclamation) has been carefully considered, having regard to the potential long term benefits of the Project, as well as adverse effects arising as a direct result of constructing the Project. Overall, incorporating both its transport and broader environmental outcomes, the design has sought to optimise use of the CMA by locating road infrastructure partly on land and partly in the CMA along the modified coastal edge.

The Project will involve the removal of a substantial amount of mangroves along the northern foreshore of the Māngere Inlet. The mangroves are not identified in the AUP (OP) as having high ecological value and this is confirmed by the ecological assessment. The mangroves to be removed do not provide a significant contribution to the natural character of the area and mangroves do not provide a buffer against active erosion. Over time mangroves are likely to re-establish along the new coast line.

15.4.1.17 Vegetation management and Indigenous biological diversity

Relevant Provisions: Objectives D9.2 and Policies D9.3; Objectives E15.2 and Policies 15.3; Objectives F2.8 and Policies F2.9 (these are also Regional Plan provisions)

Objectives F2.8.2, F2.9.2 and policies F2.9.3 seek to control exotic species and manage planting in the CMA. Objectives E15.2 and policies E15.3 seek to protect and manage the effects on biodiversity values, sensitive environments and areas of contiguous indigenous vegetation. Objectives D9.2 and policies D9.3 seek to protect areas of significant indigenous biodiversity and manage effects of activities located within both Terrestrial and Marine SEAs.

These provisions seek, on the whole, to protect and better provide for the management of areas that contribute significantly to Auckland's biodiversity, recognising the importance of biodiversity for a healthy environment, and that development has resulted in the loss of habitats and a reduction of biodiversity. The Project has responded to and recognises the presence of SEAs within the corridor, both on land and within the CMA and the presence of threatened and endangered species.

The general approach to the policy framework is to:

- Avoid adverse effects, where practicable, on ecological values of SEAs otherwise remedy or mitigate adverse effects and then offset any significant residual effects;
- Enhance indigenous biodiversity values through restoration, protection and enhancement; and
- Avoid certain uses and effects in the coastal environment.

The provisions of the AUP (OP) (in particular, Policies 9 and 10 of E15.1) seek to give effect to the NZCPS Policy 11 and the analysis of that policy above is also relevant to the assessment against the AUP (OP).

Policies 9, 10 and 11 of D9.3 seek to:

- Avoid permanent use or occupation in the CMA and SEAs - Marine, alter its physical processes, or fragment values;
- Manage adverse effects on the SEAs Marine habitat, operation or ecological and physical processes, viability of regionally or nationally threatened plants or animals; and
- Avoid structures in SEA –M1 except where it is necessary for scientific research, navigation, habitat maintenance, benefits the regional and national community, including structures for significant infrastructure where there is no reasonable or practicable alternative location on land or elsewhere in the CMA outside the SEA –M1.

The Project will have significant effects on marine ecology through the permanent loss of intertidal mudflats along the northern Māngere Inlet from construction of the road embankment, landscape features and stormwater wetlands. This significant effect also applies to avifauna as a result of the permanent loss of vegetation and habitat in Anns Creek and the loss of foraging habitat in the Inlet. The loss of habitat at Anns Creek will put the Banded Rail and Bittern further at risk, especially if any works occur during breeding season.

The details of the nature and significance of effects are set out in *Technical Report 16: Ecological Impact Assessment* in Volume 3. The loss of intertidal feeding area is assessed as potentially having a high adverse effect. However, in the context of modifications that have occurred in the past to the Māngere Inlet, and the remaining Manukau Harbour intertidal areas, the area is small. Post construction, the rocky shoreline and wetlands will provide new habitat and mitigation is proposed in order to encourage quicker recolonisation of species (although this will not completely mitigate or offset the loss of foraging habitat). There may be displacement during construction of birds and fish (marine mammals are considered unlikely to be present), however these effects will be temporary and are not assessed as being significant. Opportunities to mitigate adverse ecological effects have been identified within the local area.

Exotic vegetation species will be removed from the coastal environment and replaced with planting sourced from the same ecological district. Landscape planting proposed for the new coastal edge is an integrated part of the design of the new rocky form, and is part of the mechanism to mitigate adverse effects on natural character and amenity. The new wetlands will appear as part of the new headland features and have some ecological function.

Notwithstanding the above, the design of the Project has sought to avoid directly affecting SEAs but this has not been practicable in three locations:

- There is no practicable alternative to locating the new eastern-most foreshore headland within the SEA-M2 along the northern foreshore of the Inlet, due to the need to locate at the bottom of the stormwater catchment where current discharge points are located, and to achieve an appropriately balanced foreshore form;

- There is no practicable alternative to constructing a bridge over the SEA-M1 in Anns Creek estuary because a land-based route would adversely impact on designated railway land (KiwiRail is the Requiring Authority) and planned future railway upgrade works that are provided for by this designation; and
- Alternative alignments within Anns Creek east would require substantial land acquisition from strategically located industrial land. This includes the Southdown Co-Generation site which has a Heavy Industry zoning, enjoys close proximity to the high pressure gas line, and has plans for future development. Taking into account those restrictions, the current alignment avoids as much as of the Anns Creek area as practicable, and proposes specific restrictions on use of ONF areas where the vegetation is of the highest quality and where remnant lava flows are present.

The adverse effects of the bridge structure over Anns Creek estuary will largely be temporary but even after mitigation there will be residual adverse effects on the intertidal foraging habitat and on unique vegetation.

However, Policies 8 and 11 of D9.3 specifically anticipate and address instances where the development of infrastructure is not able to practicably avoid all effects on a SEA. Policy 8 is a general policy which identifies that it is appropriate to locate some infrastructure within SEAs and specifically resolves the tension between parts of the RPS regarding natural heritage values and provision for infrastructure. Policy 11(d) is more specific and anticipates where structures are necessary to be located within SEA-M1 and have benefit to the regional and national community. This policy is particularly important in the context of the Project because there are strategic transport benefits delivered by the Project, and the area is very constrained for development meaning options are limited.

It is not practicable to completely avoid all effects on SEAs, and the Plan recognises this in the policy framework as it applies to infrastructure. The proposed ecological mitigation and offset strategy set out in *Part H: Management of Effects on the Environment* of this AEE has recommended a series of measures which will mitigate most adverse effects of the Project and enhance existing biodiversity values through the recreation of new habitat and better management of existing areas of habitat.

The vegetation management objectives and policies seek to allow for the removal of exotic species from within the coastal environment whilst minimising the adverse effects of their removal. The objectives and policies also recognise the benefit of planting in the CMA for enhancement and for coastal hazard mitigation, as well as seeking to avoid the introduction of exotics and promote the use of native plants from within the same ecological district. This Project will achieve these outcomes through the careful selection of species for new planting, in order to complement the unique range of vegetation already present, including unique species in and around Anns Creek that are coincident with the saline/freshwater environment and lava flows. A programme of pest management is also proposed.

Wherever practicable plants will be sourced from the same ecological district. The landscape planting proposed for the new coastal edge is an integrated part of the design of the new rocky form, and is part of the mechanism to mitigate adverse effects on natural character and amenity. The new wetlands will appear as part of new shoreline, and have some ecological function. Weed removal and weed management is a significant positive outcome this Project can deliver, particularly in the Anns Creek, and Ōtāhuhu Creek areas, as well as around the fringe of the Māngere Inlet within the project area.

In addition, the provisions will provide for the role of Mana Whenua as kaitiaki in managing biodiversity, and for cultural practices and cultural harvesting in significant ecological areas where the mauri of the resource is sustained. The Project has embedded the kaitiaki role in the integrated development of the Project design and through incorporating Mana Whenua views, taking a long term, holistic view of the environment and looking further into the future at a journey towards restoring the mauri of the Māngere Inlet.

The significance of the Ōtāhuhu portage has also been recognised through its proposed reopening with the replacement of the SH1 culverts. Specific consideration of the ability to view the portage is proposed with careful placement of noise barriers to provide for views from passing traffic, and for weed removal and plant clearance where practicable.

The Project responds to Policy 3 of D9.3 by controlling where possible plant and animal pests, revegetate areas using indigenous species sourced from the same ecology district, provides for Mana Whenua, kaitiaki and kaitiakitanga.

15.4.1.18 Taking, use and damming or diverting of coastal waters

Relevant Provisions: F10.2 Objective and F10.3 Policies

The Plan seeks to appropriately manage the effects of taking, use or diversion of coastal water while protecting environmental values. The Project, particularly during construction works, will require temporary taking, damming and diversion of coastal water. The objective of the Coastal Plan is achieved through long term outcomes delivering positive environmental benefits, and minimal impact on coastal processes as a result of the diversion of coastal waters.

15.4.1.19 Discharges, Water Quality and Integrated Management

Relevant Provisions: E1.2 Objective and E1.3 Policies, F2.11.2 Objective and F2.11.3 Policies

The objectives and policies relating to discharges seek to maintain water quality where it is good and progressively improve it over time in degraded areas and for discharges from stormwater networks, prevent or minimise adverse effects of contaminants on the coastal water quality. The provisions recognise that a key concern to Mana Whenua is the effects on the mauri of water caused by pollution of a stream, river, catchment or harbour.

The Project achieves these Coastal Plan objectives and policies because its development has arisen through integrated decision-making process with Mana Whenua and Auckland Council – to deliver on opportunities identified to improve the quality of discharges to the CMA from the stormwater network and historic landfill leachate discharges. The development of the Project has involved an integrated decision-making process, and will achieve an outcome of long term multi-agency responsibility (Auckland Council and Transport Agency) for the ongoing operation and maintenance of assets.

The Project provides a unique opportunity to deliver positive environmental outcomes, despite some permanent occupation and use of the CMA with better management of discharges and restoration of natural character. This represents part of a long term journey to achieving improvement in the environment of the Manukau Harbour and is part of a joint vision between Mana Whenua, Auckland Council and the Transport Agency that this Project can deliver.

15.4.1.20 Use, development and occupation in the CMA

Relevant Provisions: F2.14 Use, development and occupation objectives F2.14.2 and policies F2.14.3 , F2.16 Structures objectives F2.16.2 and policies F2.16.3, F2.18 Underwater noise

The objectives and policies in relation to the use, development and occupation in the CMA, seek to maintain the high public value of the coast and the CMA as open space area with free public access and to provide for occupation rights in appropriate locations and in appropriate circumstances for infrastructure that has an operational need to be located in the CMA. Policy 5 of F2.14.3 provides for infrastructure which has an operational need to occupy the CMA, particularly where it cannot be practicably located on land and avoids, remedies or mitigates other adverse effects on the existing use, character and value, public access, recreational use and amenity values, and water quality which are applicable to the Project.

