REPORT

Tonkin+Taylor

Auckland Regional Landfill

Assessment of Environmental Effects

Prepared for
Waste Management NZ Ltd
Prepared by
Tonkin & Taylor Ltd
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Exceptional thinking together
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Abbreviations

Abbreviation	Definition
AADT	Annual Average Daily Traffic
AEE	Assessment of Effects on the Environment
AEP	Annual exceedance probability
ARI	Average rain index
AT	Auckland Transport
AUP	Auckland Unitary Plan
BPO	Best Practicable Option (As defined in the RMA)
CMP	Construction Management Plan
CVA	Cultural Values Assessment
DBH	Diameter at breast height
DOC	Department of Conservation
ECM	Equivalent Car Movements
ESCP	Erosion and Sediment Control Plan
ETS	Emissions Trading Scheme
GD05	Auckland Council Guideline Document 2016/GD05
GDP	Gross Domestic Profit
HAIL	Hazardous Activities and Industries List
ITA	Industrial or Trade Activity
LFG	Landfill gas
LGA	Local Government Act
LMP	Landfill Management Plan
LTP	Long Term Plan
MBT	Mechanical Biological Treatment
MPI	Ministry for Primary Industries
NES	National Environmental Standard
NESAQ	National Environmental Standards for Air Quality
NPS	National Policy Statement
NSMA	Natural Stream Management Area
NZCPS	New Zealand Coastal Policy Statement
NZTA	New Zealand Transport Agency
OIO	Overseas Investment Office
ONF	Outstanding Natural Feature
ONL	Outstanding Natural Landscape
QA	Quality assurance
RMA	Resource Management Act
RPS	Regional Policy Statement
SEA	Significant Ecological Area

Abbreviation	Definition
SEV	Stream Ecological Valuation
WAC	Waste Acceptance Criteria
WMA	Waste Minimisation Act 2008
WMMP	Waste Minimisation and Management Plan
WMNZ	Waste Management New Zealand Ltd

Glossary

General terms	
Auckland Regional Landfill	Project name, encompassing the landfill itself as well as all ancillary activities.
Waste Management NZ Limited or WMNZ	Company name of applicant.
Wayby Valley	The site is located in the Wayby Valley catchment.
WMNZ landholdings	The entire landholdings secured by WMNZ.
Project footprint	The areas where works are anticipated associated with the project.
Landfill footprint	The area directly impacted by the landfill itself within Valley 1.
Landholding description	
Western Block	The farm property previously known as Springhill Estate.
Eastern Block	Pine forestry block which includes Valley 1 and 2
Southern Block	Strip of land which access road runs through until it reaches the Eastern Block. This strip is mostly occupied by bush and forest plantation, within a separate valley across the southern side of the Western Block.
Waiteraire Tributary Block	South east corner of the site, covering tributaries that flow down towards the Sunnybrook Reserve.
Valley 1	The southernmost of the two valleys currently in forestry suitable for landfilling.
Valley 2	The northernmost of the two valleys currently in forestry suitable for landfilling, and that might be considered for development after Valley 1 has been filled, but does not form part of this consent application.
Waiteraire Stream	Stream next to the access road and bin exchange area.
Project description	
Access Road	Private road constructed from State Highway 1 through the Southern Block, bypassing the bin exchange area, to the landfill.
Airspace, or airspace volume	The gross volume available between the landfill basegrade and the top of the landfill cap. This volume includes the volume of all materials placed within this space including waste, daily cover, intermediate cover and final cap.
Basegrade	The surface at the base of the landfill (depicted as the top of lining system i.e. before placing the leachate drainage blanket)
Bin exchange area	Area where road vehicles hauling waste will exchange full bins for empty bins prior to leaving the site. Mules will collect full bins from the area and transport to the working face, returning empty bins to the area. Both full bins and empty bins may be present on the ground at any one time.
Crowther Road	Existing access road into Mahurangi Forest from 770 SH1 up to Wilson Road.

General terms	
Daily cover	A thin layer of soil placed on top of refuse at the end of each day to manage nuisance conditions such as odour, wind-blown litter, birds and vermin.
Farm entrance	Existing private driveway at 1232 SH1 leading to the Western Block, airfield and three neighbours
Footprint, or landfill footprint	The area (plan area) occupied by the landfill which has a lining system onto which waste is placed.
Intermediate cover	A layer of soil, placed over areas of refuse where further waste placement will take place but not for some time (typically > 6 months).
Landfill gas or LFG	The gas produced by the anaerobic decomposition of waste comprising predominantly methane and carbon dioxide.
Leachate	The liquid produced when water percolates through the waste and that contains dissolved and/or suspended matter from the waste.
Leachate drainage system	A combination of the leachate drainage blanket and the leachate collection pipework.
Nett Usable Airspace	The nett volume available between the upper surface of the leachate drainage blanket and the underside of the landfill cap. This volume is available for the disposal of waste and includes the volume of daily cover and intermediate cover.
Liner or landfill liner	A low permeability layer within the lining system at the bottom of the landfill to prevent the seepage of leachate into the underlying environment.
Lining system	A series of layers of liner at the bottom of the landfill to prevent the seepage of leachate into the underlying environment.
Leachate drainage blanket	Free draining aggregate placed above the landfill liner to collect leachate percolating from the waste above. The leachate drainage blanket will convey leachate to a leachate collection pipe system. The leachate drainage blanket controls the depth of leachate that can form on top of the liner.
Mule	Vehicle used to transport waste contained in detachable bins from the bin exchange area to the landfill working face.
Renewable energy centre	LFG treatment plant site with flares, electricity generators, leachate treatment plant, and potential other gas utilisation technologies.
Soil stockpile	Soil, surplus to current needs, placed as an earth fill in a specific area of the site on a temporary basis and which will be used for later operation or construction purposes. In the case of a landfill a stockpile may be in use throughout the operating life of the landfill in episodes of soil placement and soil removal.

General terms	
Waste	The material that is delivered to the site for disposal in the landfill. The material will comply with defined waste acceptance criteria.
Wastewater	Domestic type wastewater from staff and visitor toilets, washing facilities and kitchens that will be treated and disposed of on site.
Working face	The place where waste is being disposed daily.

Executive summary

Waste Management NZ Ltd (WMNZ) is seeking to obtain resource consents for the construction and operation of a new regional landfill facility within the Wayby Valley area, between Warkworth and Wellsford. This Assessment of Effects on the Environment (AEE) report has been prepared to support resource consent applications for the construction and operation of the landfill and its supporting activities.

WMNZ has been in the business of operating waste facilities in New Zealand since 1935. They are the market leader in New Zealand, employing over 1700 people and servicing in excess of 300,000 customers nationwide. WMNZ operates out of 70 locations across New Zealand and has annual revenues in excess of $500m. They are the only fully integrated national waste provider, providing a full range of collection, processing (recycling, recovery, transfer, treatment, composting), landfill disposal and renewable energy generation services. Their longevity and experience in the industry allows them to operate facilities with the highest industry standards.

The Redvale Landfill, which is owned and operated by WMNZ and is currently the largest landfill in Auckland, is nearing capacity. It holds consents which permit waste placement until 2028, however is currently forecast to be full in 2026. The company is looking to obtain consents to enable the development of a new landfill that will ultimately replace Redvale.

WMNZ has acquired land in the Wayby Valley area, north of Auckland (WMNZ landholdings) for the purposes of developing a municipal solid waste landfill, which will be known as the Auckland Regional Landfill. WMNZ will own, construct and operate the landfill. Through the acquisition, WMNZ has secured a large area, comprising approximately 1020 ha in order to provide a buffer from surrounding land-uses. The landfill footprint itself will occupy approximately 60 ha of the WMNZ landholdings.

The proposed landfill will be designed and operated in accordance with the latest guidance for New Zealand – the Technical Guidelines for Disposal to Land published by the Waste Management Institute New Zealand[1] in 2018 ('the Landfill Guidelines'). These guidelines replace earlier guidance on landfills in New Zealand, and provide technical guidance on siting, design, operation and monitoring of landfills in New Zealand, based on local and international experience.

The landfill will be a Class 1 landfill, as defined by the Landfill Guidelines. A Class 1 landfill accepts municipal solid waste, which includes residential and commercial waste, construction and demolition waste, some industrial wastes (that meet strict acceptance criteria) and contaminated soils.

WMNZ has gone through an extensive site identification and selection process over several years, which considered a range of factors including access, site size, buffer availability, geology and environmental and cultural factors. This process resulted in the identification of the Wayby Valley site as the preferred location for the landfill due to a number of features, including:

- Its proximity to State Highway 1;
- Ability to maintain separation distance from sensitive receivers;
- Potential development capacity;
- Avoidance of identified sites of cultural significance;

[1] WasteMINZ is the largest representative body of the waste and resource recovery sector. Membership includes central and local government as well as the private sector.

- Avoidance of significant ecological features and other features identified in the Auckland Unitary Plan (AUP);
- Appropriate underlying geology.

The WMNZ landholdings currently comprise a mix of predominantly pastoral farmland and plantation forestry. There are some areas of ecological value on the WMNZ landholdings, including wetlands, streams and pockets of native vegetation. To the extent possible the project has been designed to avoid or minimise impacts on these areas and, where this is not possible, to provide compensation/off-setting mitigation to minimise overall effects.

This Assessment of Environmental Effects sets out the proposed design features and operational measures for the landfill which are provided to achieve a high level of containment in accordance with the Landfill Guidelines. These include engineered environmental protection provided by a lining and leachate collection system, capping system, and landfill gas management, all of which will be constructed under a rigorous quality assurance programme with independent review and signoff. Controls on accepted waste materials are proposed, as is a rigorous programme of environmental monitoring and reporting including sediment runoff, surface water and groundwater quality, leachate quality and quantity, and landfill gas.

The proposal also involves an initial construction stage, including construction of an access road, bin exchange area, the first cell of the landfill itself, and installation of environmental controls such as stormwater ponds.

WMNZ seeks a 35 year term for its regional consents and permanent land-use consents to reflect the long term nature of a landfill development. The proposed works require consent as a non-complying activity overall under the Auckland Unitary Plan.

This AEE report draws the following conclusions:

- The works are consistent with Part 2 of the Resource Management Act 1991;
- The works are considered not contrary to the relevant objectives and policies in the Auckland Unitary Plan;
- Overall the proposal is a non-complying activity. The application meets the test of section 104D of the RMA.
- The proposal will have positive economic effects and will provide important infrastructure to support the growth of the Auckland region.
- The proposal will have more than minor effects on stream habitat and terrestrial flora and fauna within the WMNZ landholdings, and no more than minor effects on a range of other features of the environment including groundwater, surface water, air quality, traffic, noise and landscape.
- Conditions of consent are proposed to ensure the proposal is appropriately managed.

Due to the significance of this project to the Auckland region in both its size and economic contribution, WMNZ requests that the application is publicly notified to enable the community to be informed of the project and provide feedback.

Overall, the proposal fulfils the intent and purpose of the Resource Management Act 1991 (RMA) in that it will allow for the development and operation of an environmentally sound and sustainable landfill facility, which provides a safe place for the disposal of residual waste.

Schedule 4 Requirements

Schedule 4 of the RMA sets out the information required in an application for a resource consent. All relevant matters required to be included have been addressed in the assessments and descriptions in this AEE. The following table provides a summary of the information required in Schedule 4 and a quick reference to its location in this report.

Schedule 4 Item	Location within report
A description of the activity	Sections 5-7
A description of the site at which the activity is to occur	Section 4
The full name and address of each owner or occupier of the site	Section 1
A description of any other activities that are part of the proposal to which the application relates	Sections 5-7
A description of any other resource consents required for the proposal to which the application relates	Section 8
An assessment of the activity against the matters set out in Part 2	Section 13
An assessment of the activity against any relevant provisions of a document referred to in section 104(1)(b). This must include: • Any relevant objectives, policies, or rules in a document • Any relevant requirements, conditions, or permissions in any rules in a document • Any other relevant requirements in a document (for example, in a national environmental standard or other regulations)	Section 13
An assessment of the activity's effects on the environment that includes the following information: • If it is likely that the activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity. • An assessment of the actual or potential effect on the environment of the activity. • If the activity includes the use of hazardous installations, an assessment of any risks to the environment that are likely to arise from such use. • If the activity includes the discharge of any contaminant, a description of— – The nature of the discharge and the sensitivity of the receiving environment to adverse effects; and – Any possible alternative methods of discharge, including discharge into any other receiving environment. • A description of the mitigation measures (including safeguards and contingency plans where relevant) to be undertaken to help prevent or reduce the actual or potential effect.	Section 9
• Identification of the persons affected by the activity, any consultation undertaken, and any response to the views of any person consulted. • If the scale and significance of the activity's effects are such that monitoring is required, a description of how and by whom the effects will be monitored if the activity is approved.	Section 12 Section 5

Schedule 4 Item	Location within report
• If the activity will, or is likely to, have adverse effects that are more than minor on the exercise of a protected customary right, a description of possible alternative locations or methods for the exercise of the activity (unless written approval for the activity is given by the protected customary rights group).	Section 10
An assessment of the activity's effects on the environment that addresses the following matters: • Any effect on those in the neighbourhood and, where relevant, the wider community, including any social, economic, or cultural effects. • Any physical effect on the locality, including any landscape and visual effects. • Any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity. • Any effect on natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, or cultural value, or other special value, for present or future generations. • Any discharge of contaminants into the environment, including any unreasonable emission of noise, and options for the treatment and disposal of contaminants. • Any risk to the neighbourhood, the wider community, or the environment through natural hazards or hazardous installations.	Section 9

1 Introduction

1.1 Overview of proposal

Waste Management NZ Ltd (WMNZ) is one of the leading providers of comprehensive waste and environmental services in New Zealand, and is a major player in the waste industry across the Auckland region. WMNZ has acquired land in the Wayby Valley area, north of Auckland, referred to in this application as the 'WMNZ landholdings'. WMNZ is proposing to develop a municipal solid waste landfill on part of the WMNZ landholdings, which will be known as the Auckland Regional Landfill.

The Auckland Regional Landfill will provide a new solid waste management and disposal facility to replace the Redvale Landfill which currently provides for disposal of approximately 50 % of Auckland's solid waste (estimated as 1.6 million tonnes in the Auckland Council Waste Management and Minimisation Plan 2018). WMNZ will own, construct and operate the landfill.

The proposed landfill will be designed and operated in accordance with the latest guidance for New Zealand – the Technical Guidelines for Disposal to Land published by the Waste Management Institute New Zealand[1] in 2018 ('the Landfill Guidelines'). These guidelines replace earlier guidance on landfills in New Zealand, and provide technical guidance on siting, design, operation and monitoring of landfills in New Zealand, based on local and international experience.

The landfill will be a Class 1 landfill, as defined by the Landfill Guidelines. A Class 1 landfill accepts municipal solid waste, as set out in the Landfill Guidelines, which includes residential and commercial waste, construction and demolition waste, some industrial wastes (that meet strict acceptance criteria) and contaminated soils.

Accordingly, WMNZ has gone through an extensive site identification and selection process over several years, which considered a range of factors including access, site size, buffer availability, geology and environmental and cultural factors. This process resulted in the identification of the Wayby Valley site as the preferred location for the landfill due to a number of features, including:

- Its proximity to State Highway 1;
- Ability to maintain separation distance from sensitive receivers;
- Potential longer term development capacity;
- Avoidance of identified sites of cultural significance;
- Avoidance of significant ecological features and other features identified in the Auckland Unitary Plan (AUP);
- Appropriate underlying geology.

WMNZ has acquired a large area, comprising approximately 1020 ha, in order to secure a buffer from surrounding land-uses. The landfill footprint itself will occupy approximately 60 ha within this WMNZ landholdings. The term 'project footprint' is used in this application to refer to the approximate area within the WMNZ landholdings that will be subject to any work required as part of the project, an important distinction given the size of the WMNZ landholdings. Further, whilst there are a number of valleys present within the WMNZ landholdings, one valley has been identified for development for landfilling purposes – 'Valley 1'.

[1] WasteMINZ is the largest representative body of the waste and resource recovery sector. Membership includes central and local government as well as the private sector.

The WMNZ landholdings currently comprise a mix of predominantly pastoral farmland and plantation forestry. There are areas of ecological value on the WMNZ landholdings, including wetlands, streams and pockets of native vegetation, some of which are outside of the notated features in the Unitary Plan. To the extent possible the project has been designed to avoid or minimise impacts on these areas and, where this is not possible, to provide compensation/off-setting to minimise overall effects.

This Assessment of Environmental Effects sets out the proposed design features and operational measures for the landfill, provided to achieve a high level of containment in accordance with the Landfill Guidelines. These include engineered environmental protection provided by a lining and leachate collection system, capping system, and landfill gas management, all of which will be constructed under a rigorous quality assurance programme with independent review and signoff. Controls on accepted waste materials are proposed, as is a rigorous programme of environmental monitoring and reporting including sediment runoff, surface water and groundwater quality, leachate quality and quantity, and landfill gas, all of which will be undertaken in accordance with other recognised guidelines such as Auckland Council's GD05.

This report has been prepared in accordance with section 88 of the Resource Management Act 1991 (RMA) on behalf of WMNZ.

1.2 Applicant and property details

1.2.1 Company overview

WMNZ is New Zealand's largest waste and environmental services company, with a long history in New Zealand dating back to 1935. The company is the market leader in the sector in New Zealand with an established national network of vertically integrated local waste and environmental management services.

WMNZ offers resource recovery, recycling and sustainable waste management solutions. WMNZ is strongly committed to the safe and responsible management of waste, regulatory compliance and the protection and enhancement of the environment.

WMNZ's operations include:

- Collection services – regular household (kerbside) collection services and collections from commercial customers, including irregular services where collections are required by customers on an "as needed" basis.
- Recycling facilities – receipt of source-separated recyclable materials for processing and subsequent shipment to downstream processing facilities in New Zealand and overseas.
- Sorting and processing facilities – receipt, sorting and processing of mixed and source separated single stream recyclables such as paper and cardboard, plastics, glass, tyres and greenwaste.
- Resource recovery facilities – receipt of construction and demolition materials from the construction industry where materials such as ferrous and non-ferrous metals, soil, brick, concrete and timber are separated and recovered for reuse.
- Refuse transfer stations – multi-purpose facilities which serve commercial and private customers for the delivery, recovery and then transfer of materials to appropriate downstream facilities for organic, recyclable and non-recyclable materials.
- Landfill, cleanfill and managed fill disposal sites – providing for disposal or end-use of materials which cannot otherwise be recycled or re-used.
- Power generation from landfill gas – collection and use of biogas for renewable energy generation, with subsequent export into the national grid.

Across New Zealand, WMNZ has ownership and/or operational interest in seven landfills, including both landfills in the Auckland Region (Redvale Landfill and Energy Park and Whitford Landfill and Energy Park). In addition, WMNZ has an ownership and/or operational interest in 29 refuse transfer stations and 17 materials recovery facilities across New Zealand. WMNZ has 70 branches country-wide, and employs 650 people in Auckland and more than 1,700 people across the country.

In addition to Redvale Landfill (WMNZ owned) and Whitford Landfill (Waste Disposal Services joint venture with Auckland Council), WMNZ owns and operates a number of strategic waste and environmental services facilities in Auckland, including:

- 117 Rosedale Road, Pinehill : An operating Refuse Transfer Station;
- 25 Inlet Road, Takanini: An operating Refuse Transfer Station;
- 6, 8 and 10 Southdown Lane, Penrose: A heavy vehicle depot, workshop and construction waste recovery area;
- 86 Lunn Ave, Mt Wellington: A depot, maintenance facilities and office facilities;
- Puketutu Island: A greenwaste composting facility (Living Earth);
- 75 McLaughlins Road, Wiri: A tyre recycling facility.

In addition, WMNZ is a joint venture partner with

- Auckland Council (as Waste Disposal Services) in 12 Neales Road: East Tamaki Refuse Transfer Station.
- EnviroWaste in 81 Captain Springs Rd, Onehunga: Pikes Point Refuse Transfer Station.

Table 1.1: Applicant and property details

Applicant	Waste Management NZ Limited
Owner and occupier of application site[1]	Waste Management NZ Limited
Site address / map reference	1232 State Highway 1, Wayby Valley
Site area	Approximately 1020ha
Legal description	Part Section 94 Parish of Hōteo Part Allotment 163 Parish of Hōteo Lot 2 Deposited Plan 398682 Part Allotment 68 and Part Allotment 69 Parish of Hōteo Lot 2 Deposited Plan 210406 Lot 2 Deposited Plan 71574 Allotment 17 Parish of Hōteo North Western Portion Allotment 16 Parish of Hōteo Allotment 16 Parish of Hōteo Part Allotment 16 Parish of Hōteo Allotment 33 Parish of Hōteo North Western Portion Allotment 34 Parish of Hōteo Allotment S.E. 34 Parish of Hōteo Allotment 35 Parish of Hōteo Allotment 36-38 Parish of Hōteo

[1] WMNZ will settle and become the owner of the Eastern Block and Waiteraire Tributary Block (currently owned by Matariki) if and when consents are granted. WMNZ are already the owner/occupier of the Western and Southern Blocks.

	Allotment 39 Parish of Hōteo Part North Western Portion Allotment 7 Parish of Hōteo, Part North Western Portion Allotment 8 Parish of Hōteo, Part South Eastern Portion Allotment 9 Parish of Hōteo and Part Allotment 117 Parish of Hōteo Allotment 103 Hōteo Parish Southern Part Allotment 12 Parish of Hōteo Allotment 11, Allotment N12, Allotment 105-106, Allotment 177 and Allotment 184 Hōteo Parish Allotment 13-14 Parish of Hōteo, Middle Part Allotment 15 Parish of Hōteo and North Western Part Allotment 15 Parish of Hōteo Allotment N.M. 15 Parish of Hōteo Southern Portion Allotment 16 Parish of Hōteo South Eastern Portion Allotment 15 Parish of Hōteo And including any land shown for public roads, whether formed or unformed, within any of the titles listed, subject to appropriate interests in that land being transferred to WMNZ
Certificate of Title reference	NA42B/697, NA42B/699, 393450, NA939/169, NA138D/56, NA136/300, NA31B/790, NA279/207, NA1937/63, NA599/297, NA761/222, NA634/125, NA2D/102, NA26C/477, NA870/214, NA50B/713, NA907/217, NA1149/47, NA28A/580, NA1149/48, NA643/294, NA599/296, NA599/299, NA27D/570
District and Regional Council Plan	Auckland Unitary Plan Operative in Part
Address for service during consent processing	Tonkin + Taylor Ltd PO Box 5271, Wellesley Street Auckland 1141 Attention: Andrea Brabant Phone: 09 359 2759 Email: abrabant@tonkintaylor.co.nz
Address for service during consent implementation and invoicing	Waste Management NZ Ltd PO Box 228, Silverdale 0944 Attention: Bruce Horide Phone: 09 427 0613 Email: bhoride@wastemanagement.co.nz

We attach copies of the application forms in Appendix A and a copy of the relevant Certificate of Titles in Appendix B. A list of all appendices is provided in Section 1.8 below.

1.3 Overview of resource consent requirements

1.3.1 Auckland Unitary Plan Operative in Part

The resource consents sought to enable the proposal are assessed in Section 8 and listed in the table below. The following may not be an exhaustive list and if further consent matters are identified post lodgement of the application, these should also be considered as forming part of the application.

Overall, resource consent is required from Auckland Council as a **non-complying activity.**

Table 1.2: Summary of resource consents required under the AUP (in order of activity status)

Rule reference / description	Activity status
E7.4.1 (A41) - New bores for purposes not otherwise specified	Controlled
E33.4.1 (A8) - Use of land for a new industrial or trade activity listed as high risk in Table E33.4.3	Controlled
E33.4.2(A12) - Discharge of contaminants from an existing or new industrial or trade activity area not listed in Table E33.4.3 where the permitted discharge standards are not met	Controlled
E7.4.1 (A28) - Diversion of groundwater caused by any excavation (including trench) or tunnel that does not meet the permitted activity standards or is not otherwise listed	Restricted discretionary
E8.4.1 (A5) Diversion and discharge of stormwater runoff from additional impervious areas greater than 5,000m^2 of road (which include road ancillary areas that are part of a road, motorway or state highway operated by a road controlling authority) or rail corridor that complies with Standard E8.6.1 and Standard E8.6.4.1	Restricted discretionary
E11.4.1 (A5) Greater than 50,000m^2 where land has a slope less than 10 degrees outside the Sediment Control Protection Area	Restricted discretionary
E11.4.1 (A8) Land disturbance greater than 2,500m² where the land has a slope equal to or greater than 10 degrees	Restricted discretionary
E12.4.1 (A6) Greater than 2,500m² of land disturbance	Restricted discretionary
E12.4.1 (A10) Greater than 2,500m³ of land disturbance	Restricted discretionary
E15.4.1 (A10) Vegetation alteration or removal, including cumulative removal on a site over a 10-year period, of greater than 250m² of indigenous vegetation that: (a) is contiguous vegetation on a site or sites existing on 30 September 2013; and (b) is outside the rural urban boundary	Restricted discretionary
E15.4.1 (A12) Vegetation alteration or removal of any vegetation within a Natural Stream Management Areas Overlay	Restricted discretionary
E15.4.1 (A17) Vegetation alteration or removal within 10m of rural streams in the Rural – Rural Production Zone and Rural – Mixed Rural Zone	Restricted discretionary
E15.4.1 (A18) Vegetation alteration or removal within 20m of a natural wetland, in the bed of a river or stream (permanent or intermittent), or lake	Restricted discretionary
E36.4.1(A37) All other new structures and buildings within the 1% AEP floodplain	Restricted discretionary
E36.4.1 (A41) Diverting the entry or exit point, piping or reducing the capacity of any part of an overland flow path	Restricted discretionary
E36.4.1 (A42) Any buildings or other structures, including retaining walls (but excluding permitted fences and walls) located within or over an overland flow path	Restricted discretionary
E36.4.1 (A56) Infrastructure in overland flow paths not otherwise provided for	Restricted discretionary
E3.4.1 (A19) Diversion of a river or stream to a new course and associated disturbance and sediment discharge	Discretionary
E3.4.1 (A33) Culverts or fords more than 30m in length when measured parallel to the direction of water flow outside of an overlay	Discretionary

Rule reference / description	Activity status
E4.4.1(A15) Discharge of water or contaminants (including washwater) onto or into land and/or into water not complying with the relevant standards or not otherwise provided for by a rule in the Plan	Discretionary
E7.4.1 (A26) Take and use of groundwater	Discretionary
E8.4.1 (A10) All other diversion and discharge of stormwater runoff from impervious areas not otherwise provided for	Discretionary
E14.4.1 (A54) Combustion activity not meeting the permitted, controlled or restricted discretionary standards	Discretionary
E26.2.3.1 (A63) Other electricity generating facilities	Discretionary
E31.4.1(A7) Hazardous facilities that store or use hazardous substances above the specified thresholds for controlled activity and restricted discretionary activity status in the activity tables or are not otherwise provided for	Discretionary
E33.4.1 (A9) Any activity in this table that does not meet the relevant permitted or controlled land use standards	Discretionary
E33.4.2 (A24) Discharge of contaminants from a new industrial or trade activity area listed as high risk in Table 33.4.3	Discretionary
E3.4.1 (A33) Culverts or fords more than 30 m in length when measured parallel to the direction of water flow within an overlay	Non-complying
E3.4.1 (A49) New reclamation or drainage, including filling over a piped stream	Non-complying
E13.4.1 (A9) Discharges from new landfills	Non-complying
E14.4.1 (A160) Discharges to air from new landfills	Non-complying
H19.8.1 (A67) Landfill in the Rural Production Zone	Non-complying

1.4 Bundling

As the landfill and associated activities will operate as one integrated site, and all components of the landfill operations that require consent are interconnected, it is appropriate that the consents are bundled for the application and assessment purposes and that an overall assessment of the application is made as a **non-complying activity**.

1.5 Consent duration

Land-use consents are sought in perpetuity. A term of 35 years is sought for all other (ie regional) resource consents.

1.6 Lapse date

The default period of five years is sought as the lapse period for the consents.

1.7 Notification

Section 95A of the RMA is relevant when a consent authority is considering whether a consent application should be considered with or without public notification.

The applicant requests that the application be publicly notified. In accordance with section 95A(2)(a) and 95A(3)(a), public notification is therefore mandatory.

1.8 Report structure

The purpose of this AEE is to describe the proposed works associated with the development and operation of the Auckland Regional Landfill in the Wayby Valley and to assess the potential effects on the environment from the construction and operation of the landfill facility. The report also assesses the landfill against the relevant statutory documents.

Table 1.3 below outlines the structure of this report, including the associated technical reports and drawings.