The Project achieves these provisions by significantly improving quality of access to the CMA for the public.

Policy 6 of F2.16 requires structures to be located to avoid significant adverse effects and avoid, remedy or mitigate other adverse effects on the values of the following areas as relevant to the Project;

- D9 Significant Ecological Areas Overlay – Marine 1 and 2;
- D17 Historic Heritage Overlay;
- D21 Sites and Places of Significance to Mana Whenua Overlay; and
- D10 Outstanding Natural Features Overlay; and Outstanding Natural Landscapes Overlay.

The Project has responded to this policy by avoiding as far as practicable the following; D17 Historic Heritage Overlay, D21 Sites and Places of Significance to Mana Whenua Overlay and D10 Outstanding Natural Features Overlay and Outstanding Natural Landscapes Overlay. As explained above, there is no practicable alternative location for the Project outside of the D9 SEA-M1 and M2. As explained above, various alternative options have been considered and overall the Project has been assessed to be the most effective and efficient method of providing for the activity (refer assessment above – including reclamation). Whilst temporary occupation of the CMA is required to undertake construction, and access to the Manukau Foreshore Walkway will be restricted during this time, there are opportunities to provide alternative routes to enable people to continue to travel through and around the area during construction activities.

15.4.1.21 Other provisions

Additional relevant Coastal Plan provisions are found throughout the Plan as both Regional Coastal and Regional Plan provisions (and sometimes District Plan) and are considered as part of the assessments following.

15.4.2 AUP (OP) – Regional Plan

15.4.2.1 Infrastructure

Relevant Provisions: E26.2.1 Objectives and E26.2.2 Policies

The Plan states that infrastructure is critical to the social, economic, and cultural well-being of people and communities and the quality of the environment. The objectives and policies anticipate development, operation, use, repair, maintenance, upgrading and removal of infrastructure and acknowledge both the benefits infrastructure can have, as well as a range of adverse effects. Avoiding constraints on the operation of infrastructure arising from reverse sensitivity effects is recognised as essential. EWL achieves these objectives and policies by providing transport benefits including travel time savings, resilience and improved active transport modes and public transport. Supporting economic growth is a key outcome of the Project, through unlocking congested networks and supporting growth of business. The Project integrates road and rail freight transport by supporting the strategic use of the rail network into the inland ports at Southdown. There will be benefits to the Auckland regional economy and beyond, giving effect to key policies and there is a policy framework which specifically recognises and provides for infrastructure in sensitive areas where it delivers regional benefits.

It is recognised that there will be adverse effects on the environment, particularly the CMA. The policy framework recognises there is sometimes operational need for the chosen location. The combination of a new transport link realising the significant environmental opportunities of naturalising the Māngere Inlet foreshore, wider catchment stormwater and leachate capture and treatment, means the proposed location preferred to realise all these benefits.

The Project incorporates a wide range of mitigation for the potential adverse effects on people and communities, and includes, for example, permanent noise mitigation along the SH1 corridor adjacent to residential properties.

15.4.2.2 Mana Whenua

Relevant Provisions: D21, E20, E21

Sites and places of significance to Mana Whenua are recognised and provided for in the objectives and policies. The partnership approach that the Transport Agency has taken with Mana Whenua in developing the Project, means that Mana Whenua values are embedded in the Project giving effect to these provisions. The Project has sought to avoid destruction of sites of significance, and importantly, also gives priority to restoring and transforming valued areas. Restoring the Ōtāhuhu portage so that it can be traversed by people will go some way towards improving the values of this area, and the Māngere Inlet foreshore will benefit from multi-modal transport function, enhanced access to the CMA and improved discharge quality. Having involved Mana Whenua in design development and decision-making, has resulted in a unique transformational outcome for the social, cultural, and economic environment.

15.4.2.3 Natural Resources

Relevant Provisions: D9, E1, E2, E3, E4, E7, E8, E9, E10, E14, E15, E16, E17,

See also regional coastal plan assessment above.

The Project is located in a highly modified urban environment. The Project recognises the importance of managing impacts on air, land and water resources, and seeking opportunities to restore and enhance the environment. These issues are addressed in response to various objectives and policies already discussed in this section.

15.4.2.4 Natural Heritage

Relevant Provisions: D10

See regional coastal plan assessment above.

15.4.2.5 Land Disturbance

Relevant Provisions: Land disturbance provisions E11 and E12

Section E11 sets out regional objectives and policies for land disturbance and Section E12 sets out the district objectives and policies. The objectives and policies seek that land disturbance is undertaken in a manner that protects the safety of people and avoids, remedies and mitigates adverse effects on the environment. Large scale earthworks will be required Project wide. Having regard to these provisions, the earthworks will be undertaken using accepted industry practice, using a management plan framework to achieve good environmental outcomes, whilst allowing some contractor flexibility.

The Transport Agency has had an accidental discovery protocol in place for site investigations undertaken as part of the information gathering process. HNZPT authorities will be applied for in due course and these, in combination with the resource consent condition framework, will manage the process for if kōiwi, archaeological finds or artefacts of Māori origin are discovered.

15.4.2.6 Environmental Risk

Relevant Provisions: E13, E30, E31, E33, E36

The Plan seeks to manage the effects from contaminated land and hazardous substances, industrial and trade activities, natural hazards and flooding. Historic land contamination has been a key influence on the design solution chosen for the Māngere Inlet foreshore, achieving the relevant objectives and policies using a methodology that better manages discharges. Where practicable, soil disturbance is minimised and structures are proposed. Natural hazards have also informed design, with anticipated climate change levels being built into the design, and opportunity for flood hazard and sea level rise protection achieved for low lying land. Any adverse effects from disturbing the closed landfills along the Project will be appropriately mitigated to minimise any adverse changes to the groundwater regime, and to maintain and enhance the operation of the existing leachate interception system.

15.4.3 AUP (OP) – District Plan and Zoning

15.4.3.1 Port activity

Relevant Provisions: F5

The AUP (OP) zoning reflects the Operative Plan provision for the integrated and efficient operation and development of particular ports in the Auckland Region. The Port of Onehunga is identified in the Auckland Plan as part of critical infrastructure and plays an important role in the regional economy. The "Minor Port Zone" provides for the integrated and efficient operation and development of the Port of Onehunga. A wide range of land uses related to port activities are provided for as a permitted land use activity in this zone including general marine and port activities, related industrial activities, public amenities, some office uses, maritime passenger operations, and car parking. The existing land uses on the port include cement offloading and storage, fishing industry and some recreational uses. Over time, the activities using the port have changed in nature and character, and it is expected that change will continue as future uses for the area are planned.

The EWL Project provides for the continued efficient use of the Port of Onehunga and seeks to accommodate opportunities for future development, and improves connections into and out of the site. The Project supports varied transport modes including walking and cycling connectivity, and linkages to the wider region and thereby supports the Port of Onehunga current and future use both as a port and for other possible activities into the future.

15.4.3.2 Business activity

Relevant Provisions: H8, H9, H10, H11, H12, H13, H14, H15, H16, H17

The AUP (OP) zoning patterns in the Project area broadly reflect those in the operative plans seeking to maintain the Onehunga-Penrose area as a light and heavy industrial area. A key reason for the Project is to support the continued use and growth of this industrial hub and employment area (as set out in Part A of this AEE). The importance of the area and maintaining the integrity of the industrial zoning is reflected in the planning provisions whereby certain more sensitive land uses such as residential dwellings are prohibited activities. The plan also seeks to discourage activities such as retail, seeking to maintain the ability for important manufacturing, and increasingly, logistics and distribution activities, to remain in this area. The road-rail interface is a critical part of the importance of the area, providing access to the rail network which is used for freight. The Port of Tauranga to Auckland rail/road route is well used as a method for getting goods from the port into the Auckland and Northland markets. EWL will support the continued growth and development of these commercial and industrial activities by improving access into and out of the area.

The AUP (OP) zoning provides for the Onehunga Town Centre to be maintained as a local centre surrounded by light commercial/business land uses, and higher residential densities provided for in the area to the north. Sylvia Park is also an identified Town Centre in the AUP (OP) zones. The Project supports the town centre zonings within the Project area, by enhancing access to the business areas, supporting the growth of access by people through active transport modes (walking and cycling) and bus travel time reliability, and access to and along the coast. Connectivity for people into and through the area will be improved, supporting these land use zone patterns.

15.4.3.3 Residential activity

Relevant Provisions: H3, H4, H5, H6

Parts of Onehunga have been targeted for higher density residential zoning. Ōtāhuhu residential areas have been targeted as potential areas for future residential intensification, with new medium to higher density residential zones proposed on the eastern side of SH1. The Project supports future intensification through providing for improved transport linkages for people in residential areas, and this is particularly important in the Princes Street East area where access across SH1 is congested, constrained and would benefit from safer pedestrian and cycle provision. The Project removes congestion from local roads and will have a positive effect on residential amenity. The Project therefore gives effect to the residential provisions of the Plan.

15.4.3.4 Open Space and Community Facilities

Relevant Provisions: H7, H24, H26, H27,

The Project generally avoids direct impact on open space and community facilities, with the exception of minor works around the boundary of Waikaraka Park and Gloucester Reserve, and temporary construction works in a future Waikaraka Park development area. Improved open space and recreation facilities will be a key outcome from EWL including improving walking and cycling facilities, enhanced legibility of natural features along the foreshore and in Anns Creek, new local access across Ōtāhuhu Creek, access along the Māngere Inlet foreshore and towards Onehunga Mall and Sylvia Park Town Centre.

15.4.3.5 Transport corridors

Relevant Provisions: includes E27

Chapter E27 provisions are District Pan matters. The provisions in Chapter E26 support and manage the effects on the operation and development of an integrated transport network and set out specific methods to manage matters including parking and access. Land use and transport integration is recognised as important and EWL has been developed specifically to support the land use plans of Auckland. The Project will also support increased cycling and walking by providing well-designed walking and cycling facilities for a range of users. Commuter lanes are provided in addition to new recreational paths adjacent to and over the coastal edge.

In addition to objectives and policies, the district planning maps also identify particular constraints for development including designations. Existing designations have influenced the alignment of the Project. For example, the existing KiwiRail designations at Southdown (shown earlier in Figure 6-9) depict a large area of land that KiwiRail has aspirations for developing in the future. The Project will support the use of this designation through improving access to and from the rail head.

15.4.3.6 Lighting, Noise and Vibration

Relevant Provisions: E24, E25

The Plan seeks to control effects from lighting and noise so as to avoid causing nuisance to people and the environment, and conversely, to provide for a safe and healthy environment for people. The Project achieves these provisions through application of appropriate standards and controls.

15.4.3.7 Other

Some district plan matters have previously been addressed in the above provisions where they are both a regional and district plan matter. For example, Historic Heritage Overlay and Significant Ecological Areas Overlay. The Historic Heritage provisions are considered further here as directly relevant to the effects of the proposed work covered by the NoR.

Relevant provisions: Objectives D17.2 and Policies D17.3(3-7), D17.3(24-26)

The Project will have an effects on, and will change, the outlook and surrounds of the Aotea Sea Scouts Hall. The building itself will remain unchanged and the fabric of the building is not expected to be directly affected. The building will be able to remain in its current location, and thus it relationship to the coastal marine area will not change. The scouting land use includes accessing Gloucester Park for various activities (such as tent pitching), will be affected during construction and an alternative area will need to be provided for these activities. For these reasons, the Project is assessed as being generally consistent with these provisions.

15.4.3.8 Legacy plans

As discussed above, it is considered that the AUP (OP) generally carries greater weight than the legacy regional and district plans given the progress it has made towards becoming operative. An assessment of weighting is made based on the nature of the appeals.

Although parts of the Regional Policy Statement from the AUP (OP) have been made operative, for completeness and in light of the extant appeals, the RPS 1999 has also been assessed.

15.4.4 Regional Policy Statement

In the Introduction, the RPS sets out how diverse the natural environment of the Auckland Region is, with a long coastline, bush, volcanic cones, and its harbours. The Auckland Region also has significant physical resources which include the urban areas, extensive infrastructure, including transport and utilities infrastructure, and a large industrial base. The RPS recognises the need to consider all these elements to achieve sustainable management.

15.4.4.1 Issues

Issues of relevance are set out in Chapter 2.4. These issues demonstrate that there are some similar challenges recognised in the RPS from 1999 as are being experienced at present and are covered in the AUP (OP). Of note is the consistent themes recognising the importance of the integration of the transportation system and land use and development.

15.4.4.2 Objectives and Policies

The relevant RPS Strategic Objectives are set out in 2.6.1 and Strategic Policies in (for example) 2.6.2, 2.6.5, 2.6.8, 2.6.11 and 2.6.14. These set out how the policies and methods will achieve the integrated management of the natural and physical resources of the whole Region. Strategic policies for land use and transport integration (for example Policy 2.6.11) and infrastructure (for example Policy 2.6.14) recognise the importance of transport infrastructure to support growth and economic development and integrate with urban form and land use development over time. The Project has a key function of supporting industrial and commercial land use and economic growth and development which achieves these provisions.

Other relevant chapters include:

- Chapter 3 is about Matters of Significance to Iwi. EWL achieves these provisions through involving mana whenua as a project partner in resource management processes. This includes through practical recognition of kaitiakitanga in recognising a long term vision for restoration of the Māngere Inlet and the Ōtāhuhu portage, improvement in discharge water quality and access to the coastal marine area.
- Chapter 4 is about transport, which is recognised as a significant physical resource for the Auckland region. The RPS recognises that the pattern of development in Auckland has been heavily influenced by the transport system, including the low density urban form, and the RPS recognises that this is not sustainable in the long term, promoting compact sustainable urban form. These themes are consistent in the AUP (OP), albeit with a new focus on a more compact city. The Project supports the transport objectives and policies of the RPS which recognise the importance of enhancing

accessibility, and improving efficiency of road and rail transport networks for goods, services and people, whilst also managing effects on the environment.

- Chapter 6 addresses heritage, and includes Proposed Plan Change 8 relating to volcanic features. The RPS recognises that the heritage of the region is under threat, and considers both built and natural heritage including landscape, geological features and outstanding natural features. These are consistent themes as with those set out in the NZCPS and AUP (OP). As discussed above, the Project will achieve these objectives and policies through identifying heritage and notable characteristics, and specifying measures to avoid, remedy and mitigate adverse effects, at the same time as enhancing legibility and knowledge (with regard to 6.4.19 and 6.4.22) of the built and natural heritage of the area. Evaluation and knowledge (of heritage), along with restoration are key tenets of the EWL, consistent with (for example) 6.4.10, 6,4,13 and 6.4.16.
- Chapter 7 sets out the framework for management of the coastal environment recognising that it is complex and diverse and includes areas that are highly modified. The RPS recognises the importance of the coastal environment to mana whenua. The EWL achieves the objectives and policies of the RPS for the coastal environment through (and as discussed earlier) recognising a diverse range of values, balancing and managing adverse effects, enhancing natural character, improving water quality discharges and enhancing connectivity to and access along a higher amenity coastline. The RPS also encourages integrated management (for example 7.4.25) and EWL has demonstrated a high level of integration with mana whenua, Auckland Council and the Transport Agency working together to achieve outcomes.
- Chapter 8 is about water quality and recognises that there are parts of the region with degraded water quality, including from discharge of contaminants, and seeks opportunities to achieve improvements. The Project achieves these objectives and policies through the integrated approach with Auckland Council to better managing legacy stormwater and leachate issues.
- Chapter 9 relates to water conservation and allocation. The Project achieves these objectives through the management of groundwater in the vicinity of the site and seeking to avoid adverse effects on groundwater.
- Chapter 10 relates to air quality and recognises that vehicle emissions are a significant contributor to air quality in the region. The Project responds to the policy framework with some air quality improvements arising through reducing traffic congestion on local roads.
- Chapter 11 relates to natural hazards. The Project achieves these provisions through recognising and accommodating climate change considerations within the design of the Project.
- Chapter 14 relates to pests and pest management. The Project incorporates a strong focus on pest management including proposals for weed management and restoration around parts of the coastal edge and within the CMA.

EWL is assessed as achieving an appropriate balance between these issues.

15.4.5 Operative Regional Plan – Coastal

There is an appeal to the AUP (OP) on coastal matters, and the AUP (OP) has not had approval from the Minister of Conservation (a requirement before it can become fully operative), and therefore the Coastal Plan remains relevant for consideration. The Coastal Plan has themes consistent with both the NZCPS and the coastal parts of the AUP (OP) – refer to the assessments above. Having regard to the Coastal Plan, the following points are noted:

- The Coastal Plan recognises parts of Anns Creek as a Coastal Protection Area 1 (CPA1), being an area of regional, national or international significance, specifically related to wading bird habitat. Chapters 2.9, 5.3 and 5.4 seek to protect and preserve these areas from inappropriate subdivision, use and development that will have more than minor adverse effects, while recognising that activities and structures will continue to exist in the these areas. In particular, Chapter 12.4.7 recognises that structures may be appropriate in a CPA1 where they are of benefit to the regional or national community and there are no reasonable or practicable alternatives for their location.

- The Coastal Plan also recognises the entire Manukau Harbour and the 'Māngere Mount Foreshore (including Pahoehoe Lava Flow)' as Areas of Significant Conservation Value (schedule references 7 and 59, respectively). These areas have been identified by DOC for their biodiversity or ecosystem values, significant geological features and/or cultural or historic significance. Where these areas occur outside a CPA1 or 2, they are managed by the general rules of the Coastal Plan.
- The Plan recognises the importance of the coastal environment including that it is a finite resource (for example 10.2.2) and that inappropriate subdivision, use and development is generally to be avoided. Whilst the EWL does require works in the CMA, the Project will also deliver positive outcomes that would otherwise not be able to be achieved. The Plan (for example at 10.4.5) sets out guidance for where appropriate development may occur, and the EWL has been assessed as being appropriate.
- Efficient use of the coastal environment is a consistent theme in the Coastal Plan (e.g. 11.3) and the other statutory documents. The Project, having been development as an integrated solution for this area delivering social, economic and environmental benefits, as well as delivering Auckland Council and Transport Agency responsibilities together, whilst achieving positive transport outcomes, is assessed as being an efficient outcome.
- Whilst the Coastal Plan, similar to the NZCPS and AUP (OP), sets a strong test for activities requiring reclamation of the CMA, reclamation has been assessed as being an appropriate use of the CMA (refer to earlier assessments in this section under the NZCPS and AUP (OP)).

15.4.6 Operative Regional Plans – Air, Land and Water

There are appeals on air quality matters on the AUP (OP) on natural resources matters, and therefore the ALW Plan remains relevant for consideration. The Plan has consistent themes with the AUP (OP) (refer assessment above). Having regard to these, the following points are noted:

- The Plan promotes maintaining and enhancing the quality of the environment, including air and water quality (e.g. Objectives 2.1.3.1, 5.3.1) and minimising the discharge of contaminants to the marine environment, which the EWL will achieve as discussed in the above analysis. The Project specifically seeks to address both transport improvements, and environmental outcomes in an integrated manner.
- Preserving natural character of wetlands and protecting indigenous vegetation and fauna (e.g. Objectives 2.1.3.2 and 2.1.3.3 and Policies 2.1.4.1, 2.1.4.6 and 2.1.4.8) is a key outcome that the EWL achieves. Whilst there are adverse effects identified, there are important opportunities to also achieve positive outcomes, consistent with the policy framework.
- Much of the Onehunga-Penrose industrial area is classified as an Industrial Air Quality Management Area which denotes a lower level of air quality amenity consistent with the heavier industrial zoning. This recognises that there are a number of activities present that lower air quality amenity, and that are better provided for in specified areas, whilst limiting the ability of more sensitive land uses from establishing in those areas.

Overall, the EWL is assessed as being generally aligned with the ALW Plan.

15.4.7 Auckland District Plan: Isthmus Section

There are broad appeals to the AUP (OP) on zoning, largely in relation to residential zones and density, and therefore the Isthmus Plan remains relevant for consideration, particularly in relation to residential matters. The Onehunga-Penrose area to the north and east of the Māngere Inlet is generally zoned for heavy industrial purposes. The area around the Princes Street Interchange and along SH1 to the north is zoned residential. The AUP (OP) retains the heavy industrial zoning and for the most part, up-zones (i.e. proposes greater intensity) in these residential areas, as well as around the Onehunga and Sylvia Park centres.

The Project supports the continued use of these areas for these industrial land uses. It will support these land use patterns through improving accessibility and connectivity for the industrial areas, whilst also improving amenity for residential areas through reducing freight trips through and around these local areas.