Table 1.3: Report structure

Auckland Regional Landfill – Assessment of Effects on the Environment		
Volume 1	**Assessment of Effects on the Environment**	
	Appendix A	Resource consent application forms
	Appendix B	Certificates of title
	Appendix C	AEE drawing set
	Appendix D	Site selection report
	Appendix E	Consultation documentation
	Appendix F	Assessment of objectives and policies
	Appendix G	Proposed key conditions of consent
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2 Legal and policy framework for waste

2.1 Legislation

In New Zealand, waste management and minimisation is primarily managed by the following three Acts:

- Waste Minimisation Act 2008 - the objective of the Waste Minimisation Act 2008 (WMA) is to encourage a reduction in the amount of waste New Zealanders generate and dispose of. It aims to lessen the environmental harm of waste as well as encouraging better use of materials throughout the product life cycle through a legislative framework which includes product stewardship, offences and enforcement powers, and reporting and auditing requirements. Of particular relevance to the Auckland Regional Landfill project are the waste disposal levy and the requirement for Waste Minimisation and Management Plans (WMMP) to be developed by local authorities.
- Local Government Act 2002 – the Local Government Act 2002 empowers Councils to promote the wellbeing of communities. Solid waste collection and disposal is identified as a core service to be considered by a local authority.
- Resource Management Act 1991 – the RMA is New Zealand's primary environmental legislation and provides a framework for managing the effects of activities on the environment.

Much of the existing central and local government waste legislation and aspirational future waste policies focus on the minimisation of waste to landfill and the adoption of a circular economy. The three principles of a circular economy are to design out waste and pollution, keep materials and products in use, and regenerate natural systems. To achieve waste minimisation or a circular economy, more efficient ways to reduce, reuse and recycle must be adopted. Waste management facilities, and in particular refuse transfer stations and resource recovery facilities, play an important role in achieving a reduction in waste and will affect the nature and amount of residual waste going to landfill. However, despite measures to reduce waste generation, for the foreseeable future there will be demand for landfill capacity for the disposal of residual waste which cannot be diverted.

Falling out of these pieces of legislation are a number of policy documents, tools and strategies that help to deliver on these pieces of legislation as it directly applies to waste. These are set out in the sections that follow below.

2.2 National framework

2.2.1 The New Zealand Waste Strategy

The revised New Zealand Waste Strategy, published in 2010, sets out the Government's long term priorities for waste management and minimisation. The Strategy's two goals provide direction to local government, businesses (including the waste industry), and communities on where to focus their efforts in order to deliver environmental, social and economic benefits to all New Zealanders. The goals are:

- Reducing the harmful effects of waste; and
- Improving the efficiency of resource use.

Modern Class 1 landfills[2] are designed and managed using leachate collection systems, engineered liners, and systems for recovering landfill gas. As such, combining waste disposal into large well designed regional landfill facilities is the best available option for reducing harm to the environment from the disposal of residual waste.

2.2.2 Waste disposal levy

The WMA places a levy on all waste disposal to landfills that accept municipal waste (i.e. Class 1 landfills). The levy is collected by the landfill operator from the producer of waste and is paid to the Secretary for the Environment. Fifty percent of the levy funds are distributed by the Secretary for the Environment to territorial authorities for spending on waste minimisation initiatives, as outlined in their individual WMMPs. The remainder, less administration costs, goes into a contestable fund for allocation to waste minimisation projects. The WMA requires landfill operators to report on waste streams/quantities to improve information on waste minimisation. It also ensures producers, brand owners, importers, retailers, consumers and others take responsibility for the environmental effects of their products through product stewardship schemes.

As a landfill operator, WMNZ is legally obliged to carry out requirements set by the Waste Minimisation Act, and collects and pays the levy on all relevant waste which arrives at the Auckland Regional Landfill.

2.2.3 Waste Minimisation and Management Plans

The WMA also requires territorial authorities to prepare and update WMMPs. The plans have to be reviewed every six years. Requirements for WMMPs are set out in sections 43 and 44 of the WMA.

WMMPs must have:

- Objectives, policies and methods for achieving effective and efficient waste minimisation and management within the district.
- Information regarding funding for implementation of the plan (including how territorial authorities intend to use allocated waste disposal levy money).

When preparing, amending or revoking a plan, territorial authorities must also:

- Consider the waste hierarchy – reduction, reuse, recycling, recovery, treatment, and disposal. Landfills are part of the 'disposal' stage of the hierarchy, capturing residual waste, and are a critical component of the waste hierarchy.
- Have regard to The New Zealand Waste Strategy and a territorial authority's most recent waste assessment.
- Publicly consult on the WMMP.

Auckland Council's WMMP is the relevant plan for this project, and is discussed below.

2.3 Regional Framework

2.3.1 Auckland Waste Management and Minimisation Plan

Auckland Council published a new Auckland-wide WMMP in 2018. It confirms and continues the vision of achieving zero waste as set out in the first plan which was released in 2012. The WMMP

[2] Landfill classes are defined in the Technical Guidelines for Disposal to Land, WasteMINZ (2018)

aims to achieve this goal by helping people in the Auckland Region minimise their waste and create economic opportunities from the reduction in waste.

The WMMP identifies a number of short to medium term actions that aim to give effect to the Council's strategic direction and to support central government legislation. The aim is for these actions to change behaviour, create efficiencies in waste management, and result in a significant reduction in waste per capita.

While Auckland's population is forecast to grow significantly, waste minimisation programmes aim to significantly reduce the proportion of waste sent to landfill.

One of the guiding principles identified under Māori priorities in the WMMP is protection of Papatūānuku, the land, including a stated objective of no new landfills. While Auckland could choose to truck waste outside of Auckland boundaries to achieve this objective, this does not remove the issue of needing to have waste infrastructure within the region or of the requirement to dispose of residual waste safely. Auckland Region is by far the largest producer of waste in New Zealand and requires waste infrastructure, including safe and secure landfill disposal facilities. Further, trucking waste outside of the region conflicts with other strategic policies and objectives of the AUP and other local and central government policies, which seek to, amongst other things, minimise vehicle emissions, reduce trip generation and manage climate change.

The WMMP is of importance to WMNZ and the Auckland Regional Landfill project as it sets a strategic and policy directive to reduce waste to landfill and that goal relies on the private sector and landfill operators to support the achievement of the goal. As identified in the WMMP, Auckland Council only controls approximately 20 % of the waste stream in Auckland, the remainder is managed by companies such as WMNZ.

WMNZ is committed to the goal of reduce, reuse and recycle and has facilities and services set up to assist the Auckland Council in achieving its goal of a reduction of waste to landfill. In particular, WMNZ's refuse transfer stations and materials recovery facilities contribute to reducing volumes going to landfill.

While the aspirational target of achieving zero waste is supported by WMNZ, the steps to achieve this will require significant local, national and international measures to be applied and these will take some time to take effect. WMNZ's view is that Auckland Council's aspirational goal of Zero waste by 2040 will be extremely difficult given the increasing population of Auckland, which is likely to counteract reductions in waste generation on a per-person basis. In the interim, it is critical that there are appropriate waste facilities to ensure the safe and environmentally secure disposal of this waste.

2.4 Climate change

2.4.1 Climate Change Response Act 2002

2.4.1.1 Introduction

The Climate Change Response Act 2002 puts in place a legal framework to enable New Zealand to meet its international obligations under the United Nations Framework Convention on Climate Change and the Kyoto Protocol.

There are seven regulations and four orders under this Act covering a broad scope of technical regulations, including the legal framework for New Zealand's Emissions Trading Scheme (ETS). Of particular relevance to the Auckland Regional Landfill project are regulations relating to forestry and waste.

2.4.1.2 Deforestation and the Emissions Trading Scheme

The ETS is the Government's principal policy response to climate change. Its objective is to support and encourage global efforts to reduce greenhouse gas emissions by:

- Assisting New Zealand to meet its international obligations; and
- Reducing New Zealand's net emissions below business as usual levels.

The ETS puts a price on greenhouse gas emissions. This price on emissions is intended to create a financial incentive for businesses to invest in technologies and practices that reduce emissions. It also encourages forest planting by allowing eligible foresters to earn New Zealand emission units (NZUs) as their trees grow and absorb carbon dioxide.

Under section 195 of the Climate Change Response Act, the status of forestry land affected by the ETS must be recorded in notices registered on the land title. Deforestation has a specific definition in the ETS. Owners of pre-1990 forest land face financial obligations under the ETS if they deforest. Land is considered deforested when forest is cleared and the land is no longer used for forestry.

The area where the landfill footprint will be located is currently part of a wider plantation forestry area. In order to develop the landfill, this area will need to be harvested and cleared and will be retired from forestry. In order to off-set this loss of forestry, new forestry areas will be established within the wider WMNZ landholdings.

2.4.1.3 Climate Change (Waste) regulations

The Climate Change Response Act requires landfill operators to surrender emissions units in proportion to calculated methane emissions from their landfills. Methane emissions are determined using default values or calculations based on waste composition and capture and destruction of methane (by flaring or energy production). Emissions are accounted for in the year that the waste is received at the landfill. Emissions from closed landfills and legacy emissions from operating landfills are not included in the ETS. WMNZ will be responsible for paying all obligations for emissions from the landfill. It is noted that WMNZ currently report capturing and destroying 90% of landfill gas (LFG) at Redvale Landfill.

2.4.2 Auckland Council Low Carbon Strategic Action Plan

Auckland Council released their Low Carbon Strategic Action Plan (Action Plan) in July 2014, which sets out a 30 year pathway for achieving an 'eco-economy'. It includes a 10 year plan for working towards this goal. The Action Plan identifies key focus areas: travel, energy use and generation, built environment and green infrastructure, zero waste, forestry, agriculture and natural carbon assets.

One stated action for the next 10 years is to issue no new landfill consents in Auckland unless there are no alternatives, as part of the drive towards zero waste. It is unlikely that new landfill consents will have any correlation to the generation of waste, as a landfill is not a source of waste, rather it provides a secure disposal site for waste generated by others. Further, whilst no landfills may be the ultimate goal for the Auckland Region, there will be ongoing demand for a landfill for the short to mid-term. There are currently no viable alternatives to landfill available for disposal of large quantities of waste in the Auckland Region (discussed further in Section 3.5). Trucking Auckland's waste out of the region will arguably have greater climate change effects than providing a well-designed landfill within the region, with highly efficient landfill gas capture technology. Further to this, trucking waste across Auckland (north to south) will increase congestion with a corresponding increase in emissions. Due to long lead times required to develop landfill capacity, it is critically important to proactively safeguard provision of landfill capacity for the region.

Another stated objective of the Action Plan is to develop Auckland's low carbon energy options, including waste to energy conversions. The goal is to achieve 90 % of electricity supply from renewable sources by 2040.

Auckland landfills currently have capacity to generate 19 MW of renewable energy, which is exported into the local grid. WMNZ understands that the existing landfill energy centres are currently the largest source of renewable energy generation in the Auckland Region and the largest generator of renewable energy from biogas in New Zealand, however, this is not recognised in the Action Plan. The Auckland Regional Landfill will include a Renewable Energy Centre, which will capture landfill gas from the landfill and utilise it to generate energy, providing a renewable electricity supply ("Embedded Generation").

2.4.3 National Policy Statement for Renewable Electricity Generation 2011

The National Policy Statement for Renewable Electricity Generation 2011 (NPSREG) recognises the importance of renewable energy and has been developed to assist with achieving the Government's target of 90 per cent of electricity from renewable sources by 2025. The NPSREG promotes a more consistent approach to balancing the competing values associated with the development of New Zealand's renewable energy resources when consent authorities make decisions on resource consent applications.

Landfill gas is a product of biomass and as such is a recognised source of renewable energy. WMNZ's current landfills are major contributors to renewable electricity supply in the Auckland Region, and the renewable energy facility to be provided as part of this project will increase the contribution into the local grid.

3 Waste in the Auckland Region

3.1 Waste sources and trends

Waste in the Auckland Region comes in many forms and from various sources. Municipal Solid Waste can typically be categorised into residential, commercial and industrial, construction and demolition, and special wastes. Auckland's Waste Assessment 2017[3] identified the following trends in Auckland:

- Commercial waste to landfill is rising faster than Gross Domestic Profit (GDP), largely due to a spike in construction and demolition (C&D) waste[4]. A 40 % increase in waste for the region compares to a 20 % growth in GDP between 2010 and 2016.
- Domestic waste to landfill is steady overall/declining per capita, but the amount of plastic and organic waste going to landfills has increased.
- Recycling growth has stalled.
- The most prevalent types of waste to landfill (current and forecasted) are C&D/rubble waste, plastics, timber, and organics.
- Organic waste remains a significant component of commercial and domestic waste to landfill.

Despite decreasing volumes on a per household basis, the population of the Auckland Region has historically been growing at a high growth rate, and based on this continued level of growth, it is expected by 2041 there will be 2.5 million people living within the Auckland Region. This population growth places pressure on regional infrastructure and puts greater emphasis on ensuring that the region has adequate landfill capacity to meet demand. In 2016, 1.646 million tonnes of domestic and commercial waste was sent to landfill in the Auckland region – averaging more than one tonne for every Auckland resident.

3.2 Waste pathways

Taking a high level view of the waste pathways once it is generated at the customer's site, and depending on the type of waste, waste is:

- Collected at the customer's property and hauled direct to landfill;
- Collected at the customer's property and hauled to a transfer station / resource recovery facility where as much as is technically feasible is recovered for reuse or recycling before the remaining "residual waste" is consolidated and hauled to a disposal site, such as a landfill; or
- Delivered to a transfer station / resource recovery facility or direct to landfill by the customer themselves instead of by a collection contractor.

Refuse transfer stations and resource recovery facilities play a key role in the recovery of valuable resources from the waste stream and the reduction of residual waste to landfill. Unless the customer elects to undertake recycling and recovery on their own site prior to collection, a transfer station / resource recovery centre is the only opportunity once waste has been generated to reduce / recover waste prior to disposal at the landfill.

[3] Auckland's Waste Assessment 2017 (Auckland Council, 2017)
[4] Auckland Council Waste Management and Minimisation Plan 2018

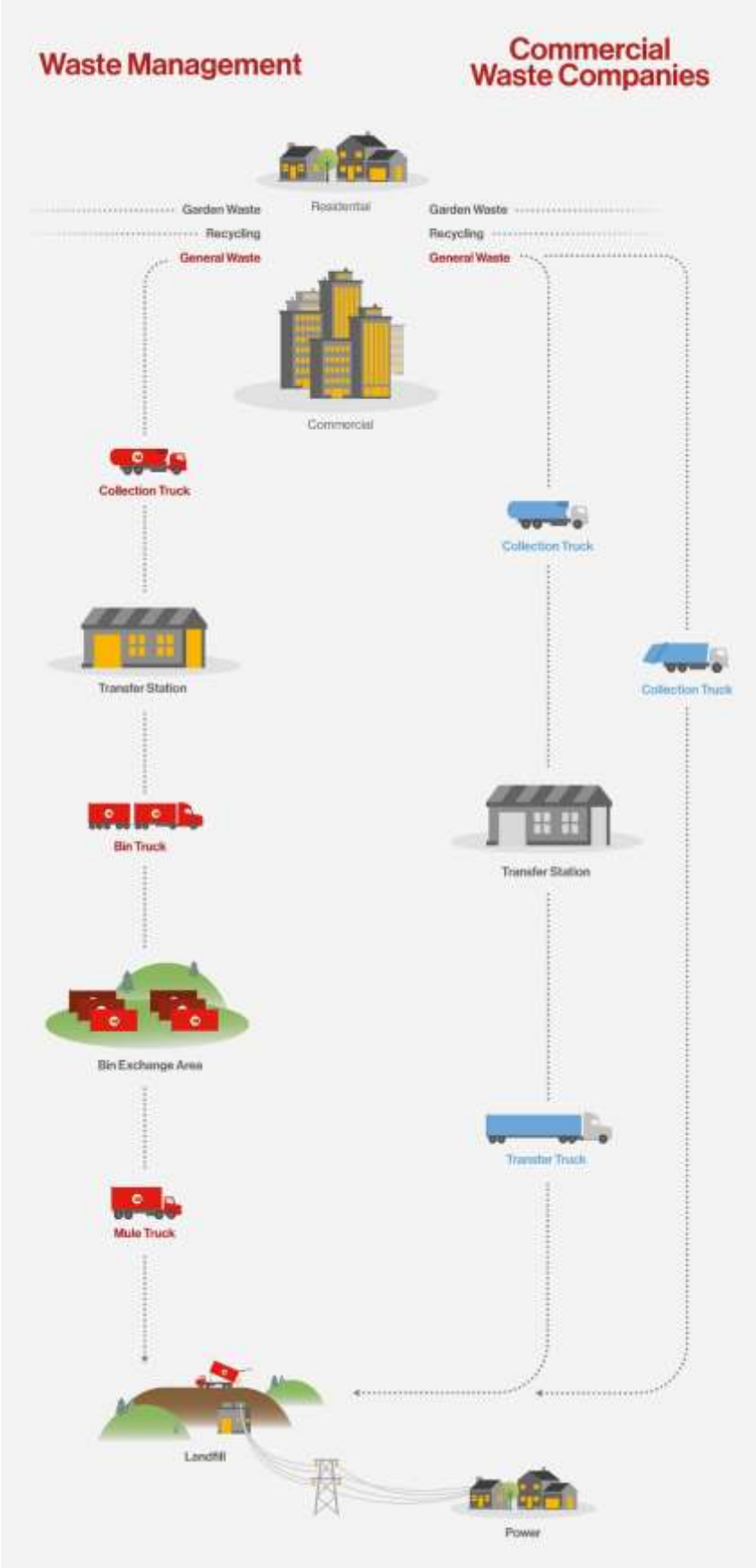


Figure 3.1: Typical waste pathways from source to landfill

3.3 Role of Landfills in the waste cycle

A Class 1 landfill is a disposal site that accepts residual municipal solid waste which has not been diverted or recycled[5]. A Class 1 landfill generally also accepts construction and demolition waste, some industrial wastes and contaminated soils. Class 1 landfills often use managed fill and cleanfill materials they accept as daily cover.

In New Zealand, a number of trends (paralleling overseas practice) have emerged in relation to Class 1 landfills. These include a tendency towards centralisation of landfill facilities and an increase in waste transfer to fewer, larger (mostly regional) facilities (WasteMINZ, 2018).

Furthermore, the introduction of the Waste Minimisation Act 2008 and the Climate Change Response Act 2002, and associated Regulations, have led to changes in waste disposal practices. There is now more waste segregation prior to landfilling and a further trend towards more specialised facilities, designed specifically for the types of fill material/waste being disposed, such as green waste facilities (WasteMINZ, 2018).

Municipal landfills are included in the definition of infrastructure in the AUP[6] as they are the final destination for municipal solid waste that cannot be recycled and are essential in the everyday functioning of a city. They contribute to the social, economic and environmental wellbeing of people and communities in Auckland and have a vital role to play in achieving sustainable management.

3.4 Existing Auckland landfills

The Auckland region currently contains two existing Class 1 landfill facilities – Redvale and Whitford. Claris Landfill is also in the Auckland Region but is not considered to be a Class 1 facility:

- **Redvale Landfill** is located to the north of Auckland's CBD. It is owned and operated by WMNZ since 1993. Redvale holds consents to continue to accept waste until 2028, at which point the landfill is scheduled to close assuming waste continues to arrive at current rates. Due to strong growth in the region, there is also the possibility that Redvale will be full before 2028. Redvale Landfill currently provides for disposal of approximately 50 % of Auckland's solid waste (Auckland's waste is estimated as 1.6 million tonnes per annum in the Auckland Council Waste Management and Minimisation Plan 2018).
- **Whitford Landfill** is to the south of Auckland's CBD and is a joint venture between WMNZ and Auckland Council (operating as Waste Disposal Services) under operational management by WMNZ. Whitford Landfill has been in operation as a Class 1 landfill since 1994 and is located in the same landholding as the Whitford Quarry, with progressive filling of the void left by quarrying activity. The landfill was re-consented in 2005, at which time it was estimated that there was 9.5 Mm^3 of remaining capacity in the landfill, to allow ongoing operation through until 2041. Depending on actual waste acceptance volumes, Whitford Landfill may also be full prior to the expiry date of 2041. The designation (ID-612 in the AUP) for the landfill restricts refuse vehicle movements to and from the landfill. While the Whitford Quarry is operating, this is limited to an average of 110 refuse trucks per day (12 month average), equating to a refuse quantity of approximately 275,000 tonnes per annum. Once the Quarry has ceased extracting rock from the site, refuse trucks will be limited to 155 per day (12 month average),

[5] Technical Guidelines for Disposal to Land (WasteMINZ, 2018)

[6] The Independent Hearings Panel accepted that municipal landfills are infrastructure, intended to serve the needs of people and activities. They have been included in the definition of 'infrastructure' in the Auckland Unitary Plan for this reason.

corresponding to a refuse quantity of approximately 350,000 tonnes per annum. This equates to just over 20 percent of Auckland's waste in 2016.

- **Claris Landfill** is an Auckland Council owned and operated landfill on Great Barrier Island, which only receives waste generated on the island.

A portion of Auckland's waste is sent outside of the region to Hampton Downs landfill, a large landfill in the north Waikato area. This site holds consents for the receipt of waste until 2030, and is consented for 30 Mm^3 of waste. Some of Auckland's waste is sent to Northland Regional (Puwera) Landfill, located in Whangarei, a partnership between Whangarei District Council and Northland Waste Limited, and operated by the Northland Regional Landfill Limited Partnership. A 2015 estimate indicated approximately 600,000 tonnes of waste generated in Auckland was disposed of outside of the region, while approximately 200,000 tonnes from outside of the region was estimated to have been disposed of within Auckland[7]. The locations of landfills servicing Auckland's waste disposal requirements are shown on Figure 1 in Appendix C.

The vast majority of Auckland's waste disposal requirements are currently serviced by Redvale in the north, Whitford in the east and Hampton Downs to the south. Once Redvale closes, a landfill to meet Auckland's waste disposal requirements is needed. As set out above, Whitford cannot serve as the replacement due to limited airspace available and restrictions on truck movements in the consents for the site. Once Whitford is full, there will be no landfill available within the mainland Auckland region, resulting in waste needing to be trucked out of the Auckland region, with associated increases in trucking distance and therefore costs and emissions associated with waste disposal. Further, this would leave Auckland in the position of relying on other regions for provision of essential infrastructure.

3.5 Alternatives to landfills in New Zealand

At the high level, an alternative solution to landfills would be zero waste. Achieving zero waste is likely to require strong political and public buy-in, and a range of measures such as:

- Legislation to force all waste to be intensively processed at source;
- Facilities to reduce residual waste to a tiny fraction of today's totals;
- Subsidies for re-processing materials;
- Legislation requiring producer take-back schemes.

An example of a facility for reducing residual waste is the Wiri Tyre Recycling facility. This facility shreds tyres and turns them into a tyre derived fuel, which can be used as a fuel for industrial processes such as cement production.

[7] Auckland's Waste Assessment 2017 (Auckland Council, 2017)

Figure 3.2: Tyre recycling at WMNZ facility in Wiri, Auckland.

Whilst a tyre recycling plant is an effective solution for tyres, it only addresses one waste type, and technologies would need to be designed, tested and implemented on a municipal scale for the full range of waste types to make a significant difference to overall waste volumes. Given that achieving wholesale changes to the existing waste cycle is likely to take significant lead-in time, in the interim, a solution of residual waste will continue to be required. There are a number of factors which tend to drive the approach used in New Zealand and internationally for waste which cannot be diverted, recycled or reused (i.e. residual waste). These include costs of establishment and operation, land availability and the management of environmental impacts.

In New Zealand, residual waste is typically disposed of to landfill with a trend towards large, high standard landfills driven by the requirements of the Resource Management Act (RMA) and economies of scale for larger operations. Many of the alternatives to landfill that have been adopted in other jurisdictions (outside New Zealand) still require some landfill capacity to dispose of residual materials including reject/unsuitable materials, pollution control residues, ash and char. There are often policy and commercial factors that favour particular approaches. For example in densely populated urban centres (for example Singapore) land availability and value can drive technologies that reduce the quantity of waste requiring disposal. Subsidies to increase the value of outputs (e.g. for energy or land applied products), landfill bans or a high waste disposal levy can also encourage alternative approaches. Policy measures banning the disposal of untreated organic waste have resulted in the pre-treatment to stabilise or remove organic waste (UK, Europe).

Advanced waste treatment approaches adopted overseas include:

- **Mechanical Biological Treatment** (MBT) involves the mechanical processing (sorting) of residual waste to capture recyclable materials such as metals or plastics followed by biological processing to stabilise degradable materials. The outputs include low grade recyclable materials, a compost-like output and unsuitable or reject material. The unsuitable/reject material is typically landfilled or processed via waste to energy. The compost-like output is typically used in applications like mine rehabilitation or landfill capping. In some cases the compost-like outputs are used as a refuse-derived fuel providing a consistent feedstock when compared with unprocessed residual waste.

MBT has been adopted where there are requirements to reduce the disposal of untreated organic waste to landfill, landfill costs are very high and there is a viable market for the stabilised organic material. (Note: at the time of writing the NSW EPA has stopped the use of compost-like output on agricultural land and has put a hold on its use in landfill and mine rehabilitation due to concerns about contaminants in the product.)

- **Mechanical heat treatment** (MHT) is similar to MBT but with heat rather than biological stabilisation of residual materials. The fate of the various outputs is similar.
- **Conventional waste to energy or mass burn incineration** (WtE) involves the burning of residual waste with a range of technologies designed to optimise the combustion process. In all cases there is significant technology (and cost) associated with managing air emissions. Outputs include bottom ash (typically 20 to 30 % of the inputs) and air pollution control residues (a small proportion, typically treated as hazardous waste requiring pre-treating prior to disposal). In theory bottom ash can be processed for use as an alternative aggregate but this relies on viable end markets. The experience in New Zealand with similar alternative aggregate products (e.g. slag from Glenbrook, recycled crushed concrete) is that developing markets require support from regulatory agencies, designers and constructors and can take an extended period of time. WtE generates carbon dioxide which is released immediately upon burning. The costs of establishing and running a waste incinerator are significant, and are likely to continue to be prohibitive in New Zealand without subsidising the energy generated from the site.
  WtE has been implemented where landfill costs are high, energy costs (revenue for the WtE operation) are high and/or there are policy measures to encourage WtE over landfilling. WtE is established in Europe, Asia and North America, in all cases alongside conventional landfill.
- **Advanced thermal treatment** (for example pyrolysis, gasification) involves treating residual waste at elevated temperatures in controlled conditions limiting air and often involving higher pressures. The general principles are similar to chemical process technologies used in petrochemical refining and chemical manufacturing but need to handle highly variable inputs as opposed to well defined feedstocks. While there are examples of these processes operating internationally they are less established at a commercial scale than conventional incineration. Outputs from these processes include energy, syngas, pyrolysis oil and char. Conceptually and depending on process design the char may be usable as a soil amendment (biochar) or activated carbon replacement but as for bottom ash these applications require development. This means there is likely to be a long lead time to develop viable markets that are ultimately uncertain.
  Advanced thermal treatment has been implemented in similar contexts to WtE. The various technologies on offer aim to address some of the limitations of conventional WtE technology. Examples include an ability to operate at a smaller scale, improved process control and targeting specific outputs (syngas, pyrolysis oil).

It is important to note that these alternative waste treatments operate in a larger waste management system that includes collections, a range of processes and a final end use or disposal option (often a landfill is still used for final by-products). Many alternative waste technologies produce potentially reusable products, for example aggregate, compost like product and low grade recyclables. However, in many cases these products end up being disposed of to landfill due to the lack of viable markets. This has an impact on the whole of system cost, potentially including the need to operate a landfill at a smaller scale and/or to handle hazardous materials such as pollution control residues from conventional incineration.

Due to the nature of many of the alternative waste disposal options such as waste to energy, they require a consistent supply of waste in order to operate. In addition, they generally seek waste materials of high calorific value (e.g. plastics). Once recycling initiatives gain momentum, the fuel source for waste to energy reduces which can make waste to energy facilities inefficient and

unsustainable, sometimes requiring subsidies to make them economically viable. In comparison, landfills do not have a required base load of waste for operation. As such, they are better able to adapt to reducing waste volumes as advances in recycling or reuse are made and to adapt to fluctuating waste volumes in parallel with economic activity cycles.

Costs of waste disposal are related to scale and technology but advanced waste treatment including conventional incineration is typically viable where landfill prices are high ($250 – 300 per tonne or higher) and/or landfill airspace is at a premium as a result of limited suitable land and/or policy controls. In New Zealand this is not the case with land available for establishing landfills (subject to required authorisations being obtained) due to relatively low population density and a legal and policy environment that focuses on ensuring that landfills are well designed, constructed and operated. Examples of policy measures that have encouraged advanced waste treatment internationally include landfill bans (UK, Europe) and landfill levies or taxes (UK, Australia – NSW, WA, VIC). In contrast, while there are numerous rules and restrictions on how landfills operate in New Zealand to ensure the environmental effects are managed, there are no bans or financial requirements that prevent their establishment or operation.

In summary, due to the significant costs, long term commitment of large waste volumes required, and different legislative settings, alternative disposal methods used in other parts of the world have not been used for any major municipal solid waste solution in New Zealand.