15.5 Section 104D assessment

15.5.1 Section 104D

As noted in Section 5.0 of this AEE, some activities for which consent is required are non-complying activities. The Project overall is therefore assessed as a non-complying activity. As noted in Section 104D sets out the “gateway tests” for non-complying activities that must be passed before the application is considered under section 104 of the RMA. Section 104D provides that a consent authority may grant a resource consent for non-complying activities only if it is satisfied that either (a) the adverse effects of the activity on the environment will be minor or (b) the application will not be contrary to the relevant objectives and policies in the operative and proposed plan. The Project has been assessed as having potentially significant adverse effects on the environment, and therefore the Project cannot pass the “effects gateway test” under Section 104D(1)(a) of the RMA. Therefore to be further considered, the Project must pass the second gateway test under Section 104D(1)(b) to not be contrary to the relevant objectives and policies.

The relevant rules that trigger a non-complying activity status for the activity are in the AUP (OP) Regional Plan and Regional Coastal Plan, and the Operative ARP: C. The activities requiring non-complying resource consents under the Regional Coastal Plan include the reclamation provisions, and activities within significant ecological areas and outstanding natural features. Regional activities with a non-complying activity status include works in streambeds and reclamation of stream beds. Since the applications are “bundled” the consent applications are, overall, treated as non-complying. Thus, the complete Regional Plan and Regional Coastal Plan policy framework (AUP (OP) and relevant Operative Plan) requires consideration under Section 104D(1)(b).

This involves a balanced assessment of the objectives and policies of the relevant statutory plan objectives and policies as a whole. That assessment should identify the most relevant objectives and policies, followed by an assessment of those provisions which are more broadly relevant, and consideration of whether the Project is “contrary” to the objectives and policies, as in “opposed in nature, different to or opposite to”. An activity does not need to be consistent with every policy. Case law has acknowledged that for a non-complying activity it is expected that the activity will not meet every objective or policy.

The Project will provide significant regional and national benefits, by supporting an established community and business/industrial area in the Onehunga-Penrose area through improved connections for freight transport. This has an important impact on wellbeing, by improving productivity and securing the importance of this area as a major employment hub for Auckland. It also makes efficient use of existing transport networks, linking into the existing State highways and major arterials in this area, and improving access to the rail network, consistent with provisions in E26.2 of the AUP (OP). Improvements to walking and cycling linkages, and public transport will enhance accessibility for people using the area for commuting trips, as well as recreational opportunities, consistent with provisions E26.2 of the AUP (OP). The residential and business zones of the AUP (OP) seek to accommodate significant population and employment growth over the next 30 years (projected medium population growth of 700,000 and high population growth of one million people for Auckland over the next 30 years).

The Transport Agency has partnered with Mana Whenua in selecting the preferred alignment, and in developing the Project as described earlier in this AEE. This has enabled an inter-generational holistic view of the environment to be incorporated in the design. In this instance, environmental benefits achieved by this Project achieve improvement of the amenity and quality of the coastal environment and enables Mana Whenua status as kaitiaki, (for example, F2.2.2(3) of the AUP (OP) and 6.3 and 6.4 of the Operative Coastal Plan). This approach is consistent with the Treaty obligations with the Transport Agency’s role representing the Crown and as set out in the planning documents.

The statutory planning documents give effect to the overarching principles set out in Part 2 of the Act, and include maintaining and enhancing the natural character of the coastal environment (for example E18 of the AUP (OP) and 3.3 and 3.4 of the Operative Coastal Plan), its ecological values, water quality and public access (consistent with 7.3 and 7.4 of the Operative Coastal Plan) – as well as enabling people and communities to provide for their social, economic, and cultural well-being and for their health and safety. The statutory planning documents acknowledge both the importance of protecting the environment, whilst allowing for growth to occur.

Overall, the assessment demonstrates that there will be adverse effects on natural character of the coastal environment in the short term, and some significant adverse effects on the coastal environment and ecological resources. Importantly both E15 and F2 of the AUP (OP) contemplate that infrastructure cannot always avoid locating in important ecological areas and so some level of effects is contemplated.

In the longer term, effects will be positive, through naturalisation of the foreshore, new habitats and reconnection of people to the coast, as well as natural resources improvements (discharge water quality) consistent with provisions in E18 of the AUP (OP). Long term, coastal processes are expected to reach an equilibrium over time such that natural channels and flows are maintained (consistent with, for example, 5.3 and 5.4 of the Operative Coastal Plan). The approach is also consistent with the Mana Whenua approach expressed in relation to whole environment (for example, F2.2.2(3) of the AUP (OP) and 6.3 and 6.4 of the Operative Coastal Plan), and demonstrates that the Project is not contrary to the overall direction of the planning documents.

Reclamation is generally discouraged, however the planning documents recognise that in some instances reclamation can be appropriate (for example F2.2.3(1) and F2.2.3(2) of the AUP (OP) and 13.3 and 13.4 of the Operative Coastal Plan). The project is assessed as not contrary to these provisions because the Project meets the criteria within F2.2.3(1) and will be designed to be consistent with F2.2.3(2). In general the Project represents a balanced approach between adverse and positive outcomes that can be achieved with the reclamation and associated activities in the longer term, including rehabilitating degraded environments, enhancing public access and encouraging indigenous species to establish, as against loss of intertidal habitats and associated adverse ecological effects.

Along with natural character, maintaining and enhancing access to the coast is an important focus of the planning documents. Whilst there will be some restrictions on public access during construction, including the foreshore walkway, the Project will, in the long term, provide for more direct and higher amenity public access to the coastal environment and CMA by opening up opportunities for walking, cycling and recreation. This is consistent with provisions in (for example) F2.2 of the AUP (OP).

Efficient use of resources, including efficient use of the CMA is also an overarching theme (for example 11.3 and 11.4 of the Operative Coastal Plan), including use of the environment for structures and making sure they are able to be used for multiple purposes and/or for public use (for example 12.2 and 12.3 of the Operative Coastal Plan). The EWL provides multiple opportunities for enhanced access to the coastal environment, and no structures are proposed that would reduce or inhibit public access.

In summary, the Regional Plan and Regional Coastal Plan (both AUP (OP) and the operative plans) specifically recognise the importance of transport infrastructure, protect certain resources and values and generally seek a balance with social, cultural, environmental and economic outcomes. Having regard to all the relevant provisions, it is concluded that the Project will not be contrary to the objectives and policies of these, when these objectives and policies are considered as a whole.

15.6 National Environmental Standards

NES set rule frameworks that are applicable to the whole country and must be given regard to through consideration of applications for resource consents. They are not relevant to the assessment of the NoRs.

15.6.1 National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health 2011

As land disturbance is proposed on contaminated land, the NES Soil is relevant to the assessment of the Project. The NES Soil has a particular focus on human health. There are other provisions in regional planning documents that have a wider remit, including environmental health. *Technical Report 17 - Contaminated Land Assessment* in Volume 3 identifies a number of contaminated sites in the Project area and catchments, which is indicative of the long history of land use and development in the area. Due to the potential level of contamination and the volume of soil disturbance proposed, the permitted activity thresholds are exceeded and resource consent is required. A CLMP forming part of the CEMP will be developed to manage risk and uncertainty relating to contamination along the Project so that adverse effects on human health and receiving environment do not occur. A draft of the CLMP is included in *Technical Report 17 - Contaminated Land Assessment*.

15.6.2 National Environmental Standards for Air Quality 2004

It is the responsibility of Auckland Council to manage air quality and to comply with the Regional Air Quality targets for their airshed(s). No specific consents relating to this standard are required, though the relevant regulations in the NESAQ have informed the assessment of construction and operational air quality effects and proposed measures to manage effects included in *Technical Report 9: Air Quality Assessment* in Volume 3.

15.6.3 National Environmental Standard: Electricity Transmission Activities 2009

The NESETA contains regulations relating to the relocation of existing transmission lines. The Project will require the relocation/alteration of existing transmission towers and lines. Any work on the existing transmission towers and lines will be undertaken in liaison with Transpower and subject to their agreement in accordance with the provisions of the NESETA. Transpower-specific conditions will be included that will address any actual and potential effects on Transpower assets, particularly during construction.

15.6.4 National Environmental Standards for Sources of Human Drinking Water 2007

This NES requires regional councils to ensure that effects on drinking water sources are considered in decisions on resource consents and regional plans. No consents relating to this standard are required. Watercare's Onehunga groundwater supply is located in the vicinity of the Project. The potential effects of the Project on Auckland's groundwater resources that are used for water supply are addressed in *Technical Report 13: Groundwater Assessment* in Volume 3. The assessment concludes that there will be no adverse effect on potable water supplies.

15.7 Additional statutory consideration relevant to designations

15.7.1 Adequate consideration of alternatives

The following section responds to Section 171(1)(b)

Section 171(1(b) requires the Board of Inquiry to have regard to whether adequate consideration has been given to alternative sites, routes and methods for undertaking the work when considering a NoR if either:

(a) the requiring authority does not have an interest in the land sufficient for undertaking the work;

or

(b) the work is likely to have a significant adverse effect on the environment.

The section only requires that a requiring authority give adequate consideration to alternatives. A decision maker is entitled to review the process and ensure that it not arbitrary or cursory. A clear and logical process for consideration of alternatives is appropriate in order to determine adequacy. The Act does not require the best or the most preferred option to be selected. The choice of site, method and route remains the Transport Agency's. A suitable range of alternatives should be considered and the requiring authority is not required to consider every feasible alternative. The process followed for EWL is set out in *Section 8.0: Consideration of alternatives* of this AEE.

The process of consideration of alternatives involved an extensive option evaluation process to arrive first at a preferred corridor and then Preferred Alignment within the Preferred Corridor. The assessment process included consideration of meeting operational (transport) needs, potential environmental constraints, and the social, cultural and economic environment in which the area is located. The process was robust, comprehensive and iterative. It involved significant engagement and assessment of options by relevant independent experts. A wide range of factors needed to be considered. The assessment of alternatives section of this AEE sets out the process. The assessment of alternatives clearly meets the relevant statutory tests.

15.7.2 Reasonably necessary to achieve objectives

The following section responds to Section 171(1)(c)

Section 171(1)(c) of the RMA provides that when considering a NoR the Board of Inquiry must have particular regard to - *whether the work and designation are reasonably necessary for achieving the objectives of the requiring authority for which the designation is sought.*

It is important to understand the interpretation of the words "reasonably necessary" in RMA terms. The context in which s171(1)(c) is to be interpreted is that 'reasonably necessary' indicates something less than absolute necessity or being essential is contemplated. It is important to acknowledge that a requiring authority may set its own priorities to establish its network, achieve its objectives or meet its obligations to implement a wider network, provided it does not predetermine the outcome of the alternatives assessment.

The Project objectives are set out in *Section 3.3: The Project objectives for East West Link* of this AEE and the NoRs.

The Project is assessed as being necessary to achieve the objectives of the requiring authority for the reasons below.

15.7.3 Necessity of project to achieve the objectives

The existing road network is heavily congested and that congestion is having negative impacts on the performance of the transport network, the operation of businesses and the general economic potential of the area. The Traffic and Transportation chapter of this AEE demonstrates that an additional link and connections between SH1 and SH20 will improve travel times and travel time reliability, as well as improve network resilience. There is future growth projected for Auckland and therefore demand for freight transport, industrial and commercial land, employment opportunities and more capacity in the transport network generally, needs to be provided for. The area is uniquely located at the road/rail interface (as set out in *Report 3: Economic Assessment* in Volume 3), meaning the Project enhances the access to this important freight hub and improves the efficiency of both the road and rail network in the upper North Island.

The additional demand for transport networks and access to transport facilities cannot be met solely by public transport. Population growth will also increase demand for recreational facilities such as walking and cycling opportunities.

The Project is therefore reasonably necessary to meet the Project objectives.

15.7.3.1 Necessity of designation as a method to achieve objectives

The designation mechanism under the RMA is reasonably necessary to achieve the Transport Agency's objectives. The designation, if confirmed will protect the land from other development, provide certainty that the Project can be constructed, operated and maintained, and provide certainty to the community as to the nature of the work and its location through inclusion in the AUP (OP). The Transport Agency has proposed a designation lapse period (pursuant to section 184 of the RMA) of 15 years. The reason for 15 years is to allow enough time for staging of construction of the Project. Alternative "consenting" methods (instead of designation) were also considered, including land use consents. Whilst a number of regional resource consents, including coastal permits are still required to authorise the Project, the designation remains a mechanism that is well understood for linear transport projects which cross multiple zones, and, with the Outline Plan process provides a mechanism for ongoing engagement on design development.

15.8 Other Matters

This section responds to Sections 171(1)(d) and 104(1)(c).

Other matters that are considered to be directly relevant to have regard to – or particular regard to in the case of a NoR – in consideration of the Project are discussed below. As stated above, case-by-case consideration of what other matters are relevant, is made by the consent authority considering resource consents and NoRs. As (generally) non-RMA planning documents, these "other matters" have been selected as being particularly relevant for a range of reasons including:

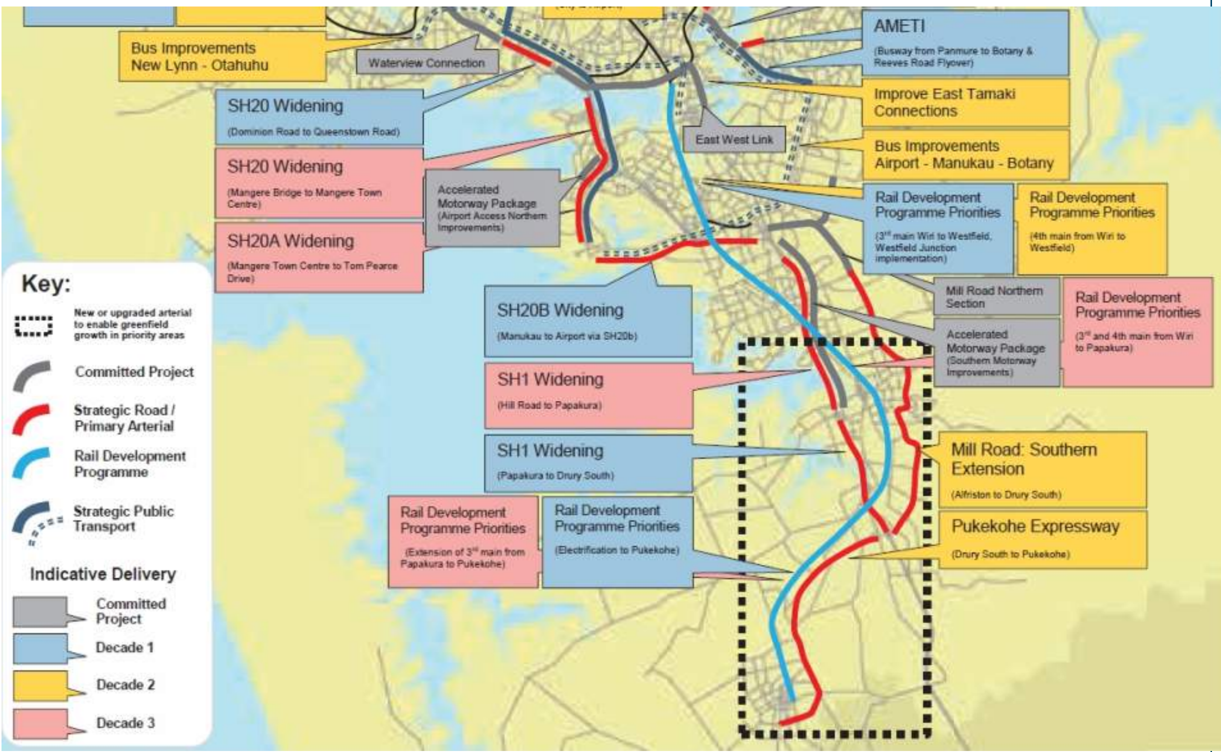
- Having been through a public engagement process where feedback from the public has been sought;
- Prepared in accordance with other related legislation;
- Specifically mention the East West Link project; or
- Are directly related to the objectives the Project is seeking to achieve (refer to *Section 3.0: Project Development* of this AEE).

Table 15-2: Any Other Matters

Matter	Discussion
Mana Whenua	
As part of the development of the Project, all relevant iwi groups which have shown interest in the Project have been closely involved and provided input to the final design. In addition, regard has been given to iwi management plans which have been made available to the Project team. These are discussed below.	
Ngāti Whātua Ōrākei Iwi Management Plan 2012	The intent of this Iwi Management Plan is to illuminate the issues of importance to Ngāti Whātua Ōrākei, provide a consistent approach for involvement/consultation in projects and to educate and form effective partnerships with key stakeholders. The objectives and policies contained within the Plan vary from place to place, but as a whole Ngāti Whātua Ōrākei is interested in any aspect of a project which may affect their tribal area. EWL is within that area. Ngāti Whātua representatives have been part of the engagement on the Project.
Ngāti Whātua Ōrākei Strategic Plan 2010-2020	This document sets out the strategic priorities of Ngāti Whātua Ōrākei and the actions which will be taken. Of note, one of the plans actions is centred on Whenua which includes Kaitiakitanga and political influence. This relates to influencing Council documents and influencing decision making over their area. Ngāti Whātua Ōrākei has been heavily involved in this project and have been provided with the opportunity to work alongside the Transport Agency in the development of the Project.

Matter	Discussion
Environmental Strategy	
A Vision for the Māngere Inlet	This Vision for the Māngere Inlet has been jointly prepared by Mana Whenua, the Transport Agency, Auckland Council, Auckland Transport, KiwiRail, and Watercare to provide a joint and long term focus on improving the health of the Māngere Inlet. The Project is entirely consistent with this strategy, being a first step on a path towards restoring the Inlet.
Transport Planning matters	
Government Policy Statement on Land Transport Funding 2015/2016 – 2024/2025	The Government Policy Statement on Land Transport Funding looks to provide funding for land transport systems which are effective, efficient, safe and in the public's interest regarding economic, social, cultural and environmental wellbeing. The Government Policy Statement on Land Transport Funding acknowledges the projected population growth within Auckland and the need for continual land transport improvements. The Project will create a more effective and efficient roading network which will reduce congestion and provide for future growth within Auckland.
Thirty Year New Zealand Infrastructure Plan 2015	The Thirty Year New Zealand Infrastructure Plan looks to advance the debate of long-term provisions, make changes to the current approach to planning and management and to encourage investment in New Zealand's infrastructure. In regards to Auckland, the Plan notes that challenges exist around projected population growth with $18.7 billion expected to be spent on infrastructure between 2015 and 2025. EWL forms a large part of this spending and falls within the scope of this plan.
Auckland Transport Alignment Project	ATAP is a joint project involving Auckland Council, the Ministry of Transport, Auckland Transport, the Transport Agency, the Treasury and the State Services Commission. The final report was released in October 2016 and recommends an aligned strategic approach, including an indicative package of transport investment, for the next 30 years. The EWL project is specifically planned for as a committed project in ATAP as shown in the following diagram (grey boxes are committed projects).