4 Existing environment

4.1 Location

The WMNZ landholdings are located in the Wayby Valley, approximately 70 km north of Auckland. WMNZ is proposing to develop and operate a landfill on part of the WMNZ landholdings. The project footprint is the area within the WMNZ landholdings that will be subject to any work required as part of the project. The project components are described in Section 5. The approximate location of the WMNZ landholdings is shown in Figure 4.1 below.

The proposed site entrance off State Highway 1 is approximately 6 km southeast of Wellsford and 13 km northwest of Warkworth and will be formed off the existing State Highway 1 with the construction of a roundabout. A location plan showing the WMNZ landholdings in relation to Warkworth and Wellsford is also included in the AEE Drawing Set (Appendix C).

The WMNZ landholdings are within the jurisdiction of Auckland Council and therefore are subject to the provisions of the AUP.

Figure 4.1 Location plan *Source: Land Information New Zealand*

4.2 Site description

The WMNZ landholdings cover an area of approximately 1020 ha that comprises a mixture of terrain and land use typologies, including pastoral farmland and plantation forestry. The topography of the WMNZ landholdings rises from the Hōteo River and farmland area in the west to a steep area covered with plantation forestry in the east. The WMNZ landholdings is zoned Rural Production zone in the AUP.

The WMNZ landholdings have been delineated into four areas for ease of description, based on topography and current land uses:

- The Western Block, comprising the western part of the WMNZ landholdings including Springhill Farm and including the Hōteo River along a portion of its western boundary;
- The Eastern Block[8], comprising an area of approximately 350 ha of plantation pine forestry. This area is predominantly steep ridges and valleys and includes the proposed landfill valley (Valley 1). A number of forestry access tracks run along the ridges;
- The Southern Block, comprising a strip of land between Springhill Farm to the north and the Sunnybrook Reserve to the south-east; and
- The Waiteraire Tributary Block, comprising an area of plantation forestry and native vegetation at the south eastern extent of the WMNZ landholdings.

These areas are shown in Figure 4.2 below.

[8] The Assessment of Aquatic and Terrestrial Ecological Values and Effects (Technical Report G) delineates the Eastern Block into two areas – the eastern side is described as the Waiwhiu Tributary Block, and the western side is referred to as the Eastern Bock.

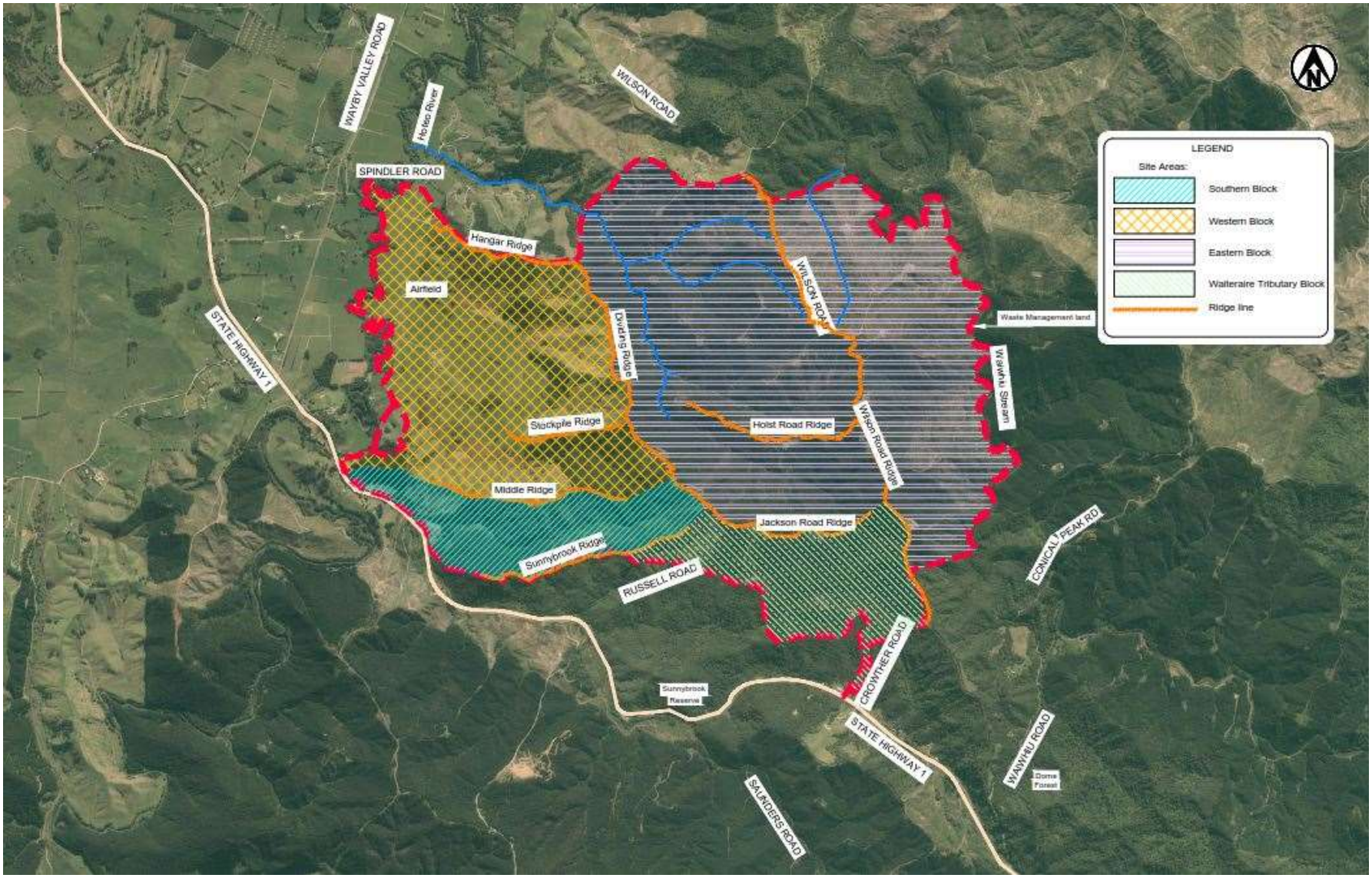


Figure 4.2: Project blocks within the WMNZ landholdings

4.3 Natural Environment

4.3.1 Topography

The WMNZ landholdings contains varying topography as described in the sections below. In general, the Western Block is dominated by the relatively flat pastoral farmland of Springhill Farm, sloping gently and then more steeply up as it moves eastward away from the Hōteo River. The Eastern Block is characterised by ridges and a number of gullies which have been deeply incised by west-north-west draining water courses that form tributaries of the Hōteo River or east draining to the Waiwhiu Stream. The south facing slopes are generally steeper than the north facing slopes. The Southern Block is delineated by two ridgelines orientated in an east-west direction, with a central valley containing a stream (AC River Number 457361) running to the west and draining into the Hōteo River via the Waiteraire Stream. The Waiteraire Tributary Block comprises a number of valley systems that generally slope to the south and west, away from the rest of the WMNZ landholdings.

4.3.2 Geology

The geology of the WMNZ landholdings is described in detail in the Geotechnical Factual and Interpretive Reports prepared by Tonkin + Taylor (Technical Reports A and B).

The project footprint is underlain by Pakiri Formation bedrock (as shown in Figure 4.3) consisting of interbedded sedimentary sandstone and siltstone with some conglomeritic layers. The bedrock is overlain by a variable thickness of residual, colluvial and landslide soil.

Some large historic landslide features have been identified as well as numerous active shallow landslips (within upper soil) within gully tributaries, appearing to coincide with spring lines. Northland Allochthon has been identified on the low rolling farmland of the Western Block.

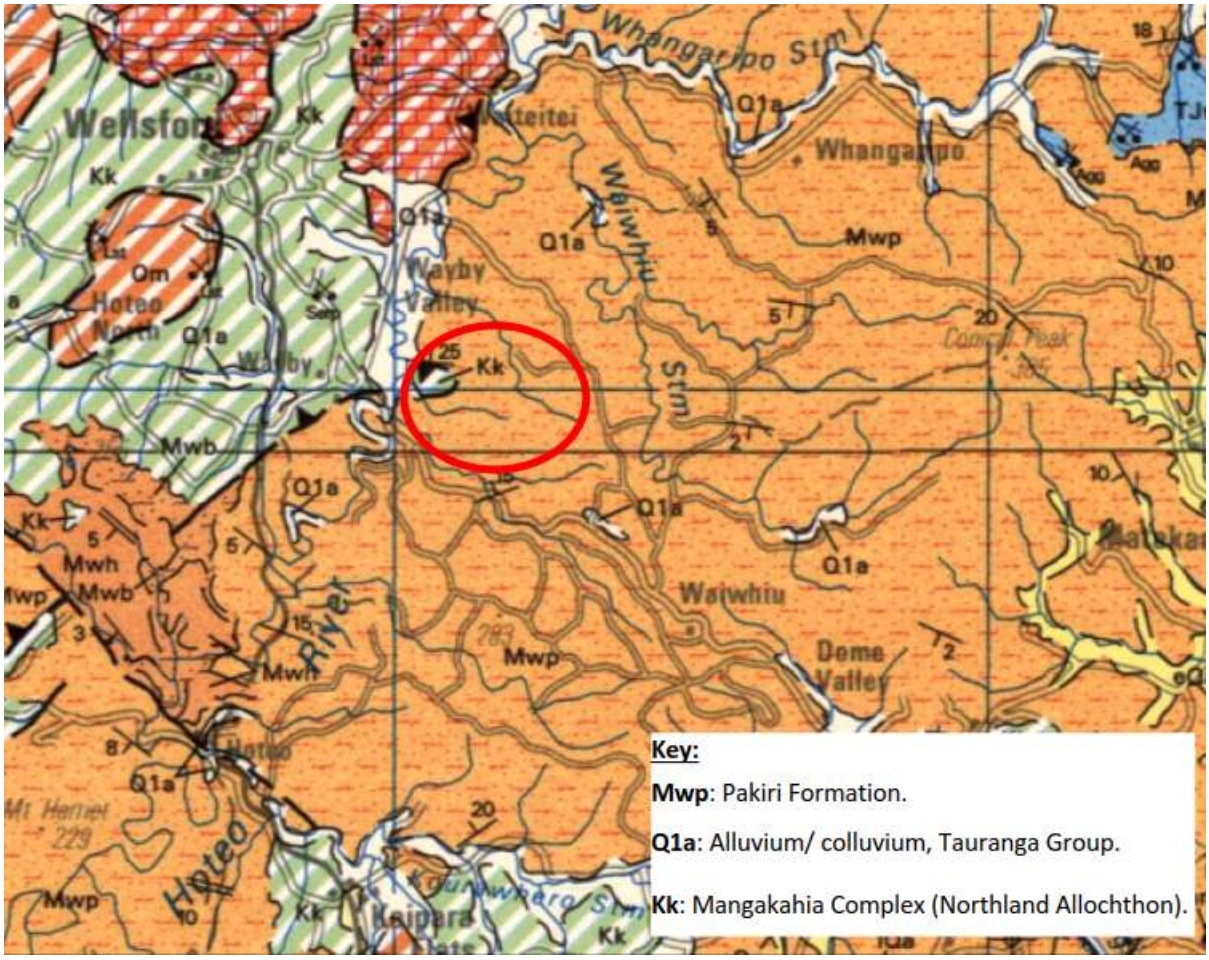


Figure 4.3: Geological setting with approximate WMNZ landholdings location in red (Source: Edbrooke, 2001)

The regional tectonic setting is described in detail in the Probabilistic Seismic Hazard Report prepared by T+T (Technical Report C), with a summary provided below.

The WMNZ landholdings are located in a low seismic hazard area relative to other parts of New Zealand. There are no active faults present within 20 km of the WMNZ landholdings according to the New Zealand Geotechnical Society (NZGS) Active Faults Database. Furthermore no fault zones have been identified by the geotechnical investigations for this project.

4.3.3 Climate

4.3.3.1 Wind

The complex topography of the WMNZ landholdings and surrounding area will create localised wind patterns. This will be most evident under low wind speed conditions, when localised winds will tend to shift to the orientation of the valleys. During calm or very low wind conditions, airflows will generally drift 'downhill', following the topography from highest to lowest elevation.

The closest meteorological station to the WMNZ landholdings is located on an elevated position with the Mahurangi Forest, approximately 3 km south of the project footprint. Winds in the local area are dominated by southerly and south-southwesterly winds, with a secondary prevalence of winds from the north-northeast (see Figure 4.4). This is broadly typical of prevailing conditions in the Auckland Region. This wind rose will understate the percentage of low wind speed and calm conditions experienced within the valleys in the area, including the landfill footprint, due to the

shelter provided in these areas by the surrounding ridgelines. A high resolution meteorological model has been developed to simulate the variability in winds across the WMNZ landholdings and wider area (Technical Report D).

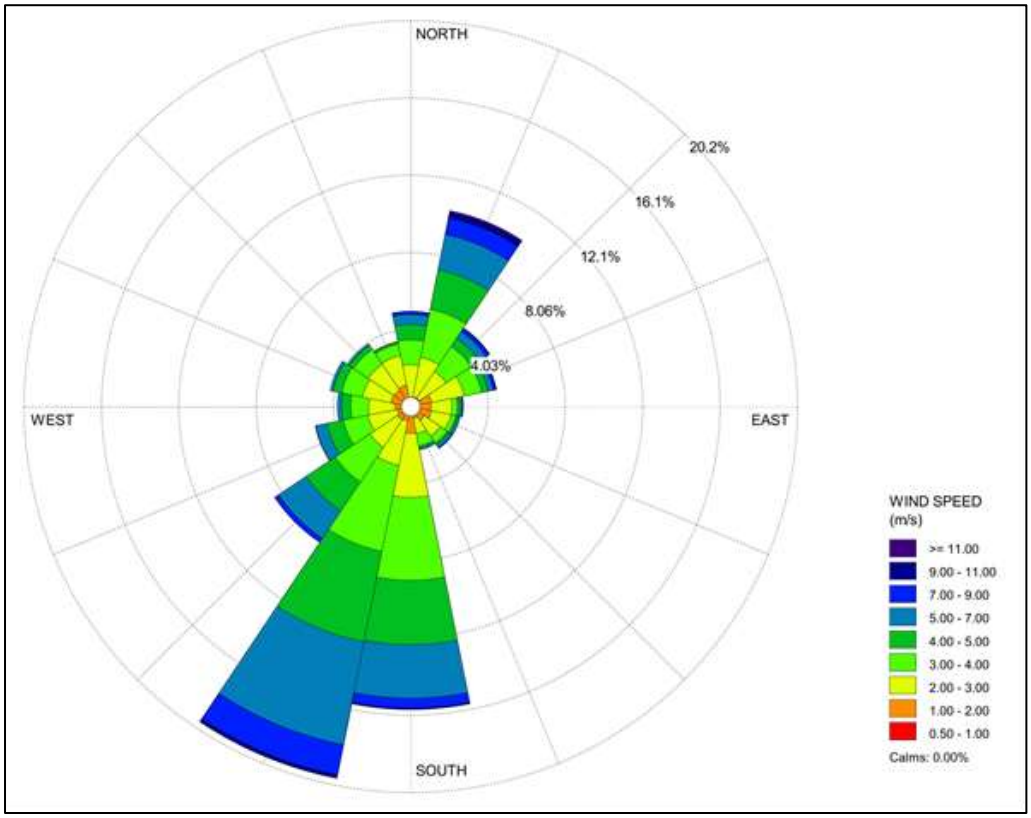


Figure 4.4: Wind rose for Mahurangi Forest Weather Station, 2014-2017 (one- hour average)

4.3.3.2 Rainfall

Meteorological data indicates that the area where the WMNZ landholdings are located experiences some of the highest rainfall in the Auckland Region, receiving on average 2000 mm per year, compared with central Auckland which experiences 1200 mm per annum. The rainfall data indicates the WMNZ landholdings receive both higher annual rainfall and longer durations at peak intensities compared to other areas in the Auckland Region.

4.3.4 Ambient air quality

As outlined in the Air Quality Assessment (Technical Report D), the current ambient air quality in the vicinity of the WMNZ landholdings is expected to be very good. There is no local air quality monitoring data, however the potential sources of air pollutants in the area include motor vehicle emissions from the surrounding roads, dust emissions from forestry, domestic heating emissions and discharges from agricultural activities. Most of these sources, apart from motor vehicle emissions on State Highway 1, are intermittent and relatively small scale and expected to be confined to within about 100 m of the source.

4.3.5 Groundwater

The hydrogeology of the Pakiri Formation, and more specifically within the WMNZ landholdings is discussed in detail in the Hydrogeological Assessment (Technical Report E), with a summary provided below.

Three groundwater systems have been identified beneath the proposed landfill valley (Valley 1) in the Eastern Block, as detailed on Table 4.1.

Table 4.1: Groundwater systems

Groundwater system	General characteristics
Shallow perched	Found at the interface of the residual soil with the highly weathered Pakiri Formation. Contributes baseflow to streams.
Upper Pakiri Formation	Found in the higher elevations of the Pakiri Formation around Valley 1. Horizontal flow along fracture zones and bedding planes, feeds seeps on the valley walls and springs near the floor.
Regional groundwater	Encountered at significant depth beneath Valley 1. Is estimated to have a gentle flow predominantly toward the Hōteo River. Flow could also occur to the south toward the Waiteraire Stream.

The regional groundwater is located at a significant depth below the WMNZ landholdings, separated from shallow groundwater by low permeability unweathered bed rock.

Both the manual and continuous readings indicate that depth to shallow groundwater is greater along the ridgelines becoming shallower towards the base of the gullies. Flows within the project footprint are expected to closely follow the topography of the land, in steep gradients as groundwater flows towards the low ground and shallower gradients at the base of Valley 1 and within the flat areas on the Western Block.

Fracture zones have been identified in the bedrock that will influence groundwater flow direction. Within these fractured areas groundwater is expected to flow through fractures and follow the natural dip of the rock bedding, resulting in variable groundwater flows.

There is a variable presence of perched groundwater in the upper highly weathered, residual and landslide soil layers of the Pakiri Formation. Perched groundwater is expected to be encountered across the majority of the WMNZ landholdings and is more likely to be encountered in the residual soils above the interface with the highly weathered Pakiri Formation.

Groundwater within the WMNZ landholdings is generally free from contamination and is akin to naturally occurring conditions. There are some metals (i.e. copper and zinc) present in the groundwater that appear to be naturally occurring and have been found to be above relevant guidelines.

4.3.6 Surface water

4.3.6.1 Surface water quality

Sampling of surface water quality throughout the WMNZ landholdings has been undertaken and is described in the Water Quality Baseline Monitoring Report (Technical Report F). Most water quality parameters are consistent with what would typically be expected for the WMNZ landholdings' current plantation forestry and sheep farming land uses. Ammoniacal nitrogen and pH appear to be reasonably stable over time. The streams within the WMNZ landholdings are generally small and clear running, with silty sediments overlaying hard beds. However at times of increased rainfall the suspended solids level can rise rapidly as a result of the silt being stirred up from the stream bed and being washed down from the edges of the streams. Overall, water quality within the WMNZ landholdings is generally good compared to the relevant guidelines and comparable to similar streams in the area.

4.3.6.2 Surface water catchments

A detailed description of the surface water catchments within the WMNZ landholdings can be found within the Assessment of Aquatic and Terrestrial Ecological Values and Effects (Ecology Report) (Technical Report G). A summary is provided below.

In general the WMNZ landholdings contain a number of intermittent and permanent streams and tributaries including the Waiwhiu Stream and Waiteraire Stream. All watercourses within the WMNZ landholdings are tributaries of the Hōteo River. The WMNZ landholdings include several surface water catchments, or parts thereof, and these are discussed below. The names being used for the purposes of this project for the surface water catchments and the ridgelines are shown in Figure 3 (Appendix C).

The Western Block contains a number of intermittent and permanent streams with headwaters along the Dividing Ridge, which separates the Western Block from the Eastern Block. Waterways within the Western Block generally flow in a westerly direction through rolling pasture before discharging into the Hōteo River. The Hōteo River is recognised as a Natural Stream Management Area (NSMA) and an Outstanding Natural Feature (ONF) along the western edge of the WMNZ landholdings. Two wetland areas are located along these waterways, which are recognised as Significant Ecological Areas (SEAs) and Wetland Management Areas (WMAs) as described in Section 4.3.8.2 below.

The Eastern Block is divided into two distinct catchments by Wilson Road Ridge, both of which are characterised by steep gully systems and exotic pine forest. To the east of Wilson Road Ridge, waterways discharge into the Waiwhiu Stream which flows to the north and eventually into the Hōteo River. To the west of Wilson Road Ridge are a number of valleys including Valley 1. The waterways within these valleys flow generally to the north-west before discharging into the Hōteo River just outside of the WMNZ landholdings.

The Southern Block is dominated by one steep gully system with an approximate catchment area of 0.85 km^2. The waterway within this gully (AC River Number 457361) is a tributary of the Waiteraire Stream and is identified as a NSMA in the lower reaches. The Waiteraire Stream discharges into the Hōteo River at the south western extent of the WMNZ landholdings. Riparian vegetation along the Waiteraire Stream is identified as an SEA at its most downstream extent.

The Waiteraire Tributary Block contains a number of steep gullies with streams that mostly flow to the south and west. These flow through the Sunnybrook Reserve and into the Waiteraire Stream which eventually discharges to the Hōteo River as described above.

In regard to flooding, while there is existing flooding within the Hōteo Catchment there are no known published effects on any dwellings within the catchment. Flooding does however restrict access to properties at times and can cause flooding of sections of State Highway 1.

4.3.6.3 Hōteo River

All watercourses within the WMNZ landholdings are tributaries of the Hōteo River. The main channel of the Hōteo River is adjacent to the western boundary of the WMNZ landholdings with the river flowing in a southerly direction towards the Kaipara Harbour. A photograph showing a section of the Hōteo River is included as Figure 4.5 below.

The Hōteo River is identified as a Natural Stream Management Area (NSMA), Significant Ecological Area (SEA) and an Outstanding Natural Feature (ONF) in the AUP. The Hōteo is also a significant cultural taonga for mana whenua and is subject to a Statutory Acknowledgement provided under the Ngāti Manuhiri Claims Settlement Act 2012 (see below). The Hōteo River ultimately flows in to the Kaipara Harbour approximately 30 km downstream of the WMNZ landholdings. The Hōteo River mouth is identified as a marine SEA in the AUP.

In 2014 Auckland Council commissioned an Environment and Socio-economic Review of the Hōteo River Catchment[9]. The Hōteo River has been identified as a priority due to the threat posed by river sedimentation to the snapper breeding ground in the Kaipara Harbour. This study reported the water quality within the Hōteo River as 'good' in 2016, and 'poor' in 2015 and 2013. The 'poor' result was due to increased turbidity and phosphorus levels measured in the river.

Watercare have consent to take water from the Hōteo River upstream of the WMNZ landholdings, to the north of Wilson Road, to supply potable water for Wellsford.

Figure 4.5: Hōteo River

4.3.6.4 Statutory acknowledgement of Ngāti Manuhiri with the Hōteo River

A statutory acknowledgement is an acknowledgement by the Crown that recognises the mana of a tangata whenua group in relation to specified areas. In particular statutory acknowledgements recognise the cultural, spiritual, historical and traditional associations with an area. Te Awa Hōteo (the Hōteo River) was an important traditional resource of Ngāti Manuhiri, and it remains a water body of major cultural, spiritual and historic significance to the iwi. It is subject to a statutory acknowledgement as part of the Ngāti Manuhiri Deed of Settlement with the Crown.

In addition to that statutory acknowledgement, other iwi authorities and hapu claim an association with the river too. These overlapping interests are described in Section 12 of this AEE.

4.3.7 Stream ecology

The ecology of streams within the WMNZ landholdings has been described in detail in the Water Quality Baseline Monitoring Report (Technical Report F) as well as the Ecology Report (Technical

[9] Auckland Council, Hōteo River Catchment: Environment and Socio-economic Review, Technical Report 2014/021, August 2014.

Report G). A summary is provided below. As part of these reports, extensive site walkovers were undertaken to classify and assess stream extents, determine stream habitat types and undertake Stream Ecological Valuations (SEVs). Freshwater systems across the WMNZ landholdings are generally considered to be of high ecological value, particularly those within the Eastern and Southern Blocks.

Within the Southern Block the NSMA has the highest SEV value, a function of its relatively intact native riparian margins and natural stream channel. Despite the presence of exotic plantation forestry, streams within the Eastern Block have high ecological value as demonstrated by biotic indices. It is expected that during forestry activities these ecological values would decrease for a period of time until the stream systems recover. While the Western Block has been modified and subject to degradation through agricultural land use, the biodiversity values within these streams are still moderate and the headwaters in particular have high potential for enhancement. The Waiteraire Tributary Block contains an unnamed tributary (the WV Stream in this application) which flows to the south, into the Sunnybrook Reserve and a NSMA.

In regard to freshwater fauna, the fish recorded at each fishing site generally reflect species recorded in nearby catchments except that no Cran's Bully were found. Species recorded within the WMNZ landholdings include, longfin and shortfin eels, banded kōkapu, inanga, various bullies and kōura.

4.3.8 Terrestrial ecology

4.3.8.1 Habitat types

The terrestrial ecology of the WMNZ landholdings has been described in detail in the Ecology Report (Technical Report G). A summary is provided below.

Terrestrial ecology across the WMNZ landholdings is broadly categorised into three habitat types:

- Exotic forest covers approximately 729 ha of the WMNZ landholdings, mostly located within the Eastern Block and Waiteraire Tributary Block;
- Pasture covers approximately 213 ha and dominates the Western Block; and
- Native habitats cover approximately 135 ha of the WMNZ landholdings and include 11 distinct native habitat types.

4.3.8.2 Wetlands

Two large wetlands within the Western Block are identified as SEAs under the AUP, referred to within this report as Wayby Wetland South (SEA_T_629) and Wayby Wetland North (SEA_T_6456). These two wetlands are also identified as Wetland Management Areas (WEA) 159 and 164 under the AUP. A photo of Wayby Wetland South is included in Figure 4.6 below. At the head of Wayby Wetland North is another SEA (SEA_T_6850), which is a 3.2 ha area of wetland dominated by wīwī, with headwaters consisting of kahikatea forest. This wetland has been degraded by stock access and pampas is present in low abundance.

These wetlands are of ecological significance and contain areas of threatened vegetation habitats including flaxlands and raupō reedlands. No project works are proposed in the vicinity of these wetlands.

Figure 4.6: Photo looking east showing Wayby Wetland South

The wetland vegetation types present across the WMNZ landholdings include 7.1 ha of Raupō reedland, 0.6 ha of flaxland, 4.4 ha of mānuka, tangle fern scrub/fernland, and 4.4 ha of exotic wetland. The majority of these wetlands, including all SEA wetlands, are avoided by the project footprint, with the exception of 0.85 ha of native wetlands (non-SEA) and 0.48 ha of exotic dominated wetlands which are within the project footprint.

Several nationally 'Threatened' or 'At Risk wetlands birds (Fernbird and Spotless Crake) were observed during fieldwork, and Australasian bittern, marsh crake and pied stilt are likely to be present because the habitat is suitable.

4.3.8.3 Terrestrial vegetation

The terrestrial vegetation across the WMNZ landholdings generally reflects the habitat types identified above. The native vegetation is in general considered to be of high ecological value with areas of significance including mature kahikatea and pukatea forest, taraire and tawa, podocarp forest and kauri, podocarp and broadleaved forest.

Of particular note are the presence of several forest and wetland SEAs, and the nationally threatened swamp maire (all of which are located outside of the project footprint).

4.3.8.4 Terrestrial fauna

A range of nationally 'Threatened' or 'At Risk' native fauna were identified during field surveys, including bats, birds, lizards, frogs and invertebrates. All but one of these (a Rhytid snail) are protected under the Wildlife Act 1953. Of particular note is the likely presence of two species

classified as nationally threatened (long-tailed bat and the Australian bittern) and sizeable populations of three 'At Risk' species (fernbird, spotless crake and Hochstetter's frog).

4.3.8.4.1 Bats

The project area offers potential suitable habitat for long-tailed bats (*Chalinolobus tuberculatus*), which are classified as nationally 'Threatened' (Nationally Critical). Automatic Bat Monitoring was undertaken to identify bat activity within the WMNZ landholdings. The overall level of bat activity recorded was low to moderate. The bat activity recorded within the WMNZ landholdings indicated that the project area is used for movement across the landscape and feeding/foraging, though roosting activity cannot be ruled out. At least 55 potential bat roost trees were identified within the WMNZ landholdings, but outside of the project activity areas. One particularly distinctive potential bat roost tree, an individual exotic pine tree (>20 m high and >150cm Diameter at breast height (DBH) was identified within the project footprint.