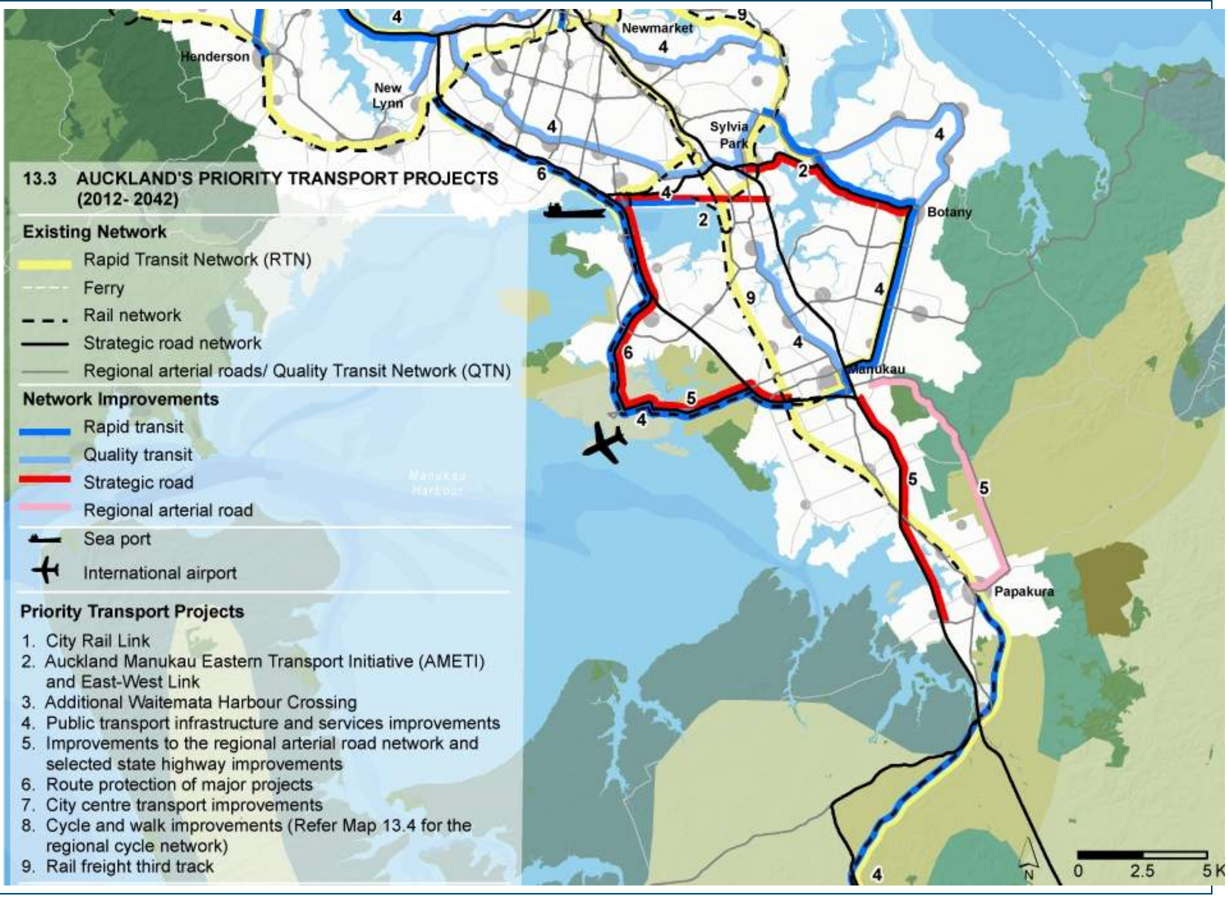
Matter	Discussion



Connecting New Zealand 2011	Connecting New Zealand summarises for stakeholders the Government's broad policy direction for the transport sector between 2011 and 2021. In regards to freight movements, the documents notes that there is a large increase in freight movements expected therefore connections between key export areas need to be established. The EWL is aimed at creating more efficient freight movements between industrial areas located within Auckland and the wider New Zealand.
NZ Transport Agency Statement of intent 2015-2019	This document sets the Transport Agency statement of intent and what is hoped to be achieved in terms of transport infrastructure over the next few decades. The integration of transport networks, improving the efficiency, safety and resilience of transport options open to New Zealanders, and to maximise returns on all transport investments. The Project forms part of the Accelerated Auckland Transport Programme which is focused around bringing forward a package of infrastructure works which will provide congestion relief, support economic growth and improve safety outcomes for Auckland and wider New Zealand.
Draft State Highway Activity Management Plan 2015-2018	This Management Plan sets out the rationale for investment in and activities on the State highway network. The outputs that the Transport Agency hopes to achieve from 2014 moving forward is planning the land transport network, providing access to and providing the use of land transport systems, managing the State Highway Network and investing in land transport. This is relevant to the Project as it forms a significant part of the Transport Agency's funding and it will work to achieve the goals set out under this management plan.

Matter	Discussion
The Upper North Island Freight Strategy 2013	This document predicts that freight movements within the upper North Island will more than double by 2035. This will have a major impact on Auckland as the region is home to a number of key exporting destinations. The critical issues to freight movements are outlined as: • Strategic road and rail network constraints; • Delivery on the high productivity motor vehicle programme; • Utilisation of industrial land; • Lack of strategic, integrated land use and transport planning and investment; • Lack of shared and accurate data; • Need to understand costs of freight supply chains for critical industries in the upper North Island; and • Challenging local government and central government funding structures. Overall, the resolution of these issues, which the Project plays a major part in, will lead to an improvement in freight efficiency and will promote economic growth and productivity ensuring New Zealand has a prosperous future.
Auckland Regional Land Transport Strategy 2010 – 2040	The RLTS is a statutory document prepared under the Land Transport Management Act. It is prepared every six years and covers a period of at least 30 years, enabling Auckland Council to provide guidance on the land transport outcomes sought by the region.
Regional Land Transport Strategy 2015-2018	This strategy was prepared by Auckland's transport delivery agencies and sets out an investment programme for Auckland in order to provide continual transport improvements to the extent possible with current funding constraints. This strategy includes all forms of transport including road, cycling and walking. Specific mention is made of the Project under section 4.8.2 as an improvement project of inter-regional significance.
Auckland Regional Road Safety Plan 2009-2012	This plan aims to have no deaths or serious injuries suffered on Auckland's transport system by law abiding road users and a 3% decline in the number of casualties per 10,000 people per kilometre travelled. The Plan sets out a number of strategies to achieve the above goals. Safety is a top priority for the EWL and has been taken into account in its design.
The Auckland Integrated Transport Plan 2012-2041	This document was created in response to the Auckland Plan and sets out the 30 year investment programme to meet the transport priorities that are contained within the Auckland plan. EWL is one of three transport projects that have been labelled as critical to Auckland's growth.
National Freight Demand Study 2014	The Ministry of Transport published the second National Freight Demand study in early March 2014. The study seeks to improve understanding of freight demand and movement, trends and changes, and associated infrastructure (e.g. transport network) requirements. The study identifies a number of themes including around the use of the Auckland-Tauranga corridor, distribution, sustainability and high productivity motor vehicles (Executive Summary page 2-3). The EWL is an important part of supporting the growth in freight in the upper North Island, and associated transport requirements, and the strategic importance of the location in relation to the rail network and port land.

Matter	Discussion
Local Government Act Policies	
Auckland Plan	The Auckland Plan provides a long-term strategy for growth and development in Auckland. The Plan identifies the EWL as the second highest priority transport project for the Auckland Region, along with AMETI. Therefore there is strong strategic direction from Council for the Project – Clause 775 and annotated on Figure 13.3 below. The Project will improve roading efficiency within Auckland, as well as better connecting New Zealand exports to the rest of the world. The Project is included as one of three Auckland priority transport projects under Section 13.3 of the Auckland Plan. The role of the transport system in facilitating liveability, economic growth and productivity is defined in the Auckland Plan by the overarching direction to *“Create Better Connections and Accessibility within Auckland, across New Zealand and to the world”* and includes four key priorities: • Manage Auckland’s transport as a single system; • Integrate transport planning and investment with land use development; • Prioritise and optimise investment across transport modes; and • Implement new transport funding mechanisms.



<table>
<tr><th>Matter</th><th>Discussion</th></tr>
<tr><td>Auckland Long Term Plan 2012-2022</td><td>The Auckland Long Term Plan 2012-2022 (“the LTP”), which is required under Local Government Act 2002, sets out the Council's 10-year financial plan, and is guided by the strategic direction set by the Auckland Plan. The Project will provide quicker freight movements within and out of the area therefore improving economic efficiency. A better connection to and from the Onehunga-Penrose commercial area to and from SH20 and SH1 will be created.</td></tr>
<tr><td>Local Board Plan 2014 Maungakiekie-Tāmaki</td><td>The Maungakiekie-Tāmaki Local Board Plan is the guiding document for the local board and is their strategic three-year plan to outline their communities’ priorities and preferences. There are six local board plan outcomes:
• Transport that meets our communities’ and businesses’ needs
• Successful businesses and good jobs for our people
• A built environment that strengthens our communities and reinforces our heritage and local character
• A healthy natural environment enjoyed by our communities
• Strong and thriving communities that are enabled to participate, celebrate and contribute
• Parks, sports and recreational facilities that promote healthy lifestyles and enhance well-being
The EWL will contribute to all these outcomes and more specifically, the Local Board has demonstrated support for the Project.
Under the first objective, one of the key initiatives to provide for more freight efficiency with minimal impact on residents is to: ‘Advocate for the East West Connections to deliver on community and business expectations.’
Further:
one of the key initiatives to achieve healthy waterways and harbours in the area is to: “Advocate and provide advice for ecological restoration along the water’s edge as part of transport projects, i.e. East West Connections”.
EWL will better connect this area to the rest of Auckland whilst reducing congestion within Onehunga and the surrounding suburbs. EWL will create more efficient freight movements between key industrial areas, the airport and the motorways within Auckland. The foreshore component assists in managing water quality and improving access to the Māngere Inlet. Walking and cycleways will be constructed along the foreshore helping cater for healthier lifestyles within the area.</td></tr>
<tr><td>Māngere-Ōtāhuhu Local Board Plan 2014</td><td>The Project will provide better linkages to SH1 for businesses operating in this area and for freight travelling in an east west direction. The overall project will also provide better walking and cycling facilities helping to better connect the Māngere-Ōtāhuhu area.</td></tr>
<tr><td colspan="2">Environmental</td></tr>
<tr><td>Draft The New Zealand Biodiversity Strategy 2012</td><td>This Strategy establishes a strategic framework for action, to conserve and sustainably use and manage New Zealand’s biodiversity. The main objectives are to promote community and individual action, protect Mana Whenua interests, halt the decline of New Zealand's indigenous species and maintain the genetic resources of introduced species which contribute to the wellbeing of New Zealanders.
Works will occur within the Manukau Harbour and a number of reserves and open spaces. Mana Whenua interests will be protected as iwi/hapū groups within an interest in the Project area have been project partners and closely involved in the design of the EWL.</td></tr>
</table>

Matter	Discussion
Auckland Indigenous Biodiversity Strategy 2012	The Auckland Indigenous Biodiversity Strategy seeks to protect, maintain and restore the indigenous biodiversity within Auckland. This involves conserving as many species as possible with particular attention being given to those species which are threatened, implementing iwi values, educating Auckland's communities and fostering guardianship and the collaboration of governmental organisations. Biodiversity has been a key consideration of the Project in particular in efforts to avoid, remedy or mitigate the potential adverse construction effects and to achieve post construction benefits.
Auckland Closed Landfills Asset Management Plan 2013	This Plan sets out Auckland Council's actions in regards to the management of closed landfills and any adverse human health and effects on the environment. The approach is centred on regulation, education and communication, demand substitution, incentives and operations. As part of effectively managing these landfills Auckland Council intends to include Māori in this management and to provide for the social, cultural, environmental and economic sustainability of the surrounding environment.
Economic Development Strategy	The Auckland Economic Development Strategy sets out Auckland Council's 10-year strategy to make Auckland an internationally prosperous city. The top priority of the Auckland Economic Development Strategy is to — *Grow a business-friendly and well-functioning city*. This strategy aims to strengthen collaboration, provide and develop supporting infrastructure, and attract, build and retain talent and business capital in Auckland. Part of this purpose is to make Auckland more internationally connected and increase Auckland's exporting capacity. The Project will provide better connections to and from areas of Onehunga-Penrose. As this area is responsible for a large proportion of Auckland's industrial activity, the improved accessibility for these locations will improve freight movement efficiency and will therefore better connect these areas.
Parks and Reserves	
Auckland Parks and Open Spaces Strategic Action Plan 2013	This Action Plan seeks to protect, and conserve Auckland's environment, heritage and landscape, expand and develop Auckland's park and open space networks, and to connect and utilise these parks and open spaces. The Project will require the acquisition of land from a number of parks/open spaces along the route during construction. This will reduce the amount of park space available to Auckland residents for the construction period. However, once complete the Project will reinstate parks, improve the environmental health of the Manukau Harbour, and provide connections between existing parks and open spaces via cycling/walking
Auckland Sport and Recreation Strategic Action Plan	This plan seeks to increase the availability to, and participation in, physical activities, recreation and sport within Auckland. In particular, the Plan focuses on increasing participation in informal recreation, providing infrastructure to improve access to open spaces and waterbodies, sporting achievement and improving Council's parks and recreation sector. This plan is of relevance as cycleway/walkway connections are proposed which will help increase informal physical activity and improve access to open spaces

Matter	Discussion
NZ Transport Agency Guidance	
Z Series	The Transport Agency has required standards for its projects that have been used in the development of the Project and in the assessments described in this AEE. These include: Z/19 Environmental and social responsibility standard; and Z/22 Archaeological discovery procedures. These have been used to guide the Project thus far, e.g. in undertaking site investigations, and in the preparation of the AEE and technical documentation.
Guidance	The Transport Agency has a range of documents that provide a good practice approach for assessing state highway projects, including achieving compliance with legislation and consistency across the country. These have all been used in the assessments informing this AEE: • Safety and geometric design • Environmental and social responsibility • Stormwater, erosion and sediment control • Community and stakeholders • Structures • Coastal • Urban design and landscaping • Transport modelling • Air quality and climate • Noise and vibration • Property • Resilience project
Other Guidance and Research	
Guidance on Good Practice Biodiversity Offsetting in New Zealand – 2014	This is administered by the DOC and has been had regard to in the preparation of the ecological impact assessment, and measures to manage effects (avoid, remedy and mitigate). Early engagement identified the opportunity to develop this corridor as part of a wider "green corridor" to link the Waitakere Ranges and east Auckland. This principle has been brought forward in an integrated landscape and ecological response through mitigation measures set out in *Part G: Assessment of effects on the environment* of this AEE.
NZ Urban Design Protocol	The Transport Agency is a signatory to the NZ Urban Design protocol. The Urban Design Protocol identifies seven essential design qualities that together create quality urban design: • Context: seeing buildings, places and spaces as part of whole towns and cities • Character: reflecting and enhancing the distinctive character, heritage and identity of our urban environment • Choice: ensuring diversity and choice for people • Connections: enhancing how different networks link together for people • Creativity: encouraging innovative and imaginative solutions • Custodianship: ensuring design is environmentally sustainable, safe and healthy • Collaboration: communicating and sharing knowledge across sectors, professions and with communities. The Project has prepared a ULDF which has close regard to the above.

15.9 Section 105

Some of the applications are for discharge permits, involving discharges to air, and discharges of contaminants into water and onto land. The applications are also to undertake reclamation and occupy the CMA with permanent structures. Therefore, section 105 is relevant. Section 105 outlines additional matters than must be considered by consent authorities for discharge and coastal permits in addition to the matters in section 104(1). Consideration of the relevant aspects of the Project against the matters included within section 105, is undertaken in Table 15-3 of this AEE.

This assessment is based on there being these types of discharges that trigger Section 15:

- Discharge contaminants or water to water (s.15(1)(a)) – e.g. the stormwater runoff from new impervious surfaces and some existing impervious surfaces in SH1;
- Discharge contaminant onto or into land in circumstances which may result in that contaminant entering water (s.15(1)(b)) – e.g. the surface contaminants from the main alignment;
- Discharge contaminants from an industrial or trade premises to air (s.15(1)(c)) – i.e. the concrete batching activities; and
- Discharge contaminants from an industrial or trade premises to land (s.15(1)(d)) – i.e. the concrete batching activities.

Table 15-3: Relevant matters for section 105(1) and (2)

Section 105	Comments	Cross-references
Nature of the discharge and sensitivity of the receiving environment to adverse effects (Section 105(1)(a))	The receiving environments in remnant freshwater streams and the Māngere Inlet, are already adapted to a contaminant load consistent with the industrial urbanised environment. General construction works will result in discharges containing higher levels of sediment than normal, and disturbances of historic contaminated land will result in the discharges of contaminants. Anns Creek has significant ecological values and rare ecosystems. Specific erosion and sediment controls in will be required within and upstream of this environment. In the long term, once construction is completed, discharges to the CMA will improve through enhanced treatment.	Sections 12 and 13 of this AEE Technical Report 15- Coastal Processes Assessment (Volume 3)
The applicant's reasons for the proposed choice (Section 105(1)(b)) Any possible alternative methods of discharge, including discharge into any other receiving environment (Section 105(1)(c))	The design process and construction methodologies to date have, as far as possible, avoided creating adverse effects on sensitive receiving environments. In circumstances where this has not been achievable the BPO is to be employed to remedy, mitigate or offset any actual and potential effects on these areas as no other feasible alternative method of discharge is available. This may, for example, include seeking to achieve a balance between the amount of area occupied by treatment facilities and the percentage treatment (TSS removal) achieved. The location of the Project within the various catchments means there are few alternative sites or methods of discharge.	Sections 12 and 13 of this AEE Technical Report 16- Ecological Impact Assessment (Volume 3)

Section 105	Comments	Cross-references
Section 105(2) …consider whether an esplanade reserve or esplanade strip is appropriate and, if so, impose a condition under section 108(2)(g) on the resource consent	The Project will construct over an existing amenity strip along the Māngere Inlet northern foreshore than is administered by Auckland Council. Access to the CMA will be replaced through the Project with the construction of new recreational access, walking and cycling paths.	Volume 2: Drawing Set

15.10 Section 105(1) – Discharges

The existing environment sections of this AEE address the nature of the discharge and the sensitivity of the receiving environment to adverse effects. The Transport Agency's reasons for the proposed choice is also well set out. Any possible alternative methods of discharge, including discharge into any other receiving environment.

Discharges to air

The discharges to air that require resource consent under Section 15 arise from the establishment of a construction-related concrete batching facility. This will be a temporary activity that would be established during the construction phase and removed after construction is completed. It will generate discharges to air for this period only. The receiving environment for the discharges is identified in the AUP (OP) as "Air Quality: Reduced Amenity" and this has been confirmed within the technical assessments on air quality. Like the AUP (OP), the ALW Plan identifies much of the industrial area as "Industrial Air Quality Management Area", also providing for reduced air quality. The air discharges are of a similar nature to other discharges within this lower air quality amenity, industrial area.

The need for a concrete batching facility located at the site arises from the potential use of material generated from dredging for the manufacture of mudcrete for embankment construction. An on-site location is the most efficient location because it is close to the source of the raw material. Alternatives could include manufacture at another off-site location though that would generate additional vehicle movements and associated effects, and any discharges would be in a different location.

At this stage, alternative methods for construction of the embankment have been broadly considered. However, the Transport Agency expects to engage a contractor to build the project in the future, and this would involve the contractor developing its own methodology for construction of the project, including sourcing raw materials and any concrete batching requirements. There are a number of different alternative methods that might be used by the contractor. It is therefore intended that some flexibility be retained for the contractor to make that decision in future.

Discharges to land and water

<u>*Construction of the Project*</u>

During construction of the Project, discharges to land and water will occur to both the Manukau Harbour and the Tamaki River receiving environments. This will largely involve discharge of contaminated soil, silt and sediment run off from earthworks and general construction activities. Both marine receiving environments are identified in the AUP (OP) as being Degraded Marine 1 and so are not of high value that will be sensitive to the discharges. The expert assessments are that the discharges will be acceptable, as standard conditions and construction management techniques are used.

These discharges are a necessary part of the construction process and cannot practicably discharge to an alternative receiving environment due to their geographic location. A range of methods were reviewed and appropriate options identified in the technical report on erosion and sediment control.

However, it is critical that industry best practice methodology is used for the construction phase to minimise effects on people and the environment, particularly given works are required in known contaminated soils and very close to high value ecological areas and the coastal marine area.

Once a contractor is appointed, the contractor will confirm proposed methodology for construction and will develop detailed procedures for management of construction related effects, including discharges to land and water.

Operation of the Project

The permanent works and operation of the Project will generate new discharge of contaminants from the road surface. These contaminants will be picked up in stormwater which will then be treated before discharge to the coastal marine area of either the Māngere Inlet or the Tamaki River. The Transport Agency is applying for a discharge consent for the stormwater from the new road and other new impervious surfaces.

In the catchments that drain to the Māngere Inlet, contaminants would be picked up in stormwater that drains to the same or similar locations as the existing Council stormwater network. The Project has also been designed to capture and treat stormwater from that Council network, as well as from the new road alignment, and thus discharge of stormwater to other alternative receiving environments is not considered to be practicable, due to the need to take account of existing discharge points and the need for any new discharge points to be located at the lowest points in the catchment.

A range of alternative methods for managing stormwater have been considered. These include:

- Treatment of the main alignment surfaces only, with the Council network remaining as current (status quo);
- Treatment of both main alignment and Council stormwater using proprietary devices (mechanical treatment chambers);
- Treatment of both main alignment and Council stormwater using naturalised wetland treatment systems;
- Treatment of both main alignment and Council stormwater using naturalised wetland treatment systems combined with biofiltration; and
- Treatment of both main alignment and Council stormwater using a combination of proprietary devices and wetlands.

Careful consideration of all these methods has been undertaken. During the assessment of different corridor options, the opportunity to achieve positive environmental outcomes from a corridor along the foreshore, including wider stormwater network treatment, was identified. This opportunity was then considered in greater detail when different alignment options were considered. The option of treating only stormwater from the road was identified as part of that process but discarded early on because the preferred option had the opportunity for achieving an integrated infrastructure solution that works in this location could deliver.

The consideration of options and choice of treatment methods has involved many elements which have included:

- the efficacy of treatment and contaminant removal;
- space efficiency of each of the methods – particularly considering the constrained urban environment and the potential for treatment methods to be located within the coastal marine area (and the strong policy direction seeking to minimise reclamation in the CMA);
- cultural preferences for more natural treatment systems where water passes over and through land for filtration and treatment prior to discharge to the receiving environment;

- the ability to gain multiple benefits from natural treatment systems, including being part of foreshore restoration works, and the significant improvement afforded to wider catchment discharge quality, which would otherwise not be able to be readily achieved;
- the efficiency afforded by the integrated approach from the Transport Agency and Auckland Council to using the opportunity that the EWL project brings for achieving an integrated solution for both the road and existing network together; and
- opportunities to use innovative methods to achieve positive environmental outcomes using the best practicable option.