4.3.8.4.2 Birds

Twenty-six bird species (21 native and five exotic species) were observed during site walkovers. The bird assemblage in the project area is dominated by native and introduced species that are ubiquitous in agricultural landscapes or forestry landscapes. However, wetlands and native forest habitats also support the nationally 'Threatened' Australasian bittern and the 'At Risk' black shag, long-tailed cuckoo, NZ pipit, whitehead, fernbird and spotless crake. The Nationally 'Threatened' kaka and 'At Risk' kākāriki and pied stilt were not detected but may be present on site. Of particular note, a relatively high number of fernbird and spotless crake were recorded in wetland habitats within the WMNZ landholdings. Almost all of the wetland and forest habitat that support these species are located outside the project activity areas.

4.3.8.4.3 Lizards

Twenty-three skinks, including four native copper skinks and 19 exotic plague species were recorded during fieldwork. No geckos were found. The native copper skink is classified as 'Not Threatened' but it is protected under the Wildlife Act 1953. The introduced plague skink is classified as 'Not Threatened' and is not protected under the Wildlife Act.

Up to four native 'At Risk' lizard species (Pacific gecko, Auckland green gecko, forest gecko and ornate skink) are likely to be present within the WMNZ landholdings based on habitat suitability and known presence in the general area, but were not detected during field surveys. Most but not all of the forest habitat that likely supports these species is located outside the project footprint.

4.3.8.4.4 Hochstetter's frogs

Hochstetter's frogs were found within hard-bottom stream cascade complexes across the WMNZ landholdings with a total of 22 frogs found during field surveys. Several juveniles were detected, indicating a breeding population. The cascade complexes that support Hochstetter's frogs constitute around 2 to 5 % of intermittent and permanent stream length within the project footprint, with very few frogs likely to be present in other stream habitat types that are impacted by sediment and/or lack refugia. The sediment is attributed to historical land use activities associated with the clear felling of original native bush and subsequent forestry rotations. Hochstetter's frogs have also been found within indigenous and pine forest vegetation surrounding the WMNZ landholdings and are common in the wider landscape (i.e. beyond the WMNZ landholdings).

4.3.8.4.5 Invertebrates

Twenty-four rhytid snails and three peripatus were detected during fieldwork. These species are expected to be common and widespread across native and exotic forest habitats within the WMNZ

landholdings. Kauri snail were not detected during surveys despite their known presence in the surrounding area. Their presence cannot be ruled out but if they do occur the population is likely to be localised and or small.

4.3.8.4.6 Introduced mammals

A number of introduced mammals and/or introduced mammal activities were observed during field visits to the WMNZ landholdings. Observations includes possums and possum scat, substantial pig rooting and scat, and sign of goat browse, bark damage and scat. Other likely mammalian predators on the WMNZ landholdings include feral cats, rats and mustelids as would be expected in mainland New Zealand forested habitats not subject to pest control.

4.3.9 Landscape and natural character

The landscape and natural character of the WMNZ landholdings is described in detail within the Landscape and Visual Assessment (Technical Report H), with a summary provided below.

The wider landscape context is largely made up of the steep ridges and valleys of the Dome Forest. This extends to the east of the site and comprises a mosaic of forestry land uses and indigenous vegetation. The Dome Forest meets the pastoral lowlands of Matakana to the east, and Wayby Valley to the west. Much of the wider landscape is manged through forestry, although the low levels of human occupation provides some sense of remoteness throughout the wider area.

The AUP identifies one Outstanding Natural Landscape (ONL), which extends to a small extent over the WMNZ landholdings, known as Dome Forest ONL (ONL ID: 32). This ONL covers an area of Dome Forest to the south east of the WMNZ landholdings, identified as significant for being a “sizable area of steeply dissected hill country containing a sequence of prominent ridges that are covered in mature remnant forest”. The extent of the Dome Forest ONL generally follows the south eastern edge of the WMNZ landholdings, with a small amount of the ONL extending onto parts of the Eastern Block, Southern Block and Waiteraire Tributary Block (the ONL does not cover any of project footprint).

To the south west of the WMNZ landholdings, the incised meanders of the Hōteo River are identified within the AUP as the nearest Outstanding Natural Feature (ONF). This ONF (ONF ID: 49) is recognised for the deeply incised meanders of the river that flow through approximately 30 km of broken hill country to the south west of the site.

In general the WMNZ landholdings and surrounding area contains environments and habitats with varying levels of naturalness, including plantation forestry, indigenous forest, pasture, wetlands and waterways.

4.4 Human environment

4.4.1 Land uses

The WMNZ landholdings are zoned Rural Production Zone in the AUP. The human land uses within the WMNZ landholdings are generally categorised by the main habitat types identified in Section 4.3.8 above. This includes the working Springhill Farm within the Western Block, extensive plantation forestry operations within the Eastern Block and parts of the Waiteraire Tributary Block. Areas of native vegetation are also present, predominantly within the Southern Block.

Within the Springhill Farm area there are three existing dwellings as well as existing farm utility buildings and sheds. There is also a working airstrip, with associated hangar buildings. The airstrip is only available for private use and emergency services landings.

Figure 4.7: Western Block

The WMNZ landholdings comprise a number of properties. The certificates of title that make up the WMNZ landholdings are listed in Table 1.1.

The plantation forestry area, which dominates the Eastern Block, is part of a larger contiguous forestry area known as the "Dome Forest". The Eastern Block and the surrounding plantation forestry is at a similar stage of harvest cycle. This includes 15 to 25 year old exotic pine forest that is within its third harvest cycle.

4.4.2 Adjacent land uses

Areas to the northeast, east and south of the WMNZ landholdings are dominated by plantation forestry, managed by Rayonier Matariki Forests (the Dome Forest). The topography of the area is undulating, with numerous steep ridges and valleys, and forestry tracks generally constructed along ridgelines.

To the west and north-west of the WMNZ landholdings the topography flattens out, with rolling hills and land uses that are predominantly agricultural. Land use is largely dairy, beef and sheep farms, and lifestyle blocks. There are also a number of small businesses operating from properties in the surrounding area, such as Coles Chimney Specialists and Boutique Farmstay, both of which are accessed from Wayby Valley Road to the west of the WMNZ landholdings.

Approximately 3.5 km northwest of the boundary of the WMNZ landholdings is the town centre of Wellsford, with a population of approximately 2,100 residents. Wellsford is a rural service town to the surrounding area and is the northern-most township of the Auckland Region.

On the southern side of the Dome Forest is Warkworth. Warkworth is the largest rural town in the northern part of the Auckland Region and serves as a large rural catchment in the area. The population of the town is approximately 3,900 people. Warkworth serves as a gateway to many villages and beaches along the Matakana and Kōwhai Coasts. Warkworth is expected to grow significantly over the next 10-30 years, with around 1100 ha earmarked for future residential and business land development. Warkworth's population is anticipated to grow five-fold over the next three decades.

There are significant tracts of native bush within the wider area, including the Sunnybrook Scenic Reserve and the Dome Forest Stewardship Area. The Sunnybrook Scenic Reserve is located south of the WMNZ landholdings, adjoining State Highway 1. We understand that this area does not have formed tracks and is not in regular recreational use, but can be accessed by goat hunters.

Within the south-eastern extent of the Dome Forest, Te Araroa Trail and Dome Forest Walkway are popular walking routes. These are located at least 3 km from the project footprint.

4.4.3 Local economy

A description of the regional and local economy is set out in the Economic Assessment (Technical Report I).

In regard to the local economy and specifically the Rodney Local Board area, Warkworth accounts for 2,850 jobs (17.9% of Rodney's total) and Wellsford 970 jobs (5.3% of Rodney's total). The most significant employment sectors in Warkworth are retail trade, manufacturing, construction, education and training, healthcare and social assistance, and accommodation and food services. For Wellsford the most significant sectors are transport, postal and warehousing, education and training, retail trade, manufacturing, healthcare and social assistance and accommodation and food services.

4.4.4 Cultural values

4.4.4.1 Mana whenua

A number of iwi groups have mana whenua interests over the area of the site. These are identified on the Auckland Council Geomaps database as:

- Ngāti Manuhiri;
- Ngāti Whātua o Kaipara;
- Ngāti Rango
- Ngāti Wai;
- Ngāi Tai ki Tāmaki;
- Ngāti Maru;
- Ngāti Te Ata;
- Ngāti Whātua Ōrākei;
- Te Kawerau ā Maki; and
- Te Rūnanga o Ngāti Whātua;

Some of these iwi groups have a particularly strong interest in the area. In particular, Ngāti Manuhiri are most affected by the project due to being mana whenua of the area. In addition, the Hōteo is subject to a Statutory Acknowledgement provided under the Ngāti Manuhiri Claims Settlement Act 2012 as discussed in Section 4.3.6.4. Ngāti Rango and Ngāti Whatua also have a significant interest in the area due to the proximity of their marae and their long association with the area and the Kaipara Harbour.

Ngāti Manuhiri have prepared a Cultural Values Assessment which has been provided to WMNZ, identifying the cultural significance of the area to their iwi group. Ngāti Manuhiri have a stong ancestral association with the area, with much of the rohe occupied and utilised by Ngāti Manuhiri for generations, including in particular areas rich in resources found in and around waters and on land. The rohe contains the maunga tapu (sacred mountains) of Tohitohi ō Reipae (the Dome), PukemŌmore (Conical Peak), Kikitangieo, Pae Kauri, and Maunga Tamahunga.

4.4.5 Archaeology

An Archaeology Assessment has been undertaken by Maatai Taonga Ltd, provided in Technical Report K. This assessment has concluded that it is unlikely that the WMNZ were subject to Māori occupation as the soil of the area is not suitable for cultivation. There is also no evidence of surface traces of any Māori occupation. Furthermore, there are no recorded archaeological sites within the WMNZ landholdings. The land was subject to subdivisions by the Crown in the second half of the 19th century, however it is likely that this was never settled. One cottage on Springhill Farm may have been occupied pre 1900, and so potentially has archaeological value[10]. No works are proposed in the vicinity of the cottage.

4.4.6 Noise

Monitoring of background noise has been undertaken by Marshall Day as part of their Assessment of Environmental Noise Effects for this project (Technical Report L). The noise environment is typical of a rural environment with some rural industry, and is considered to be generally quiet. Noise sources vary depending on location, but the main source in the vicinity of the WMNZ landholdings is traffic noise from State Highway 1, with other noise sources including natural noise sources such as wind in forestry trees, animals and insects, as well as anthropogenic noises such as forestry operations and local traffic.

The nearest receiver to any aspect of the project footprint is located on State Highway 1, approximately 360 m north west of the proposed Bin Exchange Area. The nearest receiver to Valley 1 and the landfill footprint is located more than 1000 m south of the landfill footprint.

4.4.7 Traffic

4.4.7.1 Roading network

The roading network surrounding the WMNZ landholdings is described in the Integrated Traffic Assessment (Technical Report M). Within the WMNZ landholdings there are a number of private roads that are predominantly used for the forestry operation located in the Eastern Block. These are not available to the public.

The WMNZ landholdings have two principle existing vehicle access points off State Highway 1, one servicing the existing forestry operation and one for the existing farm and dwellings in the Western Block. A third vehicle access exists off Wilson Road into the forest to the north but it is steeper and narrower than the principal forest entry point on State Highway 1. The WMNZ landholdings currently experiences low levels of traffic movements in and out of the access ways as forestry harvesting is not occurring at this stage of the cycle and the farm traffic is minimal. The existing access points have limited sight distances and do not contain any shoulders or approach lanes.

[10] An archaeological site is defined by Heritage New Zealand Pouhere Taonga as a site where human activity occurred before 1900

State Highway 1 adjoins the WMNZ landholdings to the south west and is the key national transport route between Auckland and Whangarei. This highway passes through the Dome Valley between the townships of Warkworth and Wellsford. Within the Dome Valley it is a two-way two-lane road with two northbound and one southbound passing lane opportunities between Warkworth and Wellsford. The speed limit has been reduced here to 80 km/h due to a disproportionally high number of crashes that occur in the area.

Wayby Valley Road is located to the west of the WMNZ landholdings. This road provides a connection between State Highway 1 and Pakiri/Tomarata. It is also an alternative route to access Mangawhai that bypasses Wellsford. This is a two-lane road with a speed limit of 100 km/h. The intersection between Wayby Valley Road and State Highway 1 was upgraded in 2014 by adding right turn bays on State Highway 1 to separate turning traffic from through traffic. No access or changes to Wayby Valley Road are included as part of the project.

4.4.7.2 Dome Valley Safety Upgrades

Within the Dome Forest, State Highway 1 has an Annual Average Daily Traffic (AADT) count of 13,440 vehicles per day. The New Zealand Transport Agency (NZTA) Crash Analysis System was searched for accidents along the length of State Highway 1 from Wayby Valley Road in the north to Goatley Road in the south (representing the northern extent of the Warkworth urban area), a distance of approximately 12km. Between 2014 and 2018, a total of 82 crashes have occurred within the study area of which two resulted in fatalities, 12 resulted in serious injuries, 18 resulted in minor injuries and the remaining only resulted in damage to property. Of all crashes that were reported, 53% were head-on or where the driver lost control, 19% during overtaking, and another 16% during crossing/turning. Poor observation, poor handling and failure to keep left were the top three contributing factors to the reported crashes.

To address the identified safety issues, NZTA is currently undertaking safety improvements on a 15km stretch of State Highway 1 through the Dome Valley. These include flexible median safety barriers, wider road shoulders, new right turn bays and replacing north and south bound passing lanes with slow vehicle bays. These safety upgrades have been taken into account during the design and assessment of traffic and intersection design for the project, as discussed below.

4.4.7.3 Pūhoi to Warkworth Project

The NZTA Pūhoi to Warkworth project is currently under construction, being the first stage of the Ara Tūhono Pūhoi to Wellsford project. This project will extend Auckland's Northern Motorway from the Johnstone Hill Tunnels to a new major roundabout connecting with State Highway 1 just north of Warkworth.

4.4.7.4 Warkworth to Wellsford State Highway 1

NZTA currently has a proposal to realign State Highway 1 between Warkworth to Wellsford, which is the second stage of Ara Tūhono Pūhoi to Wellsford project. This project will ultimately extend to Te Hana. Stage one, between Pūhoi and Warkworth, is currently under construction, with an estimated completion date of late 2021. The indicative alignment of the Warkworth to Wellsford section shows the route cutting across the south-western corner of the WMNZ landholdings as depicted in Figure 4, Appendix C. It is understood that NZTA is looking to lodge the Notice of Requirement (NoR) shortly in order to secure route protection. However, there is no indication that construction will follow soon after. Because of the uncertainty around the realisation of this project, the Auckland Regional Landfill has had to be designed on the basis of access being off the existing State Highway 1. However, the design is compatible with both scenarios, so if the Warkworth to Wellsford project does proceed, there will be no adverse impacts on it from the landfill project, and equally from a

traffic perspective, the intersection design for the landfill will continue to work if the Warkworth to Wellsford project does not proceed.

5 Landfill design and operation

5.1 Introduction

This section provides an overview of the proposed waste acceptance at the landfill, the waste decomposition process and the key design features of the landfill which manage the waste and its decomposition. The project layout is shown in Appendix C. More detail on the landfill design is contained in the Engineering report (Technical Report N), and is shown on the drawings in Volume 3.

Ongoing operational and phase development activities occur from the initial accepting of waste until the final cap closure. These activities include:

- Bin exchange and internal traffic movements;
- Cell construction for each phase of the landfill, including constructing, testing and quality assuring the lining system prior to placement of waste in each cell;
- Operational earthworks and refuse placement;
- Progressive capping of completed landfill cells;
- Operational stormwater, erosion and sediment control management;
- Leachate management;
- Landfill gas management;
- Environmental mitigation activities, including enhancement planting and pest control; and
- Other ancillary activities.

5.2 Project overview and layout

The project comprises the construction of a 25.8 Mm^3 landfill to provide for the disposal of municipal solid waste, and ancillary infrastructure. The general site layout is shown on drawing ENG-01 in Volume 3. As described in section 4, the WMNZ landholdings have been divided into four general areas for ease of description; the Eastern Block, the Western Block, the Southern Block and the Waiteraire Tributary Block. The overall project layout is shown on Figures 4-5 in Appendix C.

The overall project will comprise:

- An access road from a new proposed intersection on State Highway 1 entrance to the main site, and all other roads required to access the various parts of the site;
- A bin exchange area near the entrance where road vehicles will deposit bins for site vehicles to transport them to the landfill tipping face (there is no public access to either the bin exchange area or landfill tipping face);
- Operational infrastructure such as weigh bridges and vehicle wheel wash;
- All works associated with the development of an operating landfill on the identified footprint area including;
  - Earthworks to construct the required shape;
  - Construction of a lining system to prevent leachate seepage into the surrounding environment;
  - Construction of a leachate collection system above the low permeability lining system;
  - Stormwater control around the constructed landfill and ultimate treatment of stormwater before it leaves the site;
  - A landfill gas (LFG) collection system to collect LFG from the placed waste;

- A leachate management system, including leachate storage, tanker loading facilities and leachate evaporation facilities;
- LFG treatment by flare and a LFG to energy plant;
- Provision of water supplies for operational (non-potable) and staff (potable) requirements;
- Facilities for site staff, including offices and on-site wastewater disposal from staff amenities; and
- Maintenance facilities for site plant and equipment.

5.3 Landfill footprint, design and capacity

The landfill is to be located within Valley 1 in the Eastern Block, as shown in the drawing ENG-01. The landfill footprint and design is described in detail in the Engineering Report (Technical Report N), with a summary of key details provided below.

There are two valleys on the overall site which have been identified as suitable for a landfill. These are known as Valley 1, the southernmost valley, and Valley 2, the northernmost valley. Valley 1 has been selected for landfill development at this time, primarily because it was more accessible. A discussion of alternatives considered during the project development, including valley selection, is provided in Section 10. Potential future landfill activities in Valley 2 are not within the scope of this application.

The footprint has been selected to maximise the fill potential of Valley 1. The key considerations in determining the footprint are the existing contours of the site and maintaining sufficient area downstream of the landfill for long term stormwater treatment facilities, leachate handling and other operational requirements. The final post-settlement contours are shown in the Drawing Set (Volume 3). This will provide approximately 25.8 Mm^3 total airspace.

5.4 Proposed waste acceptance

The Landfill Guidelines classify landfills into five distinct types based on the type of waste received. A Class 1 landfill (such as the one described in this application) is a site that accepts municipal solid waste. Municipal solid waste is defined in the Landfill Guidelines as follows:

> *Any non-hazardous, solid waste from household, commercial and/or industrial sources. It includes putrescible waste, garden waste, biosolids, and clinical and related waste sterilised to a standard acceptable to the Ministry of Health. All municipal solid waste should have an angle of repose of greater than five degrees and have no free liquid component.*
>
> *It is recognised that municipal solid waste is likely to contain a small proportion of hazardous waste from households and small commercial premises that standard waste screening procedures will not detect. However, this quantity should not generally exceed 200 ml/tonne or 200 g/tonne.*

Class 1 landfills generally also accept construction and demolition (C&D) waste, some stabilised or treated industrial wastes and contaminated soils. Only wastes that meet stringent waste acceptance criteria are accepted into Class 1 landfills. For waste which has potentially hazardous properties or is treated hazardous wastes, it can only be accepted if it is demonstrated to meet the waste acceptance criteria, which is based on leachability criteria to ensure that leachate does not differ

from that expected from non-hazardous municipal solid waste[11]. Table 5.1 below provides some examples of the different waste categories.

Table 5.1: Waste categories

Types of waste	Explanation/Examples
Hazardous waste	Hazardous waste (as defined in the Landfill Guidelines) will not be accepted at Auckland Regional Landfill. Hazardous waste includes: • Explosives and gases • Flammable liquids or solids, such as petrol or diesel • Substances or wastes liable to spontaneous combustion • Infectious substances • Radioactive materials
Potentially hazardous waste[12] (non-hazardous)	The terminology 'potentially hazardous' is commonly used in the waste industry but can cause confusion for those unfamiliar with the term. Potentially hazardous waste is waste that contains properties that could be hazardous or toxic, but has been confirmed as not posing a risk. Potentially hazardous waste will only be accepted at the landfill where pre-acceptance screening has determined that the waste meets the waste acceptance criteria. Examples include: • Soil or other wastes which have been tested to confirm that contaminants are present in concentrations less than the acceptable limit. • Commercial and industrial waste which has been treated to remove or immobilise hazardous characteristics, such as cement stabilised heavy metals e.g. sterilised clinical waste, waste containing metals mixed with lime so the metals are in a form that cannot be leached out. Waste which does have hazardous properties, or waste that cannot be confirmed as meeting the waste acceptance criteria, will not be accepted in the landfill.
Municipal solid waste	Auckland Regional Landfill will accept municipal waste. Due to disposal practices of the general public, the landfill Guidelines recognise that municipal waste will contain a small proportion of hazardous waste from households and small commercial premises that cannot be detected with standard waste screening procedures. For example, these items can include cleaning agents, aerosols, wax products, glues, cosmetics, medicines, batteries, lighters, paint and ink, small volumes of agrichemicals.

5.5 Waste degradation process

5.5.1 Waste by-products

Once waste is placed within a landfill, it begins to break-down, generating leachate and LFG as by-products. The following sub-sections provide an overview of these by-products and their composition, as controlling these by-products forms key considerations in the design of a landfill. It is important to note that the literature shows that natural processes within a municipal solid waste

[11] The proposed Waste Acceptance Criteria for this project are provided in full in Technical Report O.
[12] Potentially hazardouns waste is identified as a waste category in the Solid Waste Analysis Protocol (Ministry for the Environment, 2002), and http://www.mfe.govt.nz/publications/environmental-reporting/waste-generation-and-disposal-new-zealand

landfill significantly limit the leaching of heavy metals[13] and many organic compounds. As such, a significant proportion of the contaminants disposed into the landfill as part of the waste stream will remain within the landfill.

5.5.2 Leachate

Water is present within the waste mass in a landfill due to rainwater infiltrating through cover material or the active filling area, and from the waste itself. Leachate is generated when soluble components are dissolved (leached) out of the waste by percolating water. As set out in the Waste Acceptance Criteria (Technical Report O) the composition of leachate will be a function of the type and age of the waste deposited, together with the physico-chemical and biological processes and water balance in the landfill.

The main components of leachate from landfills can be grouped into four categories as follows:

- Major molecules such as calcium, magnesium, sodium, potassium, iron, ammonia, carbonate or bicarbonate, sulphate and chloride;
- Trace metals such as zinc, manganese, chromium, nickel, lead and cadmium;
- Organic compounds, usually measured as total organic carbon, chemical oxygen demand or biological oxygen demand, volatile organic carbon or semi-volatile organic carbon;
- Microbiological components.

Leachate recirculation into the landfill can offer significant benefits in maximising the retention of contaminants within the landfill. It does this by redistributing contaminants within the landfill and extending the opportunity for biodegradation or reaction and sorption to be achieved.

5.5.3 Landfill gas (LFG)

As organic waste breaks down (primarily by bacteria), LFG is produced, comprised mainly of methane and carbon dioxide and smaller amounts of odorous reduced sulphur compounds (including hydrogen sulphide). Gaseous compounds can also be present in LFG due to volatilisation from the waste or chemical reactions. Normally, less than 1% (by volume) of LFG are non-methane organic compounds (NMOCs).

Methane is highly flammable so, at the landfill itself, LFG is controlled to minimise the flammable risk by capturing and destroying the methane and other organic compounds by combustion. The controls on LFG also minimise the risk of offsite odour effects. Methane is generally not of concern for toxicity. However, some of the trace constituents in LFG (principally hydrogen sulphide) could have toxic effects if people are exposed at high enough concentrations, which is another driver for capturing and destroying LFG.

5.6 Key design features of the landfill

5.6.1 Overview

There are a number of key design features of landfills, in order to encapsulate and control the waste and by-products as the waste breaks down. Landfills are constructed as a series of phases to limit the extent of the active footprint at any time. The following subsections describe the key engineering components of the Auckland Regional Landfill, which are designed to protect

[13] The Disposal Group Solid Waste Association of North America (SWANA) Applied Research Foundation commissioned a literature review of what is known about actual heavy metal releases from landfills, and the report concluded that attenuating mechanisms occur naturally during the later stages of waste degradation in landfills

groundwater and surface water from leachate contamination and protect people from the adverse effects of landfill gas, including:

- A lining system and leachate collection system;
- Landfill cover and cap;
- Landfill gas management; and
- Surface water and stormwater management.

Key design features are shown on Figure 5.1 below. These design features are supported by a rigorous monitoring and reporting regime, along with stringent operational controls. These are described in Section 5.8.

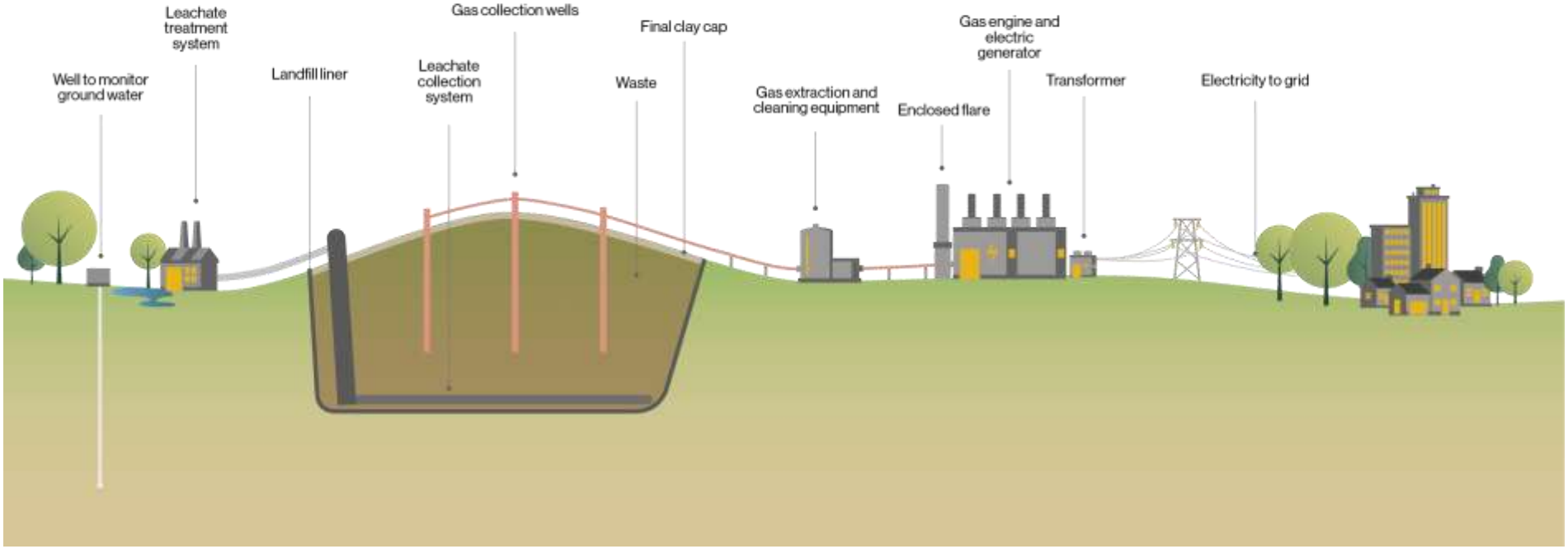


Figure 5.1: Key design features of a modern Class 1 landfill

5.6.2 Lining system

Every modern landfill in New Zealand is required to have a lining system that has the overriding aim of protecting the environment from potential contamination from the refuse. The purpose of a landfill lining system is to contain any leachate within the landfill to prevent it entering the underlying soils or groundwater. The lining system also controls the ingress of groundwater in areas where the liner system is subject to inwards hydraulic gradient. It provides a low permeability containment system on which leachate will be collected for removal from the landfill.

The design of the proposed lining system for the Auckland Regional Landfill is described in detail in the Engineering Report (Technical Report N).

The selected lining system needs to be physically robust and long lasting. A lining system is typically comprised of multiple layers, to provide appropriate contingency. As the landfill will be a Class 1 landfill in accordance with the Landfill Guidelines, the liner system will be either a 'Type 1' or 'Type 2' lining system as discussed in the Engineering Report. Both lining types are considered to provide appropriate encapsulation. A schematic cross-section of a Type 2 lining system is shown below (Figure 5.2).

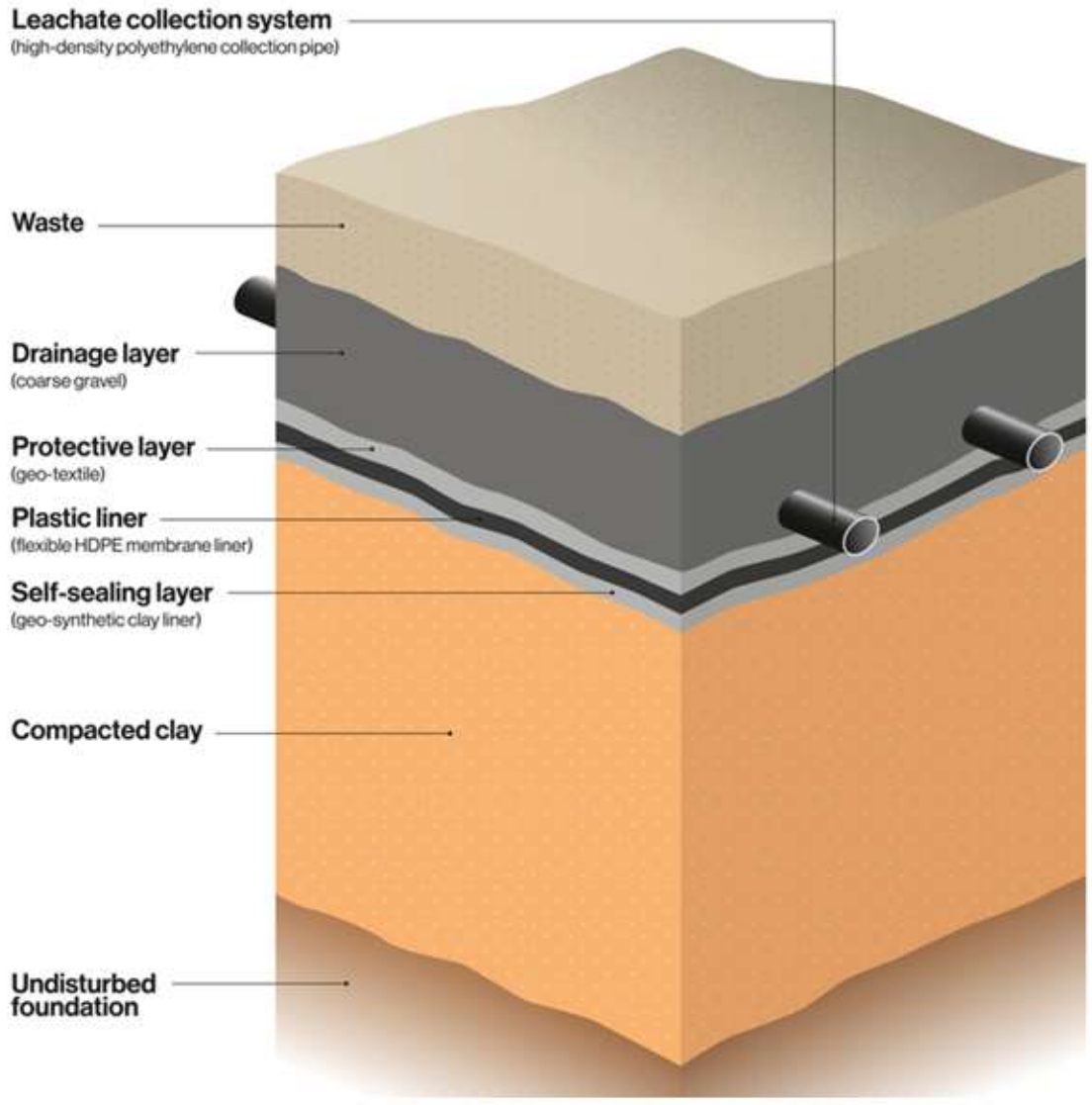


Figure 5.2: Schematic cross-section of a Type 2 lining system

The components of a lining system provide a barrier to minimise the potential for leachate to leak from the landfill, and a soil layer with good chemical attenuation properties beneath the barrier to reduce the potential effect of any leakage that does occur through the liner. The soil layer also has low permeability to provide a further barrier to any seepage that may occur through the primary liner.

To assess potential effects of landfill leakage, it is standard international practice to assume that some defects will be present in the geosynthetic layer, which may result from manufacturing defects or damage during construction.

All components of the lining system work together to contain leachate within the landfill and prevent leachate seepage. The combined system functions as follows:

- For there to be any leakage through a lining system there has to be build-up of leachate depth to create pressure. An effective drainage system above the main containment layers drains the leachate away before a significant depth of leachate can form above the containment layers, thus limiting the potential for any leakage.
- The primary containment layer is the high density polyethylene (HDPE) geomembrane. The individual sheets of the material are welded together using a robust welding system, with all welds tested for potential leaks. The HDPE geomembrane is essentially impermeable. There is low risk that the sheet is damaged during construction. However, this is mitigated by strict construction quality assurance (QA) procedures. A condition of consent has been proposed to provide QA of the lining system.
- Should there be a defect (damage) in the HDPE geomembrane, the potential seepage through this defect is controlled by the direct contact between the HDPE geomembrane and the underlying low permeability clay or geosynthetic clay layer thereby significantly restricting leakage that can occur.
- Any potential seepage through a defect then has to flow through the geosynthetic clay layer and/or 600 mm of a compacted clay liner before it flows out of the lining system. The time of travel through the system varies between 6 and 20 years. As any potential seepage passes through the clay, contaminants in the leachate adhere to the clay particles and are removed from the liquid that may eventually seep from the bottom of the liner system, thereby significantly reducing the contaminant concentration.

5.6.3 Leachate collection and removal system

The landfill operations will be managed to minimise the volume of leachate that is produced by:

- Minimising the size of the active tip area where waste is exposed to rainfall.
- Covering areas with daily, intermediate or final cover as soon as is practicable so that as much water as possible is shed into the stormwater collection system and minimising percolation of water through these layers into the underlying waste.
- Providing well managed stormwater systems to separate all stormwater flow from areas where waste is placed, and ensuring all site stormwater is diverted away from waste.

All stormwater that comes into contact with waste will be treated as leachate and will not be discharged to the stormwater system.

The landfill will have a leachate collection and removal system, the purpose of which is to enable effective long term collection and removal of leachate generated within the landfill from beneath the waste, minimising pressure of leachate on the liner. Leachate is continuously removed from the landfill throughout the landfill's operational life. The system is designed to function throughout the operating life and after-care period of the landfill. Key aspects of the leachate removal system will include:

- All landfill/lining system surfaces having a grade falling towards leachate collection drains.
- A high permeability drainage layer on the floor areas of the landfill to collect leachate and direct it to the main collector drains.
- Perforated leachate collection pipes installed within the drainage layer to collect leachate and convey it to a collection sump
- A protective filter layer over the drainage layer to prevent blocking of the drainage layer
- Leachate collection sump(s) from which leachate can be removed.

5.6.4 Leachate management

Leachate is continuously removed from the leachate collection sumps, and is then subject to onsite treatment or disposal to an off-site treatment facility. The following approach to leachate management is proposed at the Auckland Regional Landfill:

- Leachate collected from the landfill will be pumped directly to a holding tank.
- During the early stages of operation the holding tanks (approximately 200 to 500 m^3 capacity) will be located above the office area from where tankers can load by gravity for transferring. Leachate will then be taken off-site to an appropriate treatment facility for disposal.
- As far as is practicable, leachate will be recirculated into incoming waste at the landfill to minimise the quantity that needs to be transferred off-site for treatment.
- Once sufficient LFG is available at the Auckland Regional Landfill, a new evaporator or new technology will be installed on site. Once sufficient capacity is available, transfer of leachate off-site for treatment will cease. It is likely that at this time additional balancing tanks will be installed on the Renewable Energy Centre platform.

If a leachate breakout is identified, or leachate is identified in surface water, the site will have contingency procedures in place which will be included in the contingency section of the surface water section of the LMP and the Emergency Management Plan. Responses to leachate spills are also described in the Engineering Report (Technical Report N).

Ultimately, any surface water with evidence of leachate will be held in the ponds to allow for treatment or management. No discharge would occur from the ponds until monitoring demonstrates that the water quality is suitable for discharge.

5.6.5 Daily and intermediate cover and landfill cap

Landfill cover is the layer of soil which encapsulates the top of the landfill. The purpose of landfill cover is to minimise leachate generation by preventing water infiltration into the waste, minimise LFG discharges, prevent exposure of waste, and ultimately to rehabilitate the site for end uses.

Landfill cover has three main categories:

- Daily cover to manage windblown litter, odour, vermin and birds;
- Intermediate cover to minimise water ingress, reduce air intrusion, reduce fugitive LFG emissions, manage windblown litter, odour, vermin and birds, and storm water; and
- Final landfill cap to control water ingress, reduce leachate generation, provide final contour and stormwater management, control LFG migration, allow plant growth, provide physical separation between waste and plant and animal life.

The proposed approach to cover at Auckland Regional Landfill is discussed more in the description of site operations (Section 5.8).

5.6.6 Landfill gas management

5.6.6.1 Landfill gas collection

LFG management is described in detail in the Air Quality Assessment (Technical Report D), with a summary discussed below. If not managed, LFG will migrate from higher pressure zones to lower pressure zones (typically the atmosphere). LFG management systems are designed to actively extract LFG from the landfill mass, thus avoiding or minimising the migration of LFG.

Key components of the Auckland Regional Landfill LFG management system will be the landfill liner and capping, landfill gas collection system and the landfill gas flaring and utilisation infrastructure.

The landfill liner and capping is a crucial part of mitigation potential emission of fugitive LFG. Therefore, careful management of lining installation and intermediate and final capping will be undertaken to ensure the integrity for containing LFG.

A comprehensive network of LFG extraction wells will be established within the landfill as filling progresses. This approach utilises a similar well and extraction system to that used at the existing Redvale Landfill (Figure 5.3).

Collected LFG will be delivered to the Renewable Energy Centre, as discussed below.

Figure 5.3: LFG monitoring wells at Redvale Landfill

5.6.6.2 Renewable Energy Centre

A Renewable Energy Centre will be established on the ridgeline above Valley 1. This location was selected as it provides for screening of the centre from off-site audiences, as well as providing good elevation for dispersion, separation from sensitive receivers while still being accessible. Details of the Renewable Energy Centre are discussed in the Air Quality Assessment (Technical Report D), with a summary discussed below.

The Renewable Energy Centre will incorporate generators and flares for the utilisation and destruction of LFG. It has been assumed that the generators installed at the site will be similar to the most recent GE-Jenbacher generators installed at the Redvale Landfill (shown in Figure 5.4 below). These generators have a nominal generation capacity of 1 MW and LFG throughput of approximately 500 m^3/hour. The generators will exhaust via individual stacks approximately 10 m high and 0.3 m diameter, similar to those shown in Figure 5.4 below.

This application seeks resource consent for the construction of at least 14 generators at the site. However, the Renewable Energy Centre will only operate up to a maximum of 12 generators at any one time, with the additional generators allowing for programmed maintenance of the generators. The balance of LFG produced by the landfill will be destroyed in one or more enclosed flares.

Electricity will be exported from the Renewable Energy Centre at 11 kV or 33 kV by pylons and wires.

Figure 5.4: Photograph of generators at Redvale Landfill

5.6.6.3 Landfill gas flaring

Any LFG not beneficially used in the generators will be destroyed in one or more flares. Sufficient capacity will be provided in the flare/s to cater for any network outages when generation is not

possible. Details of the proposed flares are discussed in the Air Quality Assessment (Technical Report D), with a summary included below.

The enclosed ground flares will be approximately 9 m tall and will be fully compliant with the requirements of the Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins, and Other Toxics) Regulations 2004 (NESAQ) for a principal flare. The flares and generators will be maintained in good working order to ensure adequate destruction of LFG and the odorous compounds in the LFG. A photo of the flares at Redvale Landfill is included below (Figure 5.5). The flame will be fully enclosed and will not be visible.

Figure 5.3: Flares at Redvale Landfill

5.6.7 Surface water and stormwater management

The overall objective of the proposed surface water management at the landfill is to keep leachate and stormwater separate. Any surface water that drains to the open working face and associated areas will be treated as leachate and managed as such.

The stormwater system for the landfill operation has been designed to ensure that:

- Suitable diversion systems are in place to separate stormwater from waste to avoid contamination. As discussed earlier, any stormwater that comes into contact with waste is treated as leachate, and as such it is important to maintain separation of stormwater from waste/leachate.
- Practicable steps are taken to minimise erosion of soil and transport of sediment from earthworks areas. This is achieved through minimising exposed soil surfaces, installing cut-off drains to minimise flow over exposed earth surfaces, limiting gradients on stormwater

channels and concrete lining where appropriate, installing temporary measures where practicable to minimise the transport of sediment from earthworks areas, and stabilising these areas with vegetation or by other means as soon as practicable.

- Suitable conveyance systems (channels, pipes) are in place to carry the stormwater to suitable treatment devices to remove any sediment carried with the stormwater. These systems may comprise permanent systems (e.g. perimeter channels) or temporary systems as each stage is developed.
- Adequate treatment systems are in place to remove sediment from stormwater at all stages of development and operation of the landfill and prevent uncontrolled off-site discharges.

Due to the narrowness of the lower portion of the landfill valley (Valley 1) where the stormwater treatment systems will be constructed, it is not possible to separate stormwater from vegetated catchments above the area of work from stormwater from active earthworks areas. Thus all stormwater from Valley 1 will be combined into a common system, sized to deal with the 1% AEP rainfall event from the contributing catchment.

The stormwater treatment system will comprise a number of devices in series including extended detention ponds to provide sediment control and a final wetland to provide final polishing and biological treatment of any remaining contaminants. The treatment for the Eastern Block has been designed well in excess of the minimum requirements set out in GD01.

Procedures or systems will be implemented to monitor and identify potential leachate breakouts or contamination of surface water including weekly inspections of the landfill surface and continuous monitoring of conductivity at the inlet to the ponds. These are described further in Section 5.8.

The treatment of stormwater and management of stormwater from other areas of the project footprint (i.e. not in Valley 1) is described in detail in the separate report “Stormwater and Industrial and Trade Waste Assessment” (Technical Report P).

5.7 Ancillary site infrastructure

5.7.1 Intersection with State Highway 1

5.7.1.1 Roundabout design

A new roundabout will be constructed on State Highway 1 to provide the primary and permanent access to the landfill. The new roundabout will be approximately 1.5 km south of the Wayby Valley Road intersection and will connect to the landfill access road. The proposed location for the roundabout was identified following a detailed technical evaluation of traffic engineering criteria including:

- Separation from current passing lanes along State Highway 1;
- Driver visibility to and from the proposed landfill access road;
- Current safety performance of the State Highway 1 corridor; and
- Co-ordination with the NZTA Dome Valley Safety Upgrades project.

Consultation between WMNZ and NZTA representatives has occurred throughout the project development regarding site access and the safety performance of the proposed roundabout, and will continue as the intersection design is further developed. While still subject to detailed design, the roundabout will broadly involve:

- A 40m diameter central island;
- A single circulating lane;

- Design in accordance with current NZTA design guidelines and standards for roundabouts; and
- Co-ordination of design with the NZTA's safety improvements project along State Highway 1 through the Dome Valley.

Further details of the proposed roundabout are included within the Integrated Transport Assessment (Technical Report M). The design will be subject to further safety audits from NZTA at the detailed design and pre-opening stages.

5.7.1.2 Traffic volumes

The majority of traffic visiting the landfill will be expected to come from Auckland and to enter the site from State Highway 1 to the south. If State Highway 1 is relocated on the proposed Warkworth-Wellsford route (WW2W) in future, the majority of users will be expected to enter the site from the north.

Overall, and at the forecasted peak of operation, it is anticipated that the landfill will generate up to approximately 740 vehicle movements (inclusive of inbound and outbound movements) over the course of one day, with up to approximately 55 movements (inbound plus outbound) of these occurring during the busiest peak hours.

It is expected that most trips will arrive from and depart towards the south, where the majority of the population and waste generation is located. Conversely, if the WW2W is constructed with an interchange at Wayby Valley Road, then most vehicles would likely access the landfill from the north. However for the purposes of this application, it is conservatively considered that the WW2W project will not be completed and that vehicles will predominantly access the landfill from the south.

5.7.2 Access road

Access to the landfill will be through a newly constructed access road as shown in Drawings ENG-30 and 31. The design of the access road has been described in detail in the Engineering Report (Technical Report N).

The access road will connect the site entrance to the bin exchange area to the landfill, traversing the valley of the Southern Block, then crossing the ridge at the head of the valley into Valley 1 in the Eastern Block. The length of the access road will be just under 2 km.

The alignment of the proposed access road has been developed based on a number of design criteria. These include minimising the climb from State Highway 1 to the landfill within the constraints of the topography of the valley, avoiding adjacent Significant Ecological Areas (SEA) and Natural Stream Management Areas (NSMA)s to the extent practicable, and minimising earthworks to the extent practicable without compromising suitable road alignment for safety.

The access road will be screened from adjacent properties and State Highway 1 with vegetation. An NSMA is identified by the AUP in the Southern Block. An earth fill embankment and culvert on the proposed route crosses a corner of the NSMA, encroaching on the area by approximately 80 m^2.

The stormwater management along the access road to treat stormwater runoff from the sealed road surface will comprise filter strips. The filter strips have been designed based on the catchment volume, in accordance with the 'New Zealand Transport Agency, Stormwater Treatment Standard for State Highway Infrastructure, May 2010'.

5.7.3 Waiteraire Stream bridge

A bridge will be constructed over the Waiteraire Stream as part of the access road, between the site access point and the bin exchange area. The bridge will be designed in accordance with the Bridge Manual (SP/M/022), NZTA. It is currently proposed as a 4-span bridge, two lanes wide, with spans

between 20 and 25 m to provide for crossing the stream with minimal effect on the stream below. No part of the bridge structure will be constructed within the stream channel.

The final levels of the bridge are subject to detailed design, however, based on concept design, the bridge superstructure will have a height of between 1.4 and 1.6 m to provide sufficient capacity for 1% AEP floodwater to pass through.

5.7.4 Bin exchange area

As discussed in the Engineering Report (Technical Report N), a bin exchange area will be provided near the site entrance, off to one side of the new access road. The layout of the bin exchange area is shown Drawing Eng-31.

The bin exchange area will allow for standardised bins to be delivered full to the site by road haulage trucks, exchanged for empty bins, and allow road haulage trucks to immediately depart from the site. Bins will be delivered into the bin exchange area 24 hours a day, to allow traffic movements to be spread out and to avoid peak day time traffic hours. The delivered full bins will be taken to the tip face by site haulage/tipper vehicles (mules) for emptying, and subsequent return (empty) to the exchange area. Mules are trucks that are designed and dedicated to carrying detachable bins from the bin exchange area to the tip face and back. Mules will not travel on public roads and have special features to run on dirt roads and tip at the landfill. Figure 5.4 below shows a mule truck operating at Kate Valley Landfill.

Figure 5.4: Mule truck at Kate Valley Landfill

The bin exchange area has been designed to maximise efficiencies for both the landfill operation and for road haulage trucks delivering bins. Figure 5.5 below shows a schematic summary of the bin exchange area's operation.

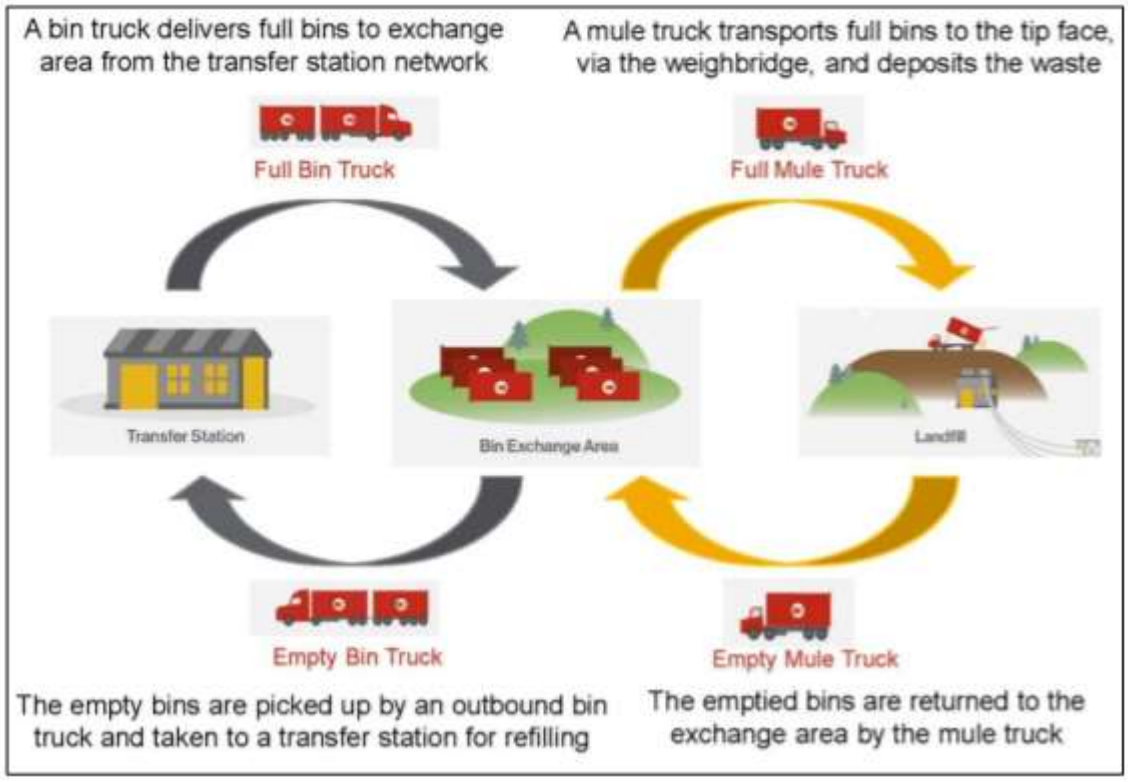


Figure 5.5: Schematic of bin exchange area operation

There will be no weighbridge prior to the bin exchange area so as to avoid queuing of arriving vehicles entering the bin exchange area. The layout of the bin exchange area will allow for one-way circular movement for trucks undertaking the bin exchange process. The bin exchange area at Kate Valley Landfill is shown in Figure 5.6 below.

Figure 5.6: Kate Valley Landfill bin exchange area

The bin exchange area will be managed under the auspices of a Bin Exchange Area Management Plan, which will include methods to ensure bins do not remain within the bin exchange area for longer than two working days and that bins are sealed and contained.

The entire bin exchange area will be paved with asphaltic concrete, with consideration to using concrete in the heavy duty areas (bin exchange bays). The minimum level of the platform will be at least 500 mm above 32 mRL, which is the anticipated flood level at this location[14]. The entire surface will drain to a rain garden stormwater treatment device, sized in accordance with Auckland Council GD01 (as described in Technical Report P).

The bin exchange area will be screened from State Highway 1 by existing trees between the area and State Highway 1, and by the construction of an earth bund adjacent to State Highway 1 that will also be planted. The bin exchange area will include the construction of an office building containing limited facilities mainly for drivers such as a lunch room, washrooms, and some staff offices.

Waste vehicles with non-standard bins not transportable by mules will not use the bin exchange area, instead provision will be made for these vehicles to go directly to the tipping face.

5.7.5 Weighbridge

A weighbridge for incoming and outgoing vehicles will be located on the access road near the entrance to the landfill valley, as shown in Volume 3. The weighbridge will be automated with use of RFID tags to identify loads. Provision will be made for the weighbridge to be staffed. Ample road length is available for queuing in this area should this occur, with allowance for a by-pass lane for non-refuse vehicles. An example of a weighbridge at Redvale Landfill is shown in Figure 5.7 below.

Figure 5.7: Weighbridge at Redvale landfill

[14] This is based on published Auckland Council data, however, the levels will be confirmed as part of detailed design.

5.7.6 Site roading

5.7.6.1 Roading requirements

In addition to the main access road described in Section 5.7.2, additional roads will be required throughout the life of the project. Proposed roading within the WMNZ landholdings has been described in detail in the Engineering Report (Technical Report N). A summary of key roading areas has been provided below.

5.7.6.2 Perimeter road

A road will be constructed around the perimeter of the landfill footprint for site vehicles to access areas of the landfill. This will typically be a gravel road, and will be progressively constructed as the landfill expands. During early stages of operation the landfill liner benches will form the landfill perimeter.

5.7.6.3 Stage access

A road will be constructed from the main access road to connect with the first bench within the landfill footprint. This will provide access for vehicles tipping waste, and will be progressively constructed over the landfill surface as landfilling progresses.

5.7.6.4 General site roading

In addition to the roads described above, various minor service roads, access roads and other roading will be established in accordance with the drawings included in Volume 3. Wherever possible, existing forestry roads which are generally located on ridgelines will be retained.

5.7.7 Wheel wash

A wheel wash on the access road for cleaning the wheels of all vehicles leaving the site which have accessed unpaved areas. The wheel wash will comprise as a minimum a ramp into a flooded basin with rumble bars through which vehicles drive.

Sediment from the wheel wash will be removed from time to time by front-end loader and placed within the landfill to dry. Overflows from the wheel wash will be diverted to a sediment pond adjacent to the wheel wash for settling of any sediment. Discharges from this sediment pond will flow into the landfill stormwater system and will pass through the site stormwater treatment system.

5.7.8 Ancillary buildings and services

A site office will be provided for staff responsible for the operation of the landfill. This building will be approximately 200 m^2 (possibly 25 x 8 m), and parking will be provided adjacent to this building for 20 cars (staff and visitors). The precise location for this building will be confirmed as part of detailed design. However, it is currently planned to be located on the ridge line above the landfill in the general area where the access road enters the landfill valley. This location is shown on Drawing ENG-02.

A workshop will be provided for plant and general maintenance. This will be a building with a footprint of approximately 250 m^2 (25 x 10 m). A hardstand area for plant of approximately 1,000 m^2 will be provided outside the building. It is currently proposed that this building will be constructed beside the access road to the lower area of the site as shown on Drawing ENG-02. Additional small buildings will also be provided in this general area to house small plant, equipment, etc.

5.7.9 Water supply

5.7.9.1 Potable water supply

Potable water is required to provide a supply for staff facilities, with some potable water required for odour suppression sprays. It is anticipated that up to 20 m^3/day of potable water will be required on site.

It is proposed that potable water will be sourced from a groundwater bore to be installed near the landfill facilities area at the location shown on Drawing ENG-02. Details of the bore are described in the Hydrogeological Report (Technical Report E). Water will be pumped from the bore to a tank located at a suitable elevation near the bore from where the supply will gravitate to the facilities on site. The proposed bore would provide the required 20 m^3/day of potable water.

5.7.9.2 Non-potable water

Non-potable water is required for dust suppression, vehicle washing, road washing, and a fire-fighting reserve.

It is proposed to use any remaining yield from the bore noted above as a source for non-potable water. Any remaining non-potable water requirement would be sourced from the main stormwater treatment ponds downstream from the toe of the landfill, as described in the Engineering Report (Technical Report N).

5.8 Landfill operations

5.8.1 Ongoing operation and phase development

The operation of the landfill generally comprises receipt of the waste, placement and compaction within the landfill and covering, as well as the associated activities described below.

The landfill will be developed and operated in a phased approach to minimise the open working area at all times. On a day-to-day basis, the following activities are generally undertaken at the landfill:

- Construction – cover winning and progressive future phase preparation and liner construction; earthworks for drainage; sedimentation pond operation; construction of landfill gas wells, horizontal trenches and related gas reticulation; intermediate cover and capping.
- Refuse transport and placement – waste receipt and weighing; refuse placement and compaction, placement of daily cover soil; and localised litter, odour and vermin control.
- Landfill gas and leachate management – leachate extraction, leachate recirculation, leachate evaporation; LFG flaring, electricity generation from LFG.
- Ancillary activities such as landscaping, fencing, general infrastructure maintenance and machinery maintenance.
- Ecological mitigation, including pest management, planting and maintenance.
- Landscape planting and maintenance.
- Environmental monitoring, including site walkovers and sampling.

Details of these operations are provided below.

5.8.2 Landfill Management Plan

5.8.2.1 Overview

The landfill will operate under the auspices of a Landfill Management Plan (LMP). A draft Table of Contents of the LMP is included as Technical Report Q. The purpose of this plan is to:

- Describe the management, construction, operation and monitoring framework which will be put in place at the site to ensure the landfill is operated in accordance with the relevant consents;
- Satisfy resource consent conditions which require the implementation of the LMP;
- Identify all consents that are relevant to the landfill and
- Provide reference information on the operation of the landfill for all on-site staff, regulators and peer reviewers.

5.8.2.2 Landfill access

Access to the landfill will be strictly controlled. Entry will be restricted to authorised bulk haul vehicles that meet site entry requirements. Public access to the landfill (including the bin exchange area) and casual tipping of waste by the public will not be permitted.

Public vehicles that inadvertently turn into the site will be informed by signage that the landfill access road and bin exchange area are accessible by authorised vehicles only, and will be able to turn around in the vicinity of the bin exchange area or if they continue to proceed up the landfill access road, the weighbridge access controls prior to the landfill face will ensure that no unauthorised vehicles are able to proceed further.

5.8.2.3 Hours of operation

The working face will be open from 5.00 am to 10.00 pm Monday to Saturday, and from 7.00 am to 5.00pm on Sunday. The bin exchange area will operate 24 hours a day.