In consideration of the alternatives and including these relevant considerations, the preferred method was a naturalised treatment method that was able to be integrated within the foreshore landforms.

For the balance of the Project alignment similar methods were considered for the treatment of the State highway road surfaces (new and existing), again having regard to the constrained urban environment, though with more cognisance of the ability to minimise the impact on useable land.

The conclusion is that alternative sites and methods, and therefore other receiving environments, have been properly considered.

15.10.1 Section 105(2) – Reclamation

The Māngere Inlet foreshore works will create new public open space that will be available for public access and use. At this stage it has not been determined whether an esplanade reserve or strip would be created. Because the land is available for public access, and is not being created for a private land use, this determination will be made at the time land is formally vested.

15.11 Section 107

The Board of Inquiry cannot grant a discharge permit if the discharge is likely to result in certain effects specified. For the EWL Project these are not generally expected to occur, subject to good management (of construction in particular). The Act also states that a consent authority may grant a discharge permit which gives rise to these effects if it is satisfied—

(a) That exceptional circumstances justify the granting of the permit; or

(b) That the discharge is of a temporary nature; or

(c) That the discharge is associated with necessary maintenance work— and that it is consistent with the purpose of this Act to do so.

The assessments in this AEE and in the technical reports demonstrate that the Project will pass the tests within Section 107(2)(b) because:

- The discharges will be short term and any effects will occur at limited times, though not necessarily consistently, over the duration of construction, as demonstrated in the erosion and sediment control effects assessment (for example, Plan Set 10);
- It is inevitable that some sediment will be discharged into streams and the CMA, however measures will be put in place to manage and minimise discharges during construction; and
- There will be no ongoing adverse effects once construction has been completed, and an improvement in the quality of discharges from existing impervious surfaces to the CMA is anticipated.

In summary, the Project is assessed as meeting the tests outlined in section 107 of the RMA.

15.12 Section 89

The Project requires consent for land use activities on the future reclamation under Section 87 and 89. The RMA provides for applications to be made in anticipation of the future reclamation becoming land, and for the activities occurring on that land:

(2) Where—

(a) an application is made to a territorial authority for a resource consent for an activity which an applicant intends to undertake within the district of that authority once the proposed location of the activity has been reclaimed; and

(b) on the date the application is made the proposed location of the activity is still within the CMA,—

then the authority may hear and decide the application as if the application related to an activity within its district, and the provisions of this Act shall apply accordingly.

The activities that will be occurring on the future reclamation include:

- New State highway (an arterial road and links into new or extended local roads) and associated works including street furniture, signage and safety requirements;
- Walking and cycling paths; and
- Associated works including stormwater treatment, landscape planting and creation of new public access.

In future, it is anticipated that the Transport Agency may seek to alter the designation so that it applied to the parts of the State highway required for permanent works, operation and maintenance. This could only occur once land was vested (as land).

15.13 Part 2 Assessment

The purpose of the RMA is to promote the sustainable management of natural and physical resources as defined by section 5(2). In promoting sustainable management, there is often the requirement to balance consideration of the competing resource values and the benefits and adverse effects associated with a proposal. The designation of a public work involves careful consideration of the local, regional or national benefits that might accrue from the Project and the more localised adverse effects that the Project (and its activities) might have on the environment, including on people, communities, and natural resources and values.

15.13.1 Section 5 – Purpose and Principles

In terms of Section 5 of the RMA, the Project will enable people and communities to provide for their social, economic and cultural wellbeing and for their health and safety, by:

- Providing for economic growth, by improving accessibility and connectivity, and through new connections in and out of the Project area and across the Region;
- Providing significant community, social and transport benefits including improved connectivity between town centres, improved cycling and walking, accessibility and safety and reduction in traffic congestion:
  - Travel time improvements for buses between Māngere Bridge and Onehunga;
  - Making the local environments more pleasant – e.g. through making it easier to get into and out of side streets, to and from work places, and walk along the road and cross the road with less traffic passing;
  - Pedestrian and cycling links;

- Improved reliability for freight movements and resulting economic benefits; and
- Cultural well-being is provided for through mana whenua kaitiaki and improved mauri.

Sustainable management also involves the promotion of the matters in section 5(2) (a) through to (c) of the RMA. In this regard, the following conclusions from the planning assessment set out in this report are made:

- In terms of sustaining the potential of natural and physical resources for future generations, the Project will deliver positive environmental benefits for water quality discharges;
- Occupies an existing area of foreshore and coastal marine area that is compromised and / or degraded by historic activities but, through naturalisation of the proposed coastal edge and other enhancement measures, provides an area of enhanced natural character, accessibility, and water quality;
- Is intended to meet the growing transportation needs of the Region;
- Increases the growth and capacity of the surrounding industrial, commercial and residential land resource, to provide for future demand;
- Does not preclude future opportunities for other land transport development, such as improvements to public transport, particularly rail;
- The Project safeguards the life supporting capacity:
  - Of air – by reducing congestion and improving air quality at a local level;
  - Of water – although there will be a short term adverse effect on water quality from sediment discharges, there will be important long terms benefits arising from improvement in ground water stormwater treatment and water quality discharging both to the Māngere Inlet and the Ōtāhuhu Creek;
  - Of soils – by the management of construction works and improving existing drainage systems in historic landfills;
  - Of ecosystems – by avoiding (where practicable), remedying and mitigating the adverse effects on, particularly, the coastal environment, Anns Creek and avifauna; and
  - Of people and communities – by managing actual and potential adverse effects both during construction and operation, and by having significant positive effects on the transport network, potential economic growth, and the wider community; and
- The Project avoids where practicable, remedies and mitigates the majority of adverse effects on the environment in the design concept developed to date, and through identification of mitigation measures (*Part H: Management of Effects on the Environment* of this AEE).

15.13.2 Section 6 – Matters of national importance

The Project recognises and provides for the matters within section 6 of the RMA. In particular, the Project recognises and provides for specific matters:

- The Project has been assessed to be an appropriate use and development of the coastal environment, recognising that the Project is located within a highly modified part of the CMA, and that there are opportunities to improve the amenity and ecological habitats in the area, and enhance access for people and communities;
- The Project will have an adverse effect on some elements of the natural character of the coastal environment. However taking into account the significant modification of the CMA that has been undertaken to date, the comparative scale of the modification proposed as part of this Project, and the opportunity to improve the amenity and naturalise the coastal edge of the Māngere Inlet, the effects are assessed as being generally positive. At Ōtāhuhu Creek, the natural character will be improved through reinstating a navigable channel along the Creek;

- There are two outstanding natural features identified within the Project area, and both have been modified in the past through urban development. The Project has generally avoided these volcanic features by carefully identifying their location on the ground visually and through physical investigations, whilst also identifying opportunities to enhance legibility and improve understanding of the Auckland volcanic field which recognises and provides for protection of these features;
- Areas which exhibit significant indigenous biodiversity characteristics have been avoided as far as practicable. The Project will, however, involve the removal of indigenous vegetation and permanent loss of marine intertidal habitat. The majority of the affected areas have not been assessed to be of high value, though it is a noted wading bird foraging and roosting area. Habitat creation is proposed post construction, and there are opportunities for significant habitat improvement. As all practicable measures have been undertaken to avoid and minimise adverse effects on significant indigenous vegetation and habitats and enhancement and restoration measures are proposed, the protection of indigenous biodiversity has been recognised and provided for;
- Existing public access to and along the CMA has been recognised by the Project. Public access has been provided and enhanced and in some instances provides for improved connectivity to the existing wider public access network. A boardwalk is proposed within the CMA to reduce reclamation area and provide access to the CMA;
- The relationship of Mana Whenua and their culture and traditions with their ancestral lands, water, sites, wāhi tapu and other taonga has been recognised and provided through embedding Māori cultural values in the Project. Mana Whenua have had significant involvement in developing the Project scope and have been strongly influential in viewing the Project as enabling a kaitiaki role. The improvement in quality of discharges to the Inlet is expected to improve the mauri of the environment; and
- The protection of historic heritage has been recognised and provided for through the route selection which avoids any direct effect on scheduled heritage sites and includes measures to mitigate adverse effects. Outcomes will include improving visibility/legibility of historic lava flows in the area, and educational information about the volcanic heritage of the area.

15.13.3 Section 7 – Other matters

The Project has had particular regard and appropriately responded to the matters in section 7 of the RMA. In particular:

- The kaitiakitanga of Mana Whenua has been recognised through engagement at all stages of the Project development and will continue through construction and operation. The Project is seen through a long term viewpoint as an opportunity to repair damage to the environment that has occurred through previous urban development;
- The ethic of stewardship has been recognised in the engagement with and participation of community groups who have a specific interest in and exercise stewardship over particular resources;
- Input throughout the design process from various agencies has enabled the integrated development of an option that is an economic and transport solution, and that provides important community and environmental outcomes;
- Improvements in the transportation system will address congestion and improve freight efficiency. The Project will address these issues and significantly improve the efficiency and effectiveness of the state highway network and local connections. Through the alternatives assessment process, the Project was determined to be the most efficient use of natural and physical resources;
- The selection of the alignment and design has sought to avoid adverse effects on ecosystems as far as practicable;
- The alignment selection and design process has sought to avoid adverse effects on existing amenity values. Particular regard has been given to the maintenance and enhancement of amenity values in the assessment of alternatives for the Project, in both the natural environment and built environment

solutions. Walking and cycling facilities will be notably improved throughout the Project improving the safety and amenity of the urban environment; and

- The Project has been designed to respond to the effects of climate change. The new road will be designed to accommodate sea level rise, and will provide protection for urban land in the Onehunga-Penrose area.

15.13.4 Section 8 – Treaty of Waitangi

The Transport Agency has formed a long term partnership with Mana Whenua for the delivery of this Project. As an agent for the Crown this is consistent with the principles of the Treaty.

15.13.5 Part 2 Conclusion

On balance, and while the Project will have adverse effects, when considering the significant national and regional benefits of the Project, alongside the measures proposed to avoid, remedy and mitigate the adverse effects, it is concluded that the Project achieves the purpose and principles of the RMA.

APPENDIX A

CONTENTS OF THE DRAFT CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

EAST WEST LINK

CONTENTS OF THE DRAFT CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

DECEMBER 2016

NZ TRANSPORT AGENCY
WAKA KOTAHI

East West Link

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Revision schedule					
Rev. Nº	**Date**	**Description**	**Prepared by**	**Reviewed by**	**Approved by**
0	December 2016	Final for lodgement	Lesley Hopkins	Mike Trebitsch	Patrick Kelly

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