5.8.2.4 Waste acceptance criteria

As set out in Section 5.4 the landfill will only accept non-hazardous residential, commercial and industrial solid waste, including:

- Clean fill material.
- Managed fill material.
- Construction and demolition (C&D) waste.
- Municipal solid waste.
- Household waste.
- Commercial waste.
- Industrial waste.
- Treated hazardous waste.
- Contaminated soil.

The landfill will not accept liquid waste. Procedures are outlined in the WAC Report (Technical Report O) and cover pre-acceptance, acceptance, testing, monitoring and contingency actions.

The landfill will take waste from transfer stations and from waste sources directly. WMNZ will run dedicated, custom-designed line-haul trucks from its transfer stations. The landfill will be open to

third party customers of WMMZ subject to commercial terms. The proposed waste management controls are consistent with the WasteMINZ Guidelines.

5.8.2.5 Odour management

There are several potential sources of odour at the landfill, including waste on arrival, freshly exposed topsoil, chemical reactions in the landfill, landfill gas (LFG) and leachate. Odour can generally be managed through good landfill operating procedures. Measures for managing odour are set out in the proposed conditions (Appendix G) and the Air Quality Assessment (Technical Report D).

The landfill will not accept known malodorous waste unless specific pre-acceptance criteria and procedures have been put in place to manage potential odours from these wastes. Potentially malodorous waste, such as egg wastes or wool scourings, must be pre-treated by the waste generator to reduce odours prior to delivery. In these examples, pre-treatment might include mixing the waste with lime.

A precautionary approach will be taken when accepting any new potentially malodorous waste streams, including trial disposal of small quantities before entering into longer term contracts. Where waste is assessed as being excessively odorous, or has been identified as excessively odorous on-site, future loads will not be accepted unless the waste can be pre-treated to reduce odour to acceptable levels.

5.8.2.6 Litter, bird and vermin control

Litter sources at the landfill may include the tip face, re-mobilised litter caught on fences and trucks entering and exiting the landfill. Litter fences will be installed around the active landfill to minimise the potential for litter to leave the site. Staff will be scheduled to pick up litter from around the tip face on a daily basis.

Birds can cause issues such as damage to crops on adjacent sites, interference with equipment, spread of disease and hazard to aircraft. Primary control methods include operating machinery on the tip face continuously, minimising potential for uncovered waste (e.g. covering trucks, minimising tip face area) and providing vegetation cover on inactive areas. If trigger levels for birds described in the LMP are reached (e.g. a high number of birds at the landfill), secondary control methods such as distress tapes, athletic starter pistols, and shooting will be utilised. Protected species will not be shot.

Vermin at the landfill may include rabbits, possums, rats, flies, midges, feral cats, and mustelids. Operation of the landfill in accordance with the LMP, and particularly the placement of daily cover, will virtually eliminate vermin presence at the tip site. A Pest Management Plan – Landfill Operations will also be prepared, to prevent populations of pests becoming established (see proposed conditions 186-187).

5.8.3 Operational earthworks and refuse placement

5.8.3.1 Operational earthworks

The operation of the landfill generally comprises receipt of the waste, placement and compaction within the landfill and covering. The operational earthworks and refuse placement are described in detail in the Engineering Report (Technical Report N), with a summary included below.

For a landfill with an airspace volume of approximately 25.8 Mm^3, a soil volume of approximately 5 Mm^3 is required for its operation. This soil is used for daily cover, intermediate cover, final cover and incidental construction works on the landfill site. This material is made available by providing for a

surplus cut over fill when developing the landfill footprint, so that there is an overall soil balance over the life of the landfill.

Typically, any surplus soil from the construction of a stage or cell is carted to a stockpile on site. Soils required for the operation of a cell would be taken from the footprint of the next cell, to minimise double handling of materials and to optimise haulage distances. If there is no soil readily available from future development areas it would need to be taken from the soil stockpiles.

Any unsuitable material within the landfill valley, such as soft organic material, will be removed and stockpiled to ensure unacceptable strains on the lining system are avoided.

5.8.3.2 Phasing

The development of the landfill will involve progressive construction of individual landfill cells, which are called phases. An indicative phasing plan has been developed and is discussed in Technical Report N. Seven phases are proposed, each designed for approximately five years of capacity, although this varies to suit the layout of each phase. Within a phase there will be a number of smaller stages, which are determined as a phase progresses.

Landfilling will commence from approximately 300 m from the final toe of the landfill, and progress up the valley. This buffer area will allow for extra stormwater treatment to be undertaken within the landfill footprint for the initial phases. The valley topography is such that the first two to three stages will progress in this manner (approx. 20 – 25 m depth), then subsequent stages will be above these stages, developed from the head of the valley back to the toe. It is likely that the landfill will be developed in three vertical stages in this manner.

5.8.3.3 Cover winning, haul roads and phase preparation

Soils are excavated from undeveloped parts of the site and are carted either directly to the tipping zone for use as cover or to the phase construction area for structural earth fill and liner. Due to the surplus of soils on the site, some of the soils are held in stockpiles.

The on-site soil cartage operations are designed to avoid double handling, keep haul routes as short as practical to maximise efficiency. Temporary haul roads are constructed and maintained to allow refuse hauliers to move between the permanent road system and the current tipping face. These roads are designed taking into account gradient, traction, safety, and potential for mud transport and dust. Haul roads for earthmoving plant are designed in accordance with specific requirements at the time.

Construction of new phases involves heavy mobile machinery and materials to construct earth fills, lining system and leachate drainage. This activity takes place typically each summer to prepare 1-2 ha of landfill ready for refuse placement.

5.8.3.4 Refuse placement and compaction

The area of refuse exposed at the placement site will be kept to approximately 80 m by 80 m at any time.

In order for the landfill to operate, it is anticipated that 45 staff and the following vehicles will be available at the landfill itself:

- Compactors
- Bulldozers
- Hydraulic excavators
- Dump trucks

- Water trucks
- 4WD utility vehicles

Waste will be tipped as directed by a spotter/pointsman on site, on a tipping pad as close as practicable to its final disposal site. The waste will then be compacted with heavy compaction equipment. Waste is generally compacted in flat layers of approximately 0.6 m depth. WMNZ will aim for waste compaction densities of 0.8 to 1.0 tonnes/m³.

5.8.3.5 Daily cover

Daily cover is utilised to reduce nuisances (birds, vermin, litter, odour, dust), LFG emissions, and infiltration of stormwater which generates leachate.

At the end of each day, natural earth material or a suitable alternate material will be placed over refuse to a thickness of 150 mm. Bulldozers will be used to spread the soils as daily cover. The next working day, some of this daily cover will be stripped and stockpiled alongside the tip face for reuse.

If earth material has been tipped and deemed as waste (e.g. low level of contamination), it may be used as daily cover if weather conditions permit, provided that the level of contamination is low such that stormwater for runoff won't be contaminated and it is machine rolled to prevent stormwater infiltration or it is covered with an alternative inert cover.

5.8.3.6 Intermediate cover and final capping

Intermediate cover will be used to provide temporary cover over incomplete parts of the waste pile (where refuse may be placed at a later date) or as permanent cover over completed parts of the waste pile (where the intermediate cover may eventually form part of the final cover). Earth fill materials are placed and compacted to at least 300 mm depth.

Intermediate and final cover minimise water infiltration (and subsequent leachate generation), gas emissions and odour, and air intrusion (which helps with gas extraction).

The final cap is constructed over parts of the landfill that have reached their design capacity and will not receive any more waste. The final cap is described in more detail in Section 7.

5.8.3.7 Stockpiles

Several areas within the WMNZ landholdings have been identified for stockpiling soil. During the operational phase of the landfill, any surplus soil from the construction of a stage or cell will be carted to a stockpile on site. Soils required for the operation of a cell would be taken from the footprint of the next cell, to minimise double handling of materials and to optimise haulage distances. If there is no soil readily available from future development areas it would need to be taken from the soil stockpiles. At the end of the landfill life, soils for construction of the final cap would be taken from the soil stockpiles.

Where practicable, stockpiles will be filled from the proposed final toe of the stockpile, with the front face formed and shaped as filling progresses. As soon as sufficient area is available, the surface of the externally facing side of the stockpiles will be vegetated. This will comprise covering with a layer of topsoil or other suitable growth layer and sowing grass seed, or hydroseeding the face. Material will then be preferentially excavated from the back of the stockpiles to minimise visible areas of earthworks.

5.8.3.8 Clay borrow area

An area within the Western Block has been identified as having appropriate geology (Northern Allocthon) for providing a source of clay material for use in the landfill lining system. This area of the

site will periodically be excavated throughout the operational life of the landfill to provide clay as required for cell construction. Excavations will occur during the summer construction period, with the area being stabilised over winter (May to October).

5.8.3.9 Operational sediment management

The proposed strategies for management fall into two main approaches; erosion control and sediment control. Erosion and sediment control will be delivered using temporary, semi-permanent and permanent sediment control measures for the site under the specific control areas of construction, operations and completed areas.

The main principles of erosion and sediment management within the project footprint are to minimise surface erosion, promote sedimentation of suspended solids before water leaves the site, and control flows to minimise adverse effects of discharge water on downstream biota.

Erosion and sediment control measures will include:

- Slope stabilisation of bare slopes by compaction, mulching, seeding or covering with slash;
- Coarse silt retention measures such as silt fences and hay bales;
- Cut off channels;
- Channel reinforcement including rock, concrete and geotextile placement;
- Velocity controls such as flatter grades, intermediate ponds and baffles;
- Flow retention ponds;
- Road surfacing and road cleaning;
- Sediment retention ponds; and
- Wetlands.

5.8.4 Ongoing use of the Western Block

With the exception of the clay borrow area and Stockpile 1, the majority of the Western Block will not be used for activities associated with the landfill operation. Much of the existing farmland will continue to be used for grazing, and the areas of the farm that are currently in pasture will predominantly be leased (excluding those areas which are proposed for ecological enhancement, landscape planting or plantation forestry).

The existing site entrance to Springhill Farm at 1282 State Highway 1 will remain as the principal access for the farm, two land-locked properties, and the homestead located over the old bridge to the northern side of the Hōteo River. Refuse trucks will not use this entrance.

Some of the farmland will be converted to new pine forestry to off-set pine forestry that will be permanently felled to form the landfill footprint. The new forestry is outside the scope of this application, and will be undertaken by others (Matariki Forests). The proposed forestry areas are shown on Drawing ENG-01 in Volume 3.

The existing airfield on Springhill Farm is closed but is being maintained until WMNZ has considered options for its future.

5.8.5 Ecological compensation and off-set

5.8.5.1 Overview

A significant programme of ecological enhancement and restoration is proposed to address the ecological effects of the project which cannot be avoided. This includes on-site planting and protection of areas of ecological value; pest management; and off-site stream enhancement works.

The proposed ecological compensation and off-set is described in more detail in the Ecology Report (Technical Report G), and conditions of consent are proposed, setting out the process for confirming the details and location of ecological enhancement.

5.8.5.2 On-site planting and protection of areas of ecological value

The proposed on-site planting and protection of areas of ecological value are shown in the Ecology Report (Technical Report G). This includes forest, wetland, riparian and wetland margin revegetation, with a focus on replacing/replanting plant species that have been affected by the project and optimising ecological benefits through improved connectivity and buffering of existing ecologically significant habitat types. The areal extent and spatial configuration of plantings will be confirmed as a condition of consent, but will include:

- Enhancement and/or protection of 14 km of stream within or as close as practicable to the WMNZ landholdings.
- Planting of 9.9 ha of native terrestrial vegetation within WMNZ landholdings.
- Protection by covenant of 11.9 ha native forest areas within WMNZ landholdings.
- Planting and protection of all (4.63 ha) degraded wetlands within the Western Block that are not affected by the project.
- Planting of wetland buffers of 10 m or 5 m around SEA and non-SEA wetlands within the Western Block, approximately 15.18 ha.
- Protection by covenant of all native wetland habitats, approximately 25.59 ha.

These plantings will be completed within three years of the first load of waste being accepted at the site. A monitoring and maintenance plan will be developed and implemented for the duration of the landfill operation to ensure plant densities and 90% survival rate are maintained.

5.8.5.3 Pest management

To address adverse effects on native fauna and loss of habitat associated with the project, WMNZ will undertake a programme of pest management for a period of 35 years over the whole of the WMNZ landholding, and within appropriate areas of Sunnybrook Reserve, subject to securing the necessary landholder approvals. The focus on pest management is to reduce and maintain rats, possums, feral cats, mustelids, feral goats and pigs to low densities and exclude farm stock.

The areal extent of pest control operations within Sunnybrook Reserve is to be confirmed following consultation with the Department of Conservation, and may vary over the life of the consent. This programme is separate to, and in addition to the predator and vermin control described in Section 5.8.2.6, which is targeted at controlling predators and vermin within the landfill operational areas.

5.8.5.4 Off-site stream enhancement

A programme of off-site stream enhancement shall be undertaken over the life of the landfill to provide compensation for residual adverse effects on streams associated with the project. WMNZ is proposing to undertake habitat restoration on a 3:1 restoration ratio for residual stream length affected which has not been fully off-set by the works carried out in accordance with the Ecological Enhancement and Restoration Plan. As such, WMNZ will achieve a total 46.2 km stream length of enhancement including on-site measures, if the loss of permanent and intermittent streams is equal to 15.4 km. The overarching principles for the identification of restoration sites will include a preference for sites within the Hōteo Catchment, and in close proximity to the location of development, where this will result in the best ecological outcome. In addition, the preference will be for sites where the ecological values being achieved through the enhancement works are the same or similar to those being lost.

WMNZ will set up a process for informing landowners within the Hōteo catchment of the opportunity to apply for areas of their land to be enhanced. A set of criteria for selection will be developed, in line with the overarching principles described above. WMNZ will also establish a group comprising mana whenua and interested community representatives and land-owners to provide suggestions on enhancement sites and help inform the decision making process on enhancement site selection.

WMNZ will undertake the compensation in a staggered manner, providing, subject to suitable sites being identified, at least 1.5 km of stream enhancement each year until the required restoration ratio has been achieved. The details of works to be completed each year will be provided to Council, and ongoing monitoring of enhancement sites shall occur for at least five years following completion of an individual site. Areas of enhancement will be protected in perpetuity via covenant or other appropriate measures.

5.8.6 Landscape and visual mitigation

Planting and mitigation is proposed in addition to the ecological enhancement planting described above, to further mitigate adverse landscape and visual effects of the project. The proposed planting and mitigation is set out in more detail in the Landscape and Visual Assessment (Technical Report H), and includes the following proposals:

- Establish and maintain tree shelterbelts to provide effective visual screening of the landfill during its development and during the aftercare period.
- Ensure planting is of appropriate scale and mix of species to reflect the existing vegetation structure of the rural and forested area.
- Outline an ongoing and adaptive planting and management process for the landfill both during its development and during the aftercare period.

Native vegetation will be preferentially selected for landscape mitigation, but where appropriate such as around the perimeter of Valley 1 and around Stockpile 2, exotic species will be used to achieve faster screening. Landscape and visual mitigation measures will also include stabilisation of exposed earthworks areas at the end of each summer earthworks season using grass, hydroseeding or other planting.

5.8.7 Environmental monitoring and reporting

Monitoring is the collection and assessment of environmental and discharge information gathered at and around a landfill site. An extensive environmental monitoring programme will be implemented throughout the life of the landfill operations, as set out in the proposed key conditions of consent (Appendix G). The monitoring programme will involve the following focus areas:

- Leachate
- Stormwater
- Landfill Gas
- Groundwater
- Surface water
- Sediment
- Ecology

An initial period of baseline monitoring is underway and will continue until works commence on the site (refer condition 18). This will provide an understanding of the baseline environmental conditions before development, such that subsequent environmental conditions during site development, operation and aftercare can be monitored and controlled appropriately. Regular reporting on the results of the monitoring will be provided to Auckland Council.

5.9 Bond

WMNZ will enter into a bond, taking into account the risks and costs of remediation, closure and aftercare. The details of this are to be agreed with Auckland Council as part of the consenting process.

5.10 Walking and cycling access tracks

As part of the overall proposal, where practicable, a walking track will be formed to the east of the landfill footprint, along the Waiwhiu Stream, including amenity areas that may be appropriate at any swimming or picnicking sites along the stream. In addition, WMNZ has committed to, subject to reaching agreement on reasonable recommendations from the Department of Conservation (DOC) and Walking Access Commission (WAC), and obtaining the necessary landowner approval, implement the following:

a two opportunities to enhance the recreational value of Sunnybrook Scenic Reserve

b two opportunities to create mountain bike tracks

All access tracks shall be registered by way of an esplanade strip or walkway easement within 12 months of being completed. As these works are still the subject of ongoing consultation with DOC and WAC and there is still uncertainty about the details; any potential consent requirements for forming the access tracks would be subject to a separate resource consent process.

5.11 Summary

Once waste is placed within a landfill it begins to break-down, generating leachate and landfill gas as by-products. At a high level, the purpose of a landfill is to provide a contained disposal location for waste. As such there are key design features of landfills that are intended to encapsulate and control the waste and the by-products generated as the waste breaks down.

This section has provided an overview of the key design features of the Auckland Regional Landfill which have been designed to encapsulate and control the waste and by-products as the waste breaks down. The key engineering components of the landfill include:

- A lining system and leachate collection system;
- Daily and intermediate cover and landfill cap;
- Landfill gas management; and
- Surface water and stormwater management.

These design features are supported by a rigorous monitoring and reporting regime, along with stringent operational controls, as set out above, and in further detail in the accompanying technical reports (Volume 2).

6 Site establishment and initial construction

Initial construction activities will occur prior to the landfill accepting its first waste. Due to the complex nature of the site, it is expected that initial construction activities will occur over a period of approximately five years, including 3-4 earthworks seasons of bulk earthworks prior to the landfill accepting waste. During this period, the site infrastructure will be constructed, including:

- The first landfill phase, including lining and leachate collection system;
- The site entrance and roundabout on State Highway 1 providing a dedicated site entrance;
- The bridge over the Waiteraire Stream;
- The bin exchange area;
- The main site access road formation through the Southern Block;
- Site access roading to the first stage for landfilling and to all stockpile areas;
- Permanent site stormwater controls downstream of the landfill and any other stormwater controls required for initial earthworks (e.g. at stockpile areas); and
- The main site office area and workshop facilities.

The following sections describe the various site establishment and initial construction activities to be undertaken before the landfill accepts any waste.

6.1 Construction programme

An indicative construction programme is provided below.

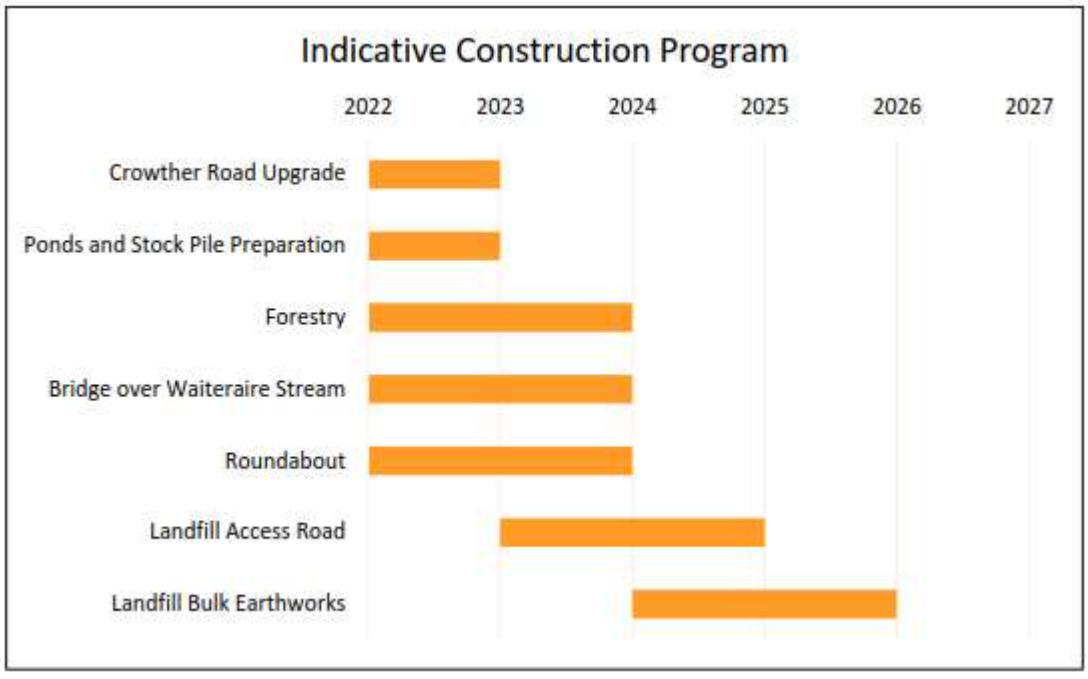


Figure 6.1: Indicative construction programme

The existing forestry within the landfill footprint will be felled by Matariki Forests, separately to the works which WMNZ will be undertaking. The forester will vacate the land as the landfill development progresses starting with the downstream half of Valley 1. Vacated forestry land will be left in a 'cut-over' state at the time that WMNZ takes control of the area.

Once WMNZ takes control of the site, the works will generally be phased as follows:

- **Preparatory works** – this includes initial works to enable site establishment and construction, such as stabilisation of any areas of the site left exposed by the forestry operator; site surveys and further site investigations to inform detailed design (such as geotechnical investigations); ecological surveys and salvage; establishment of detention ponds and erosion and control measures; and formation of initial access tracks.
- **Site establishment and initial construction -** Following the preparatory works, the main construction works will occur, including bulk earthworks (cut and fill), bridge construction, construction of the first landfill cell including leachate collection system and lining system, and establishment of stockpiles. This will be followed by permanent road surfaces, site buildings, and planting.

6.2 Construction erosion and sediment control

The proposed approach to construction stormwater, erosion and sediment control is described in detail in the Sediment and Erosion Control Assessment (Technical Report R), with a summary included below.

Prior to any sediment generating works being undertaken on site, erosion and sediment control measures will be put in place. A draft Construction Erosion and Sediment Management Plan (CESMP) has also been prepared for the site, and is included as an appendix to the Sediment and Erosion Control Assessment. The purpose of the CESMP is to provide a framework of controls for the construction earthworks to avoid, remedy and/or mitigate the potential adverse effects on the receiving environment, including measures to ensure sediment generation is minimised and the works are conducted in accordance with best practice. The CESMP has been prepared to document the earthworks and sediment control procedures that will be required during the initial construction phases of the project.

The CESMP requires development of a site specific ESCP for the earthworks associated with each area of work. In particular, site specific ESCPs will be required for the construction of the wetland and sediment ponds, the access road and the stockpile sediment ponds.

The key controls for minimising effects from erosion and sedimentation include:

Erosion controls:

- Use of cleanwater diversions where possible, to direct cleanwater around the works areas.
- Undertaking the works progressively to minimise the open areas.
- Progressive stabilisation.

Sediment controls:

- Use of super silt fences downstream of the works areas.
- Use of decanting earth bunds.

Further, receiving environment monitoring will be undertaken throughout the construction earthworks, to confirm the effectiveness of the measures and to ensure measures adapt to minimise the generation and discharge of sediment are being implemented. The results of the monitoring programme will be used as a feedback loop to trigger the need to review and investigate both the effectiveness of measures, and whether additional controls, inspections or monitoring is needed to better control erosion and sedimentation.

6.3 Construction noise management

Construction works will generally occur between 0630 – 2000 hrs Monday to Saturday. All construction works are predicted to comply with the Monday to Saturday day-time construction noise limits set out in NZS 6803: 1999 - Acoustics - Construction Noise (NZS6803:1999). However, as

set out in the Assessment of Environmental Noise Effects (Technical Report L), construction noise on Crowther Road has the potential to exceed this noise limit within a certain setback distance from the receivers during the initial construction phase near the entrance of Crowther Road, and as such additional controls are proposed in the vicinity of this area, namely:

- No construction materials or earthmoving plant delivered prior to 0730 hrs as there is potential to exceed the L_{max} limit;
- No construction works on road upgrades prior to 0730 hrs when an excavator or grader is anticipated to be within 150m of a receiver;
- A Construction Noise and Vibration Management Plan is prepared by a suitably qualified person prior to construction works commencing for works that are within 100m of a receiver. It should, as a minimum, contain the provisions in Appendix E of NZS 6803:1999.

With the exception of this area, compliance is expected to be easily achieved as works move up Crowther Road and across the rest of the project works areas.

6.4 Construction traffic management

Traffic during the site establishment and initial construction will be managed in accordance with a Construction Traffic Management Plan (CTMP) (see conditions 35-37). The CTMP will provide a framework to be adopted by WMNZ to avoid, remedy or mitigate the adverse traffic and access effects of the construction works. In particular, the CTMP will include a range of measures to manage the potential effects on traffic, such as:

- Procedures to prevent queuing of vehicles accessing the site out on to State Highway 1 at any time.
- Limitations on construction traffic movements between 7.30am and 8.30am, 3.30 – 4.30pm on school term weekdays to avoid overlap of heavy traffic movements with the operation of the school bus pick-up and drop-off activity at the Crowther Road intersection with State Highway 1.
- Means by which the movement of large machinery/items can be undertaken at times and in a manner which minimises effects on State Highway 1 users

The construction of the roundabout will be undertaken in close consultation with, and subject to detailed design approval and safety audit confirmation from NZTA, as operators and managers of the State highway network. As with any works on or adjacent to State Highways, particular care will need to be taken to address construction traffic effects and works in close proximity to cars travelling on State Highway 1. Timing and sequencing of any required road closures and the nature and duration of any traffic management measures that will result, including any temporary restrictions, detours or diversions, will be developed and agreed with NZTA, and communicated to the public.

6.5 Bin exchange area

A bin exchange area will be provided near the entrance to the site as shown on the drawings in Appendix C. The operation of the bin exchange area is described in Section 5.7.4.

The platform for the bin exchange area will be constructed by a combination of fill on the lower areas and cut into the slope to the eastern side of the proposed location.

Earthworks and site preparation for the bin exchange area are anticipated to be undertaken over approximately two earthworks seasons. Following this initial work, services, lighting, other amenities and the permanent road surface will be constructed over a period of approximately two additional years.

The construction of the bin exchange area will require cutting and removal of material to create the working platform, with erosion and sediment control likely to be provided by a sediment control pond combined with careful sequencing and progressive stabilisation of the area to minimise sediment generation.

6.6 Access road and bridge

Construction of the access road will initially involve vegetation clearance, the establishment of a haul road and the construction of erosion and sediment control measures. Following this, the required earthworks will be undertaken including retaining walls and culverts where necessary. Construction of the access road will involve cutting and filling along the access route. Due to the access restrictions within the access road valley, and to minimise vegetation clearance and open earthworks areas, the road will be constructed in stages. These construction activities are anticipated to take up to four years, followed by a further year of sealing the road surface and planting of the embankments.

Due to the steep terrain, and need to minimise vegetation removal it is anticipated that there will be insufficient room to include sediment ponds for erosion and sediment control. As such the use of additional silt fences will be required, and works will need to minimise open areas and progressive stabilisation will be required. The key erosion and sediment controls proposed for the access road construction are as follows:

- Use of cleanwater diversions where possible, to direct cleanwater around the works areas.
- Undertaking the works progressively to minimise the open areas.
- Progressive stabilisation.
- Use of super silt fences downstream of the works areas.
- Use of decanting earth bunds.

Construction of the bridge will require the construction of piles near the stream bed, as well as construction of earth embankments at both ends. The bridge piles will be located outside of the stream. The key controls for these works are as follows:

- Minimising piling works and works within or near the watercourse to dry weather periods.
- Undertaking the works progressively to minimise the open areas.
- Progressive stabilisation.
- Use of super silt fences downstream of the works areas.
- Use of sediment ponds.

6.7 Valley 1 construction

Prior to the construction of the lining and leachate system for the first cell, earthworks will be undertaken within Valley 1 to prepare the landfill footprint. In general terms, the landfill valley will be ‘smoothed out’ to facilitate landfill construction, although the natural valley angles will be predominantly maintained to minimise earthworks volumes.

To minimise any effects from the discharge of sediment during the initial construction works for the first stage of the landfill including construction of the access roads and the work platforms for the workshop, Sediment pond 1 will be constructed prior to bulk earthworks commencing in Valley 1, to provide temporary sediment control. This will provide sediment control for the construction of the upstream ponds and works.

The downstream end (toe) of the re-contoured valley will be closed off by an earth bund. Pipes will be installed through the toe bund, to allow drainage by gravity. The floor of the re-contoured valley

will contain a stormwater pipe to allow upstream clean water to by-pass beneath the landfill waste pile. Temporary diversions will be established within the construction area in accordance with the Construction Erosion and Sediment Control Plan (ESCP).

These earthworks will form the base grade profile to provide a surface to facilitate geosynthetic liner installation for the first landfill cell.

6.8 Stockpiles and clay borrow area

Stockpile locations have been considered in the Engineering Report (Technical Report N) and are shown on Figures 4 and 5 in Appendix C. Two main stockpiles have been identified for stockpiling soil – Stockpile 1 is to be located in the Western Block, and Stockpile 2 in the Eastern Block, as well as a stockpile for topsoil (also in the Eastern Block).

It is anticipated that Stockpile 1 and the topsoil stockpile will both be utilised early in the construction programme, as large quantities of soil will be excavated for the construction of the Valley 1 sediment ponds and the access road. If required, Stockpile 2 and the clay borrow area may also be used for stockpiling materials in the initial construction phase. The stockpiles and the clay borrow area will each have an associated permanent sediment control pond to provide on-going management of runoff from the placement and removal of material. The permanent ponds for each area have been sized based on 3 % of the relevant stockpile / borrow area. The ponds will be constructed prior to placement of any material in the stockpiles or excavation from the clay borrow area.

Additional controls will be used during operation including stabilisation of placed material, cleanwater diversions around the areas where material is being placed or removed, and silt fences within the works areas.

The construction of the sediment ponds to treat the stockpiles and clay borrow will be undertaken during dry weather where possible, with controls in place including super silt fences. More detail on the ongoing operation and management of the stockpiles and clay borrow area throughout the operational phase of the project is provided in Section 5.8.3.

6.9 Streamworks

As described in the Ecology Report (Technical Report G), works will be required in streams across the project footprint, including construction of culverts in, and reclamation of, intermittent and permanent streams. Prior to any streamworks commencing, a detailed Streamworks Methodology will be prepared and will set out the site specific erosion and sediment controls for each area of works and controls on the works (refer condition 44). All streams will be de-fished prior to works commencing within the stream, and works will be undertaken at times when normal in-stream flows can be diverted around the works and a four-day weather forecast predicts no rainfall.

Works will also occur within ephemeral streams, including reclamation, which is permitted by the AUP. The Hōteo River and its river banks will not be disturbed.

All streams in the valley containing the waste pile will ultimately need to be reclaimed and diverted. Staging of the landfill development will be designed to delay reclaiming streams for as long as practical. Progressive reclamation of streams up the valley will occur as the landfill develops, with fish relocation occurring prior to forestry clearance.

6.10 Ecological management and monitoring

Throughout this work a programme of ecological management and monitoring will be put in place to avoid, remedy, or mitigate potential adverse ecological effects relating to construction. This programme will include the protection and/ or salvage and relocation of ecologically significant flora

and fauna from within the construction footprint, where practicable. These measures are described in more detail in the Ecological Assessment and are summarised below.

6.10.1 Vegetation clearance

A Vegetation Clearance Plan will be prepared prior to vegetation clearance commencing, and will be implemented to minimise the area of vegetation impacted by the project (refer condition 49). Vegetation clearance will be minimised by physical delineation/protection of areas and individual significant or high value large trees that are close to but outside the project footprint, to prevent intrusion of works into the areas surrounding the project footprint. Following clearance of vegetation, felled logs with a DBH of 60 cm or greater will be moved into areas proposed for revegetation, to support the establishment of new areas of planting as functioning ecological areas. Clearance of areas of contiguous vegetation will be timed to avoid the peak bird breeding season (September – December inclusive for forest birds and August – January inclusive for wetland birds) to the extent practicable. In addition, felled vegetation shall be placed away from streams to avoid adverse effects from wood leachate on water quality.

6.10.2 Fauna management

As described in Section 4.3 a range of native fauna have been identified as present within the WMNZ landholdings. As such, a comprehensive programme of fauna surveys and salvaging and relocation will occur prior to and throughout the construction works, in accordance with a Fauna Management Plan. The requirements for this are set out in more detail in the Ecology Report (Technical Report G), and in Conditions 50-58 (Appendix G). In summary, the Fauna Management Plan will cover measures to avoid, remedy or mitigate effects on:

- Bats;
- Avifauna (birds);
- Herpetofauna (lizards, frogs);
- Native fish and kōura; and
- Invertebrates (peripatus, snails).

The measures will include:

- Restrictions on timing of works to avoid more sensitive times such as breeding season;
- Identification of and avoidance/setbacks from sensitive areas (where practicable);
- Processes for checking fauna are not present within a particular area prior to vegetation clearance, or where they are present, processes to salvage and relocate fauna; and
- Methods for salvaging and relocation including salvage methods and timings, relocation site location(s) and habitat enhancement measures at the relocation site (such as deployment of logs and pest control).

7 Closure and aftercare

7.1 Landfill closure

Once the landfill reaches capacity, the landfill shall be closed and the final cap shall be installed. The proposed final fill contours for the landfill are shown in Volume 3, representing the expected final contours after settlement.

The life of the landfill will depend on waste volumes – if waste generation decreases over time, the landfill life will be extended, and vice versa for increasing waste volumes.

7.2 Final cap

The final cap of the landfill will be constructed progressively as areas of the landfill reach final design levels. Stockpiled soil will be utilised to construct the final cap, with the surface contoured to direct stormwater into perimeter drainage systems. Finally, topsoil will be placed and vegetation will be established on the cap. The extent and type of planting will be determined closer to the time of closure, but needs to ensure that plants that are established on the cap are shallow rooting species, so they do not pierce the landfill cap. As a minimum the entire cap would be planted with grass (i.e. will not be left as bare earth). A cross-section of a typical final cap is shown in Figure 7.1.

Additional closure works will include grading stockpile areas to integrate them into to the surrounding topography, probable removal of sediment ponds and the re-vegetation of any exposed earthworks areas.

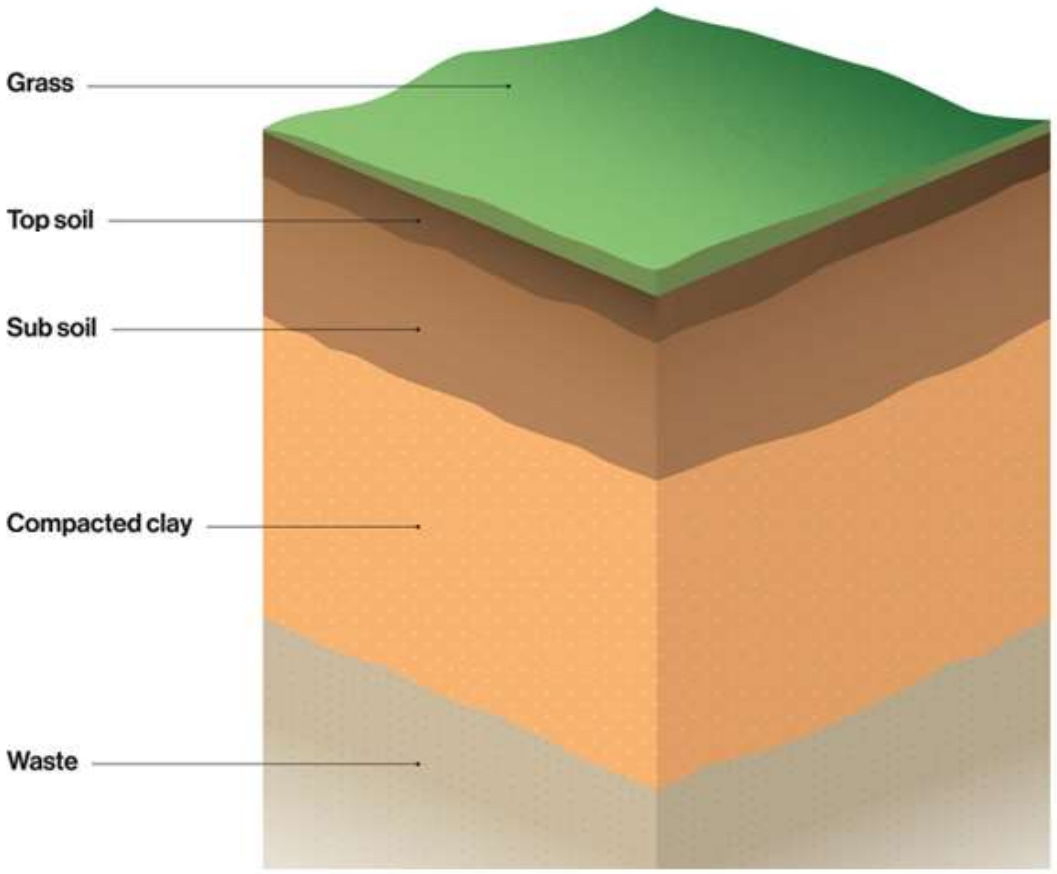


Figure 7.1: Schematic cross-section of a typical final cap

7.3 Rehabilitation and aftercare

At least 24 months prior to the landfill ceasing to accept waste for placement, WMNZ will prepare a Post Closure Management Plan (PCMP) (refer condition 201 in Appendix G). The PCMP will describe the measures to be taken to stabilise the site and maintain environmental controls including stormwater, leachate and landfill gas collection and treatment. The plan will set out the key objectives of the closure, restoration and aftercare plan, which will include:

- Ensure the final landfill surface remains in a stable, vegetated condition, in accordance with the approved planting plan;
- Minimise long term infiltration into the landfill and hence minimise leachate generation; and
- Minimise LFG migration through provision of a low permeability compacted earth cap and continued LFG extraction and disposal, for the duration of the post closure period

Following final closure, WMNZ will be responsible for full care and environmental maintenance of the facility for the post closure period, including implementation of the PCMP. Leachate treatment, LFG extraction, and monitoring across the site will continue through this period in routine operating mode.

8 Resource consent requirements

8.1 Auckland Unitary Plan

The Auckland Unitary Plan (Operative in Part) is a single comprehensive plan for the Auckland Region and includes the RPS provisions, regional provisions and district provisions that apply across the region. The AUP was made operative in part in September 2016 and replaced the former regional policy statement and 12 district and regional plans.

The requirements for resource consents are determined by the rules in the AUP. There are no provisions of the AUP under appeal relevant to this application, and hence it is deemed to be the operative document for this application. The rules which apply are determined by the zoning of the site, any identified notations in the AUP and the nature of the activities proposed.

The general zoning and planning limitations that apply to the site under the AUP are set out in Table 8.1 below, and are shown on Figure 6 in Appendix C.

For the avoidance of doubt, WMNZ is seeking resource consents under the rules identified in Table 8.2 and any other rules which may apply to the activity, even if not specifically noted.

Overall, resource consent is required from Auckland Council as a non-complying activity.

Table 8.1: Zoning and planning notations

Zoning / Overlay or other planning limitation	Comment
Rural Production Zone	The Rural Production Zone is the underlying zone of the whole site – this zone is intended to provide for the use and development of land for rural production activities and rural industries and services, while maintaining rural character and amenity values.
Significant Ecological Area Overlay (SEA)	Several SEAs are identified within the wider WMNZ landholdings. SEA overlays protect areas of vegetation which have been identified as having particular characteristics and are afforded a higher level of protection by the AUP. No works are proposed within the SEA overlays on the WMNZ landholdings.
Natural Stream Management Areas Overlay (NSMA)	A NSMA is identified within the Southern Block, covering the main stream in the base of the valley. Another NSMA is identified along the Hōteo River channel. This overlay applies to rivers and streams with high natural character and high ecological values. The project footprint largely avoids these areas, although a small unavoidable encroachment of approximately 80m² will occur at the upstream end of the NSMA identified in the Southern Block
Outstanding Natural Landscapes Overlay (ONL) – Area 32 Dome Forest	This overlay is to the south of the proposed landfill footprint and covers the Sunnybrook Reserve, with a small proportion of the ONL extending onto the WMNZ landholdings. The ONL overlay is intended to protect outstanding natural landscapes from inappropriate subdivision, use and development. None of the project works will occur in this overlay.
Emergency Management Area Control – New Zealand Refining Pipeline	The emergency management area control relates to the petroleum pipeline which crosses the Western

Zoning / Overlay or other planning limitation	Comment
Designation ID 9101 – Taupaki to Topuni Gas Pipeline	Block and is intended to manage risk. The pipeline is also designated. No works are proposed in the vicinity of the pipeline, except for earthworks associated with the roundabout at the proposed site entrance on State Highway 1. The earthworks will be separated from, and will be undertaken in a way that does not affect, the pipeline.
Designation ID 6500 – Petroleum Pipeline Rural section	
Overland flowpaths	Council mapping shows a number of overland flow paths within the project footprint area and across the WMNZ landholdings. There are rules for activities within overland flowpaths, which have been assessed in this AEE.
Flood Plains	The margins of the main stream channels within the WMNZ landholdings and an area to the east of SH 1 in the Southern Block are identified by Council mapping as floodplains. This overlay identifies areas predicted to be covered by flood water as a result of a rainstorm event of a scale that occurs on average once every 100 years, based on hydraulic modelling. There are rules for activities within flood plains, and consents that are required under these rules are sought.

Table 8.2: Resource consents required under the AUP

Rule reference / description	Activity status	Comment
Activities in, on, under or over the bed of lakes, rivers, streams (including intermittent streams) and wetlands		
E3.4.1 (A19) – Diversion of a river or stream to a new course and associated disturbance and sediment discharge	Discretionary	A number of streams are proposed to be reclaimed and their flows subsequently diverted as shown in the drawings in Volume 3. Accordingly, consent is sought as a discretionary activity under Rule A19.
E3.4.1 (A33) – Culverts or fords more than 30m in length when measured parallel to the direction of water flow	Discretionary	A number of culverts are proposed to be installed, including significant culverts at the head of the Southern Block and beneath the lining system in Valley 1. The location of these is shown in the drawings in Volume 3. Details of the key culverts are provided in the Engineering Report (Technical Report N). Accordingly, consent is sought as a discretionary activity under Rule A33.
E3.4.1 (A33) – Culverts or fords more than 30m in length when measured parallel to the direction of water flow	Non-complying	A culvert is proposed to be installed at the upstream end of the NSMA in the Southern Block. This will encroach into the NSMA by approximately 10m. As such, consent is sought as a non-complying activity under Rule A33.
E3.4.1 (A49) – New reclamation or drainage, including filling over a piped stream	Non-complying	Approximately 15.4 km of stream is proposed to be reclaimed. The streams, including their classification as intermittent/permanent, are described in Technical Report G. Accordingly,

		consent is sought as a non-complying activity under Rule A49.
Discharge of contaminants to land –		
E4.4.1(A15) - Discharge of water or contaminants (including washwater) onto or into land and/or into water not complying with the relevant standards or not otherwise provided for by a rule in the Plan	Discretionary	The proposed development will utilise irrigation of leachate back onto the landfill footprint when needed as part of leachate management for the site, as described in Technical Report N. Accordingly, consent is sought as a discretionary activity under Rule A15.
Taking, using, damming and diversion of water		
E7.4.1 (A9) - Take and use of surface water, including dams not meeting the permitted activity, controlled activity or restricted discretionary activity standards or not otherwise listed	Discretionary	A 150 mm diameter pilot groundwater bore was drilled to 250 m depth and was cased to approximately 200 m depth, for the purposes of investigating groundwater level and quality in accordance with the permitted activity standards for rule E7.4.1 (A38). However, it is now proposed to utilise this bore for the purposes of supplying potable water. As such, consent is sought for the bore and for a daily water take of 50 m^3 under Rule A9 as a discretionary activity. In addition, water will be extracted from the stormwater ponds for non-potable water, including for use as dust supply. This is a water take from a dam, and accordingly consent is sought as a discretionary activity under Rule A9
E7.4.1 (A26) - Take and use of groundwater	Discretionary	A groundwater take of 50 m^3 per day is proposed to provide potable water supply for the site, as described in Technical Report E. Accordingly, consent is sought as a discretionary activity under Rule A26.
E7.4.1 (A35) - Dams not otherwise listed	Discretionary	Dams will be created by the construction of stormwater ponds at the base of Valley 1, as described in Technical Report P. Due to the location of these ponds (on-line) and the volume of storage in the ponds, consent is sought as a discretionary activity under Rule A35.
E7.4.1 (A28) - Diversion of groundwater caused by any excavation (including trench) or tunnel that does not meet the permitted activity standards or is not otherwise listed	Restricted discretionary	The landfill development will require excavations which exceed 1 ha in area and more than 6 m below the natural ground level, and therefore the permitted activity standards are exceeded. Consent is sought for the diversion of groundwater associated with the proposed excavations. Expected volumes of groundwater to be diverted are described in Technical Report E. Accordingly, consent is sought as a restricted discretionary activity under Rule A28.
Stormwater – discharge and diversion		
E8.4.1 (A5) - Diversion and discharge of stormwater runoff from additional impervious areas greater than 5,000m2 of road (which include road ancillary areas that are part of a road,	Restricted discretionary	The proposed access road will result in an impervious road surface greater than 5000 m^2. Stormwater from the road will be diverted and discharged via filter strips, as described in Technical Report P. Accordingly, consent is

motorway or state highway operated by a road controlling authority) or rail corridor that complies with Standard E8.6.1 and Standard E8.6.4.1		sought as a restricted discretionary activity under Rule A5.
E8.4.1 (A10) - All other diversion and discharge of stormwater runoff from impervious areas not otherwise provided for	Discretionary	Stormwater from impervious surfaces required for landfill operations will require diversion and treatment. As described in Technical Report P, stormwater will be diverted and discharged following treatment from a number of discharge points across the site. Accordingly, consent is sought as a discretionary activity under Rule A10.
Land disturbance (Regional)		
E11.4.1 (A5) – Greater than 50,000m^2 where land has a slope less than 10 degrees outside the Sediment Control Protection Area	Restricted discretionary	In excess of 5.5 Mm^3 of earthworks will be undertaken over the course of the landfill operation. This includes more than 700,000 m^3 for the access road construction during the initial construction stage as well as ongoing earthworks associated with clay borrow, formation of new cells, daily cover, stockpiling of soils. Accordingly, consent is sought as a restricted discretionary activity under Rule A5 and A8.
E11.4.1 (A8) – Land disturbance greater than 2,500m^2 where the land has a slope equal to or greater than 10 degrees	Restricted discretionary	
Land disturbance (district)		
E12.4.1 (A6) – Greater than 2500m^2 of land disturbance	Restricted discretionary	In excess of 5.5 Mm^3 of earthworks will be undertaken over the course of the landfill operation. This includes more than 700,000 m^3 for the access road construction during the initial construction stage as well as ongoing earthworks associated with clay borrow, formation of new cells, daily cover, stockpiling of soils. Accordingly, consent is sought as a restricted discretionary activity under Rule A6 and A10.
E12.4.1 (A10) – Greater than 2500m^3 of land disturbance	Restricted discretionary	
Discharges from cleanfills, managed fills and landfills		
E13.4.1 (A9) Discharges from new landfills	Non-complying	Rule A9 requires discharges from new landfills to obtain consent as a non-complying activity. This rule applies regardless of the size of the landfill. Accordingly, consent is sought as a non-complying activity under Rule A9.
Air quality		
E14.1.1 (A2) - Activities not meeting the permitted activity standards and not provided for by any other rule	Discretionary activity	Once sufficient landfill gas is available on site, leachate is proposed to be evaporated on-site rather than being trucked off-site to a treatment facility. Evaporation of leachate is not provided for by any other rule, and as such consent is sought as a discretionary under Rule A2.
E14.4.1 (A54) - Combustion activity not meeting the permitted, controlled or restricted discretionary standards	Discretionary activity	Combustion of landfill gas will be undertaken, both by the energy centre for electricity generation, as well as through the flare. Accordingly, consent is sought as a discretionary activity under Rule A54.

E14.4.1 (A160) - Landfills that do not comply with restricted discretionary or discretionary activity standards	Non-complying activity	Discharges to air from new landfills receiving waste material, including domestic and industrial wastes are non-complying. Accordingly, consent is sought as a non-complying activity under Rule A160.
Vegetation Management and biodiversity		
E15.4.1 (A10) - Vegetation alteration or removal, including cumulative removal on a site over a 10-year period, of greater than 250m² of indigenous vegetation that: (a) is contiguous vegetation on a site or sites existing on 30 September 2013; and (b) is outside the rural urban boundary	Restricted discretionary	The site is outside of the rural urban boundary. 5.6 ha of native vegetation is proposed to be removed, comprised of 0.863 ha of mature native, 4.616 ha of regenerating native and 0.132 ha of indigenous wetland vegetation. The areas of clearance are shown in Technical Report G. While not all contiguous, a conservative approach has been taken for the purposes of assessment against this rule. Accordingly, consent is sought as a restricted discretionary activity under Rule A10.
E15.4.1 (A12) - Vegetation alteration or removal of any vegetation within a Natural Stream Management Areas Overlay	Restricted discretionary.	An area of fill and associated culvert is proposed at the upstream end of the NSMA in the Southern Block, which will result in vegetation removal over an area of approximately 80 m². Accordingly, consent is sought as a restricted discretionary activity under Rule A10.
E15.4.1 (A17) - Vegetation alteration or removal within 10m of rural streams in the Rural – Rural Production Zone and Rural – Mixed Rural Zone	Restricted discretionary.	Vegetation will need to be cleared along the edges of streams across the project footprint, as shown in Technical Report G. Accordingly, consent is sought as a restricted discretionary activity under Rule A17.
E15.4.1 (A18) - Vegetation alteration or removal within 20m of a natural wetland, in the bed of a river or stream (permanent or intermittent), or lake	Restricted discretionary.	There are a number of natural wetlands within the site as described in Technical Report G. Vegetation clearance is proposed within 20m of several of these, including within some of the wetlands where they overlap with the project footprint, as shown on the drawings in Technical Report G. Accordingly, consent is sought as a restricted discretionary activity under Rule A18.
Infrastructure		
E26.2.3.1 (A63) – Other electricity generating facilities	Discretionary	The energy plant will generate electricity from burning landfill gas, which will be exported to the national grid. Accordingly, consent is sought as a discretionary activity under Rule A63.
Transport		
E27.4.1(A5) - Construction or use of a vehicle crossing where a Vehicle Access Restriction applies under Standards E27.6.4.1(2) or E27.6.4.1(3)	Restricted discretionary	The site access will be constructed off State Highway 1, which is identified as an arterial road in the planning maps. As such Vehicle Access Restrictions apply under E27.6.4.1(3), and accordingly consent is sought as a restricted discretionary activity under Rule A5.
Hazardous substances		
E31.4.1(A7) – Hazardous facilities that store or use hazardous substances above the specified thresholds for	Discretionary	It is proposed to store diesel in a 40,000L tank at the workshop, which exceeds the restricted discretionary threshold for the Rural-Production

controlled activity and restricted discretionary activity status in the activity tables or are not otherwise provided for		zone. The tank will be located away from watercourses and will have secondary containment. Accordingly, consent is sought as a discretionary activity under Rule A7.
Industrial and trade activities		
E33.4.1 (A8) - Use of land for a new industrial or trade activity listed as high risk in Table E33.4.3	Controlled	Consent is required for the establishment of a high risk industrial trade activity. All landfills regardless of size are deemed to be a high risk activity. In addition the bin exchange area will involve storage of waste, and is considered an industrial trade activity. Accordingly, consent is sought as a controlled activity under Rule A8.
E33.4.1 (A9) - Any activity in this table that does not meet the relevant permitted or controlled land use standards	Discretionary	The project includes a number of areas which have been assessed as industrial or trade activities, including the access road, energy centre, wheel wash and workshops (Technical Report P). These are not listed ITA activities, and treatment will be installed to avoid, remedy or mitigate adverse environmental effects. Measures to manage the ITA areas of the site are described in Technical Report P. Accordingly, consent is sought as a discretionary activity under Rule A9 and as a controlled activity under Rule A12.
E33.4.2(A12) - Discharge of contaminants from an existing or new industrial or trade activity area not listed in Table E33.4.3 where the permitted discharge standards are not met	Controlled	
E33.4.2 (A24) - Discharge of contaminants from a new industrial or trade activity area listed as high risk in Table 33.4.3	Discretionary	Landfills are classified as a high risk activity in Table 33.4.3. Accordingly, consent is sought as a discretionary activity under Rule A24.
Natural hazards and flooding		
E36.4.1(A37) – All other new structures and buildings within the 1% AEP floodplain	Restricted discretionary	The area where the bin exchange area is proposed is identified as being within the 1% AEP floodplain. Filling will be undertaken in the floodplain, and accordingly consent is sought as a restricted discretionary activity under Rule A37.
E36.4.1 (A41) – Diverting the entry or exit point, piping or reducing the capacity of any part of an overland flow path	Restricted discretionary	A number of overland flow paths are identified within the proposed project footprint, and will be diverted, piped or filled, as shown on the drawings in Volume 3. The pre-development overland flow paths are shown in Technical Report G. Accordingly, consent is sought as a restricted discretionary activity under Rule A41.
E36.4.1 (A42) - Any buildings or other structures, including retaining walls (but excluding permitted fences and walls) located within or over an overland flow path	Restricted discretionary	Various structures and buildings will be located within or over an overland flow path, as shown on the drawings in Volume 3. The pre-development overland flow paths are shown in Technical Report G. Accordingly, consent is sought as a restricted discretionary activity under Rule A42.
E36.4.1 (A56) – Infrastructure in overland flow paths not otherwise provided for	Restricted discretionary	The landfill footprint and access road are considered to be infrastructure but are not otherwise provided for in the rules. Both will cross and divert numerous overland flow paths,

		as shown on the drawings in Volume 3. The pre-development overland flow paths are shown in Technical Report G. Accordingly, consent is sought as a restricted discretionary activity under Rule A56.
Rural Production zone – land-use		
H19.8.1 (A67) – Landfill	Non-complying	The proposed development involves the establishment of a landfill in the Rural Production zone. Therefore consent is required as a non-complying activity under Rule A67.

8.2 Other consents and approvals required

8.2.1 Additional approvals

In addition to the resource consent process, WMNZ will need to obtain a number of other authorisations, including building consents for buildings and structures on the site. WMNZ will apply for building consent for the construction of the ancillary buildings following any grant of the required resource consents for the site.

No archaeological authority under the Heritage New Zealand Pouhere Taonga Act 2014 is considered to be required as no works are proposed in the vicinity of known archaeological features. If an accidental discovery occurs during the works, an archaeological authority will be obtained in accordance with the accidental discovery protocol in the AUP.

Other required approvals are described below.

8.2.2 Solid Waste Bylaw

Auckland Council's Solid Waste Bylaw was adopted by Council in 2012. The bylaw is part of a multi-pronged approach to reducing waste to landfill in the Auckland region. The bylaw provides for a licensing system for waste collectors and operators of waste facilities. The bylaw also provides the framework for operational controls about the collection, transportation and disposal of waste, and collection of waste. The Council is currently in the process of reviewing the bylaw.

Section 16(1) of the bylaw requires any person who operates a fill site, including a landfill, to obtain a licence to do so from the Council. WMNZ will obtain a licence from Council prior to commencing operation of the site, which will need to be renewed annually.

8.2.3 Freshwater species relocation permits

As described in Section 6.9, electric fishing will be undertaken prior to works occurring within streams in the project footprint. Permits are required under the Conservation Act 1987 to transfer and release freshwater aquatic life. If the relocation site already has the species present, permits are obtained from MPI. If the species is not present, an authorisation must be obtained from DOC. Tonkin + Taylor holds existing permits from MPI and DOC for electric fishing and fish relocation within the same catchment, and will discuss with MPI and DOC whether these permits can be used for this project. If not, project-specific permits will be obtained. The release location will be confirmed as part of the proposed Fish Relocation Plan, which will be prepared prior to works commencing. If required, additional permits will be sought from DOC and MPI.

8.2.4 Wildlife Act permits

Permits will need to be obtained from DOC under the Wildlife Act 1953 for salvage and relocation of protected species and for unintentional deaths of protected species, which could occur as a result of the project works. These will be sought once fauna management plans have been developed and potential relocation sites have been confirmed.

8.2.5 Minor alteration to designation for State Highway 1

The project includes construction of a new roundabout on State Highway 1 to provide access to the site. The footprint of the roundabout will exceed the current width of NZTA's designation for the State highway. As such, WMNZ will prepare a minor alteration to the designation, on behalf of NZTA, to change the extent of the designation to ensure the entire roundabout is within the designation boundaries, so as to provide for NZTA's future operational and maintenance requirements. This minor alteration is to occur after completion of the construction works associated with the roundabout, which are proposed to be authorised under the resource consents being sought.

8.2.6 Road stopping of unformed legal roads

There are a number of unformed legal roads within the WMNZ landholdings, including some which cross Valley 1. WMNZ will seek to have these roads stopped under the Local Government Act 1974. Unformed legal roads on the WMNZ landholding are under the control of Auckland Transport as the relevant Road Controlling Authority. An application will be made to Auckland Transport for the road stopping.

8.2.7 Access approval

WMNZ will apply to NZTA for an access approval, given the upgrade of the access for the site onto the State Highway 1 and the change in the nature of traffic entering State Highway 1 from the site. This approval will be provided to Auckland Council once received.

9 Assessment of effects on the environment

9.1 Introduction

The following assessment identifies and assesses the types of effects that may arise from the proposed works. The conclusions in the following subsections have been drawn from the technical reports contained in Volume 2. This section also outlines the measures that the applicant proposes to avoid, remedy, mitigate, or off-set any potential adverse effects on the environment.

9.2 Positive effects

9.2.1 Provision of regionally significant infrastructure

As recognised by the AUP, municipal landfills are a vital piece of regional infrastructure. The establishment and operation of infrastructure in itself provides a positive benefit to the region, as it provides a necessary service, which enables society to function. Landfills such as the Auckland Regional Landfill provide an important component of the overall waste management system for the Auckland region. They provide a final point of disposal for residual wastes which cannot be reduced, reused or recycled. Waste is generated by both residential households and businesses as well as through construction activity. The functioning and growth of Auckland cannot be supported if there is no infrastructure in place to deal with waste generated.

The Auckland Regional Landfill will provide a centralised, contained and controlled location for disposal of residual waste which has not been diverted or recycled. In the absence of a controlled disposal location for containment of waste, there would be potentially significant adverse environmental and economic effects associated with uncontrolled waste.

9.2.2 Job creation in the local area

As discussed in the Assessment of Economic Effects (Technical Report I), locating the proposed Auckland Regional Landfill near Warkworth and Wellsford will provide additional employment, incomes and expenditure for the local Rodney economy. Once operational, the proposed new Auckland Regional Landfill is expected to create 45 to 70 new full-time equivalent jobs (30 to 40 permanent full-time Waste Management staff and 15 to 30 contractor full-time equivalent staff) in the Warkworth-Wellsford area. The additional employment in the area creates indirect benefits for other businesses, as employees spend their income in the local economy. In addition, WMNZ estimate expenditure by the landfill with local Rodney businesses for goods and services to average $2 million to $4 million per annum during the operating life once construction is completed. The types of local Rodney businesses likely to benefit from this expenditure are civil engineering and earthmoving contractors, building companies, plumbing and electrical trades, mechanical/electrical manufacturers, landscapers, scientific monitoring service providers, and to a lesser extent hospitality, accommodation, and food and beverage service providers.

9.2.3 Energy generation

Landfill gas (LFG) is an unavoidable by-product of the decomposition of organic material. The Auckland Regional Landfill will include a sophisticated system to capture LFG. The LFG will then be sent to the energy generation plant which will convert the LFG into electricity.

This electricity will be fed into the national grid and is a positive use of a waste by-product. As the landfill is progressively filled, generation of LFG will continue to increase, with LFG volumes peaking at the point where the landfill reaches full capacity. It is expected that, after 20 years, the power generation plant will generate enough electricity to supply approximately 16,000 houses. The Renewable Energy Centre at Redvale Landfill is currently the largest contributor to renewable energy

supply in the Auckland Region, and it is likely that this facility will also be a significant contributor to the region. This ties in to wider government policy, which has an increasing focus on renewable energy generation.

LFG will also be used to power part of the leachate evaporator process, which avoids the adverse environmental effects of trucking and treating this leachate off-site.

Alternative uses for the treated LFG by industry as a source of renewable energy may also be investigated.

9.2.4 Recreation access

WMNZ proposes as a condition of consent, subject to reaching agreement with DOC and WAC and obtaining the necessary landowner approval, to implement the following:

- Two opportunities to enhance the recreational value of Sunnybrook Scenic Reserve[15];
- Two opportunities to create mountain bike tracks within the WMNZ landholding; and
- Establish and form a walking and cycling access to and along the Waiwhiu Stream, including amenity areas at appropriate swimming or picnicking sites along the stream.

These new opportunities for recreational access will enhance and improve recreational opportunities in the area, complementing existing tracks and increasing the usability of Sunnybrook Reserve. This will create positive social and health and well-being benefits for the community and other users.

9.2.5 Conclusion

The Auckland Regional Landfill will result in a range of positive effects, including:

- Provision of a controlled disposal location for Auckland's waste, avoiding potentially significant adverse effects associated with uncontrolled disposal of waste;
- Provision of landfill capacity to enable and support Auckland's population growth and development;
- Economic benefits for the surrounding community, including new employment and expenditure in the region;
- Positive use of biomass, to generate renewable electricity and feed this back to the national grid, with potential to provide energy for up to 12,000 houses in the wider Auckland region; and
- Provide new recreation opportunities in the area.

These will result in significant positive effects associated with the project.

In addition to those effects there will be a range of further and long term positive outcomes associated with a range of proposed revegetation and restoration works described in the sections below.

[15] As WMNZ does not own the land within Sunnybrook, this will be reliant on achieving agreement with DOC, with WMNZ providing the funding for these opportunities rather than directly implementing them.

9.3 Geology

9.3.1 Site suitability

The underlying geology is a critical consideration when selecting a site for landfill development. Ideally, the geology should provide long term natural containment of leachate, as an additional safe guard should the engineered lining system ever fail. As such, high permeability soils, karst geology or areas subject to coastal erosion are avoided.

The geology within the proposed landfill footprint includes variably weathered and fractured Pakiri Formation bedrock and associated residual soils. The bedrock and residual soils generally have low permeability, which should provide good natural containment. The site is not close to the coast, or any active faults and does not overlie Karst geology or high permeability sand and gravel. The rock and soil materials available on site are generally suitable for liner construction and landfill operation. Additional engineering controls are proposed in the Engineering Design Report (Technical Report N) to provide additional containment and protection to the surrounding environment where the WMNZ landholdings are underlain by fractured rock.

The ground investigations as set out in the Geotechnical Interpretive Report (Technical Report B), have indicated that the underlying geology of the project footprint is generally suitable and appropriate for landfill development, provided that the landfill is constructed in general accordance with the Technical Guidelines for Disposal to Land[7] and recommendations contained within the Geotechnical Interpretive Report.

9.3.2 Slope stability

The development of a landfill relies on having a safe and efficient site with good slope stability. Slope instability can cause a range of potential adverse effects, including uncontrolled sediment discharges and damage to the landfill lining system. Slope instability can be triggered by placing fill on a slope (fill embankments) or cutting into a slope, destabilising the material above. As such, it is important to identify potential instability risks, and adapt the design accordingly to remove or manage the area.

Some pockets of historic land instability have been identified within the WMNZ landholdings, including a couple of potential historical areas of landslips within Valley 1. Accordingly, this has been taken into account in the development of the landfill design, and will be managed through a range of measures, including:

- The construction of the landfill will involve modification of the existing valley by flattening, buttressing and draining of the existing slopes. All of these steps will improve and enhance the stability of Valley 1.
- Geotechnical engineering investigations and monitoring will occur throughout the construction, and if adverse or unexpected geological conditions are encountered, the earthworks design will be amended to address these conditions, which may include excavating out or stabilising areas subject to potential instability. Observations of the works by a geotechnical engineer are particularly critical in order to confirm that the ground and groundwater conditions assumed as part of the design process are consistent with what is encountered as part of the physical work.
- Areas of the site that have been disturbed will be protected to minimise erosion.

In summary, while there are some areas of potential historical instability within the WMNZ landholdings, these will be managed (avoided, remedied or mitigated) during the landfill design and construction process, such that the potential risks and associated adverse effects of slope instability will be minor.

9.3.3 Seismic risk

Earthquakes pose a potential risk to landfill stability and containment. In the event of an earthquake, there is a risk of liner failure or collapse. Accordingly, the potential seismic risk to the landfill was a key consideration during project development. A site specific seismic hazard assessment has been prepared for the site to assess the risks (Technical Report C).

The study concluded that the proposed Auckland Regional Landfill site is in an area of relatively low seismicity compared to the rest of New Zealand. There are no active faults present within 20 km of the project site according to the New Zealand Active Faults Database, and no significant fault zones were encountered in the boreholes or other geotechnical investigations. The site specific study predicted lower levels of shaking during a hypothetical earthquake event than specified in the relevant design standards for the site. As the landfill will be designed to meet the relevant standards[16], then the landfill seismic design standards are considered to be conservative. By designing to the relevant seismic design standards, the adverse effects of seismic risk are expected to be less than minor and within accepted engineering standards for the proposed activity.

9.3.4 Conclusion

Overall, the Geological Investigation Report (Technical Report B) has confirmed that the underlying geology within the landfill footprint is suitable for landfill development. The landfill footprint is underlain by low permeability soils, and fractured bedrock, which will provide good containment with controls. The WMNZ landholdings are not close to any active faults, and suitable soils are located within the WMNZ landholdings for liner construction and landfill operation.

The proposed ongoing investigations and oversight from geotechnical engineers throughout the life of the landfill will inform design and ensure that the landfill is constructed to appropriately manage the existing ground conditions. WMNZ has a track record of successfully managing geotechnical hazards and risks at other operating landfills. Provided the hazards and risks are managed appropriately, the potential adverse effects of underlying geology on the landfill integrity, and seismic risk is considered to be minor.

9.4 Air quality

9.4.1 Introduction

The potential air quality effects of a landfill generally fall into two categories – amenity effects associated with odour and dust, and potential human health effects associated with landfill gas generation and combustion. The following sub-sections describe the nature of discharges to air from the project and the proposed controls to minimise these discharges and mitigate effects.

9.4.2 Amenity effects

9.4.2.1 Odour

The main potential sources of odour at a landfill are from the waste itself or from LFG which contains traces of odorous gases. LFG and waste odours are intrinsically offensive in character and could potentially cause adverse amenity effects for surrounding receivers.

[16] NZS1170.5 and the Bridge Manual

To assess the potential for adverse effects from odour, modelling has been undertaken (Technical Report D). The modelling predicted that at the nearest sensitive receptors (houses), odour is expected to be imperceptible.

The large separation distances to sensitive receptors will contribute significantly to minimising off-site odour effects. As shown in Figure 7 (Appendix C), the separation distance to the nearest sensitive receptor from the landfill is greater than 1 km. A separation distance of more than 500m from the bin exchange area to the nearest sensitive receptor is also achieved. The availability of separation distances was an important factor in the site selection process. Consequently, there is no appreciable risk of odour nuisance effects in the surrounding area as a result of normal operational odour emissions at the landfill.

A range of odour management measures are proposed to be implemented at the landfill to minimise the risk of abnormal odour emission events (which are reflected in the proposed conditions). The measures include:

- Waste acceptance controls;
- Management of the bin exchange area, including minimising storage time of bins and use of enclosed bins;
- Management of the working face, including minimising the area of open working face, the mixing and burying of refuse, and special procedures for odorous waste;
- The use of odour neutralising sprays;
- LFG collection system;
- Efficient operation of the generators and flare; and
- Leachate management.

These controls will ensure that there is a very low risk of unplanned odour events that would cause offsite effects. As such, the combination of large separation distances and proposed controls will result in potential adverse effects of odour associated with the landfill operations being less than minor.

9.4.2.2 Dust

Dust will be generated at the landfill, particularly during dry, windy conditions, either during construction earthworks, or associated with daily landfilling operations. This has the potential for nuisance effects if not well-controlled.

The degree of dust generation during landfilling operations is generally related to traffic movements on the site and face access roads, particularly any unsealed sections of road, areas of exposed earthworks and the actual tipping of dusty loads of waste at the working face under windy conditions. The construction of the landfill entrance and bin exchange area have the greatest potential for offsite dust effects due to their relative proximity to the site boundary. The closest sensitive receptors (houses) to the bin exchange area are approximately 500 m away. It is noted however that this will be a temporary effect, as upon completion of the access road and bin exchange area, these areas will be sealed and therefore the on-going potential for dust from these two aspects is deemed to be low. After these construction works are completed, the nearest sensitive receptors (houses) will be 700 m away from any dust generating activities (the clay borrow area).

A range of dust control measures that are proposed to minimise dust emissions, thereby reducing any potential nuisance or visual amenity effects. These measures include:

- Paving of the main access road;

- Use of the vehicle wheel wash and maintenance to remove dust from the access road (as necessary) to minimise tracking of mud from the site, which later becomes dust;
- Use of a water tanker vehicle in periods of dry, windy weather to dampen down areas of earthworks and unpaved site roadways and in periods of wet weather to clean off mud that would later become dust;
- Control of dusty loads tipping at the working face (by damping down and/or immediate coverage), and by initiatives with customers to reduce dust in their wastes;
- Limiting vehicle speeds on unpaved roads to levels that do not raise excessive visible dust, particularly during dry or windy weather; and
- Reducing the area of exposed earthworks.

These measures are consistent with the Ministry for the Environment Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions (MfE, 2001), and are expected to ensure that off-site nuisance and any visual amenity effects of dust will be less than minor.

9.4.3 Contaminants generated from burning LFG

The combustion of LFG in the generators and flares at the Renewable Energy Centre will generate exhaust containing a number of contaminants. These contaminants are principally products of combustion (fine particulate, oxides of nitrogen (NOx), carbon monoxide (CO) and sulphur dioxide (SO_2)) similar to those generated by burning natural gas or other hydrocarbon fuels. These products of combustion have the potential to cause adverse health effects if people are exposed to them at sufficiently high concentrations. This can include both acute (short term) and chronic (long term) exposures.

Landfill gas can also contain low concentrations of volatile organic compounds and reduced sulphur compounds. These compounds are destroyed in the flares and generators, but there will be some residual emissions in the combustion discharges, as well as emissions in fugitive landfill gas from the landfill surface. The potential health effects of exposure to these compounds is assessed in the Health Risk Assessment (Technical Report T), which has not been completed at the time of writing.

In a rural area, residential dwellings are sensitive to both acute and chronic effects of air contaminants as people may be present almost continuously. However, in the wider rural environment, it is unlikely that people would be present at a single location for more than a typical working day (8 to 10 hours) and therefore would only be sensitive to acute effects.

Atmospheric dispersion modelling has been undertaken to assess the potential effects of discharges to air of the combustion products of burning LFG (Technical Report D). This modelling shows that, taking into account likely background concentrations, cumulative effects of these discharges from the project are expected to be well within relevant ambient air quality standards and guidelines at residential dwellings and will not cause any exceedances of NESAQ values beyond the boundary. Therefore, the adverse effects on air quality from the burning of LFG are considered to be negligible.

9.4.4 Conclusion

Overall, the potential amenity effects of the project associated with odour and dust are expected to be less than minor, while the potential health effects from combustion of LFG are expected to be negligible.

9.5 Groundwater

9.5.1 Introduction

Potential effects on groundwater associated with the development and operation of a landfill can be broadly split into two categories – potential effects on groundwater quantity and levels associated with taking and diverting water; and potential effects on groundwater quality from any potential contaminant migration.

9.5.2 Groundwater quality

One of the main by-products from the waste degradation process is leachate. Should leachate escape into the surrounding environment, it has the potential to migrate into and contaminate groundwater. Potential effects on groundwater quality will be largely avoided by the design and construction of an appropriate landfill lining system, capturing the leachate. The details of this lining system are summarised in Section 5.6.2. A thorough quality assurance process will be followed for installation of the lining system, to minimise the potential for defects (condition 74). Further, the proposed Waste Acceptance Criteria (Technical Report O) place restrictions on the contaminant composition of waste. This ensures the properties of leachate do not exceed expected characteristics. In addition, an extensive monitoring programme is proposed for groundwater to verify that leachate is being adequately contained and is not escaping into the underlying aquifer.

The Hydrogeological Assessment (Technical Report E) has undertaken an assessment, including modelling of contaminant migration in groundwater (based on an assumed rate of leachate seepage through the liner system), to understand the potential effects if leachate seepage through the lining system was to occur. The modelling demonstrates that even if a worst case scenario of leachate concentrations is assumed (i.e. no attenuation of contaminants as the leachate passes through the lining system), concentrations of contaminants in groundwater will be several orders of magnitude below guideline values for the relevant receptor (e.g. livestock, human health) at all potential points of exposure. Therefore, the effects of discharges of contaminants to groundwater as a result of leachate seepage are expected to be less than minor.

9.5.3 Groundwater take, diversion and drawdown

9.5.3.1 Introduction

Groundwater levels and volumes can be affected by excavations which extend below the water table, structures which change or intercept the direction of groundwater flow, and by direct extraction takes as described in Technical Report E.

9.5.3.2 Construction effects

The excavations required during the construction of the landfill are likely to extend below at least one of the perched water tables and as such may have potential effects on groundwater through take and diversion of perched and shallow groundwater. However, the quantities of groundwater which will be diverted are small, estimated to be approximately 47 m^3/day across the project footprint. Excavation depth will not extend into the deeper regional aquifer. Due to the small volumes of groundwater which may be diverted during construction, the effects of take and diversion are expected to be negligible.

9.5.3.3 Sub-soil drainage

Sub-soil drainage will be installed beneath the landfill lining system to avoid compromising the lining system. These drains will capture and divert groundwater springs beneath the landfill, which could potentially result in shallow groundwater drawdown and diversion of baseflows to surface

waterbodies. Due to the shallow nature of the upper groundwater system and low permeability of the soil, effects on shallow groundwater drawdown are anticipated to be limited to the immediate landfill footprint. As the diverted groundwater will be discharged as surface water near the existing confluence of Valley 1 and Valley 2 streams, where it would have naturally flowed, the effects on downstream surface water baseflows is expected to be less than minor. While many of the streams in Valley 1 are steep and spring fed, the streams will be reclaimed as a result of the project. Therefore the effects on the baseflow to the streams within Valley 1 are not considered. Considering the above points and the low volume of groundwater flow that is anticipated to be diverted by the sub-soil drainage the effects are expected to be less than minor.

9.5.3.4 Extraction for potable water

WMNZ is proposing to take up to 20,000 m^3/year or 50 m^3/day at a maximum rate of 0.55 L/s as potable water supply from the deeper regional groundwater. Extraction of water can cause draw-down at neighbouring bores, and if volumes in an aquifer are not carefully managed, they can become over-allocated and be depleted. A full assessment of the potential effects of this proposed take is included in the Hydrogeological Assessment (Technical Report E). In summary, as the proposed take is a small quantity, the aquifer has water available for allocation, and the proposed take is located approximately 2.2 km from the nearest consented bore, drawdown and quantity effects from the proposed take of regional groundwater are considered to be negligible.

9.5.4 Conclusion

In conclusion, the adverse effects of the project on groundwater are expected to be minor as:

- Contaminant concentrations at all potential points of exposure will be well below the relevant trigger levels, therefore any potential seepage of leachate through the landfill lining system is highly unlikely to have any adverse effects on receivers or receiving environments.
- The potential effect of the diversion of groundwater is less than minor because of sub-soil drains which will direct flows from seeps and springs to the stormwater system, which will eventually flow to the stream downgradient of the Valley 1 and 2 convergence. Thus the groundwater flow will largely enter the same systems that it would naturally have contributed to.
- There is negligible potential for adverse effects from the proposed groundwater take on the regional groundwater resource and for groundwater drawdown beyond the WMNZ landholdings boundary.

9.6 Erosion and sedimentation

9.6.1 Introduction

Earthworks and on-site activities associated with the project will increase the risk of sediment loads in the surrounding waterways. Increased sediment loads can have adverse effects on freshwater ecology and channel morphology. The Hōteo River Catchment is sensitive to discharges of sediment with potential effects within both the Hōteo River and its tributaries as well as within the Kaipara Harbour itself.

Earthworks will occur throughout the construction and operation of the landfill, however as the scale of earthworks during the initial construction works will be significantly greater than the on-going operational earthworks, they are discussed separately below.

9.6.2 Initial construction earthworks

The initial construction period will include formation of the roundabout, access road and bridge, construction of environmental controls such as stormwater ponds, and formation of the first landfill cell, all of which will require significant volumes of earthworks.

Erosion and sediment control measures are proposed to be implemented in order to minimise the extent of soil erosion and sediment yield from the WMNZ landholdings during construction works. A draft Construction Erosion and Sediment Control Plan (ESCP) has been prepared (refer Technical Report R), which outlines general mitigation measures that will be put in place. The erosion and sediment control measures proposed are in accordance with *Auckland Council Guideline Document 2016/005 (GD05): Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region.* For each area of specific works a site specific ESCP will be prepared, which will include the staging of the works and specific controls appropriate for the terrain and scale of works.

The general mitigation strategies to be undertaken on site include:

- Minimise land disturbance;
- Stage construction and minimise open areas of earthworks;
- Protect steep slopes;
- Protect watercourses;
- Provide rapid progressive stabilisation of exposed areas;
- Install perimeter controls to divert clean water around earthworks areas to avoid generating more sediment laden water;
- Employ detention devices;
- Train staff and contractors; and
- Inspect, monitor and maintain the controls.

Additionally, on-going monitoring of erosion and sediment control measures will be undertaken throughout the construction period. This monitoring will provide feedback to enable an adaptive approach to be used. Additional controls or measures will be implemented where there is a greater risk of sediment discharges, or where monitoring indicates that additional controls are required.

Considering the points above, including the taking of an adaptive approach to management, and assuming best practice erosion and sediment control, any potential effects on the environment arising from erosion and sedimentation during the construction phase are expected to be no more than minor.

9.6.3 Operational sediment discharges

During the operational phase of the landfill, the potential sources of sediment are associated with cell construction, borrowing clay, and moving fill into and out of the stockpiles. To manage the potential generation of sediment-laden water, a range of sediment control measures will be utilised. This will include the provision of a number of sediment control ponds for Valley 1 and the stockpile locations. The permanent sediment ponds for the stockpiles will be designed in accordance with Auckland Council's sediment control guidelines (GD05). The proposed permanent stormwater treatment for Valley 1 (two ponds in series and a wetland) exceeds the requirements of GD05 and is expected to achieve an overall sediment removal efficiency of 99%. Even during periods of high flow where the wetland is bypassed, the two sediment ponds in series is expected to achieve an overall removal efficiency of 96% of sediment.

In addition to the provision of permanent sediment ponds, additional measures will be utilised including the use of interim ponds within both the landfill and the stockpiles to provide additional

sediment removal prior to the permanent ponds and the use of silt fences and clean water diversion drains.

Assuming the operational sediment treatment devices are installed and operated in accordance with best practice, and given the high levels of sediment removal to be provided by the ponds, the adverse effects associated with sediment discharges are expected to be no more than minor.

9.6.4 Conclusion

Overall, the proposed measures to be implemented during construction and operation of the landfill will minimise sediment generation, such that the potential adverse effects are minor.

9.7 Stormwater and Industrial and Trade Activities

The potential effects on the environment from the ongoing discharge of surface water during the operational phase include:

- Water quantity effects through an increase in the volume and flow rate of stormwater discharged into the receiving environment;
- Stream stability and channel erosion through increased peak flows from impervious surfaces;
- Water quality through the discharge of contaminants (other than sediment) into the receiving environment; and
- Potential discharge of contaminants from Industrial and Trade Activities (ITAs).

9.7.1 Water quantity and flooding

Changes in impervious areas in relation to landfill development can result in increased stormwater peak flows, higher stormwater volumes, and longer duration peaks flows during storm events. These changes to the hydrology of an area can result in increased flooding if the capacities of the existing systems and streams are not adequate to handle the increased flows.

To assess the potential contribution of the project to flood levels, runoff calculations have been undertaken, which show negligible change in runoff in the Western Block and Waiteraire Tributary Block. Within the Southern Block, the changes in peak volumes associated with discharges from the project into the Waiteraire Stream have been calculated to be between 0.1 and 0.2% depending on the size of the storm event.

The Wayby Valley flood plain is downstream of the WMNZ landholdings and is approximately 430 ha. Based on the difference between the calculated pre-development and post-development volumes for a 100 year storm event, the total additional volume of runoff from the project is estimated to potentially result in an increase in the depth of the flood plain of 1 mm, which is considered a less than minor increase.

Within the Eastern Block, runoff volumes will vary over time as the landfill development progresses. Stormwater will be managed through the extensive network of stormwater, and erosion and sediment control structures proposed as part of the landfill design. Runoff calculations have informed the design of these control structures, with sufficient storage to be provided for up to a 100 year ARI storm event.

Therefore, any effects from changes to water quantity and flooding are considered to be less than minor.

9.7.2 Stream stability and channel erosion

As above, the development of the landfill will result in additional impervious surfaces and changes to hydrology in the catchments within the WMNZ landholdings, which can result in erosion of stream

channels if the stream capacity is insufficient for the increased flows. Discharges from the site will all flow into a number of tributaries at the head of the Hōteo River. The streams into which surface water will be discharged are sensitive to bank erosion and instability. Increased stormwater volumes as a result of the development therefore have potential to cause erosion and bank instability. In order to mitigate the effects of stormwater on downstream channels, the stormwater systems for the site have incorporated detention of the 95th percentile rain event, in line with Auckland Council's GD01 guidance document. Therefore, the effects of stormwater from the project on stream stability and channel erosion are expected to be minor.

9.7.3 Stormwater quality

Surface water runoff from roads and impervious surfaces open to traffic is known to have contaminants present including heavy metals, hydrocarbons and sediment. The landfill activities also have the potential to result in additional contaminants being present in surface water runoff including heavy metals and ammonia. As well there may be changes to the pH, chemical oxygen demand and conductivity of water at the point of discharge to the receiving environment.

Changes in water quality within an aquatic environment can affect the benthic community health, including effects on macroinvertebrates and aquatic species.

Rainfall that falls on the active areas of the landfill, and hence potentially contaminated by waste, is managed through the proposed leachate system. Rainfall on peripheral and closed areas of the landfill is generally considered to be uncontaminated but may contain sediment which requires management. Consequently, all stormwater within the landfill catchment (excluding any stormwater falling into or flowing through any active landfill areas that might be potentially contaminated by waste) will be directed to sediment ponds before discharge via a wetland. The sediment ponds have been designed to provide effective removal of sediment within the site, but will also provide removal of suspended contaminants including heavy metals. Stormwater flows up to the 95th percentile rainfall event will also pass through the engineered wetland. This will provide final treatment for contaminants including any organics and dissolved contaminants.

The access road has been assessed as being a low risk source of contaminants. This is due to the limited vehicle numbers using the road (and hence low contaminant loads). The main contaminants of concern are typical contaminants from roads including copper and zinc. The provision of filter strips will provide effective treatment of the discharges.

In addition to good management practices, stormwater treatment for runoff from the bin exchange area will be provided by a rain garden. This will be designed in accordance with Auckland Council GD01.

In addition to the treatment of stormwater, on-going monitoring over the life of the landfill will be undertaken. The monitoring serves two purposes. Firstly, it enables monitoring to be undertaken to confirm that the effects of discharges from the landfill are not resulting in any significant effects on the receiving environment, and secondly, provides for monitoring to identify any potential unintended discharges of contaminants.

Considering the stormwater management measures outlined above and the ongoing monitoring proposed, adverse effects of the proposed development on stormwater quality are considered to be minor.

9.7.4 Industrial and trade activities

The RMA defines Industrial and Trade Activities (ITAs) as:

a any premises used for any industrial or trade purposes; or

b any premises used for the storage, transfer, treatment, or disposal of waste materials or for other waste-management purposes, or used for composting organic materials; or

c any other premises from which a contaminant is discharged in connection with any industrial or trade process;

d but does not include any production land.

The project will involve the establishment of operation of ITAs, as described in Technical Report P, including workshop areas, the access road and the bin exchange area. These areas involve the use and/or storage of environmentally hazardous substances, such as oils, greases or fuels. These ITA activities need to be managed to minimise discharges of environmentally hazardous substances onto or into land or water.

The key method for addressing this issue is to prepare and implement site specific environmental management plans, which identify the environmentally hazardous substances associated with a particular ITA activity. The plans set out methods to avoid, remedy or mitigate discharges and describe the use of stormwater treatment or monitoring. Redvale Landfill operates under the auspices of a similar plan, with proven success.

A draft Environmental Management Plan (EMP) has been prepared as an appendix to Technical Report P, which identifies the activities with the potential to generate contaminants and outline methods to avoid or minimise potential effects. With the implementation and use of these documents, potential adverse effects from industrial and trade processes can be managed to result in less than minor effects.

9.7.5 Conclusion

There are a number of potential adverse effects on water quantity, flooding and water quality associated with the project. However, a range of measures are proposed to avoid and mitigate for adverse effects on water quality. The proposed controls are consistent with best practice and are similar to measures implemented at Redvale Landfill with proven success. On the basis of the proposed controls, the potential adverse effects on surface water quality and quantity are expected to be minor.

9.8 Leachate management

Leachate is one of the main by-products of the waste degradation process. If leachate escapes into the surrounding environment it can have a range of adverse effects, including effects on surface water quality, groundwater quality, ecology and human health. Consequently, an effective leachate containment, collection, treatment and disposal system is a critical component of the landfill's operation. One key aspect of this is minimising the quantities of leachate being generated by keeping clean stormwater separated from the waste. The proposed measures to manage and collect leachate are described in Section 5.6.4, and will ensure appropriate control and containment of leachate.

As leachate is collected, it then needs to be appropriately treated. For the Auckland Regional Landfill, WMNZ proposes to initially store collected leachate in holding tanks before transferring off-site to an appropriate treatment facility (e.g. a large municipal treatment plant that is consented to deal with liquid industrial or trade wastes). Once sufficient landfill gas (LFG) is being produced at the landfill, an evaporator (or similar technology) will be installed to reduce the volume of leachate such that it can be recirculated back into the landfill. Both of these approaches will ensure the leachate is appropriately managed to prevent adverse environmental effects.

An extensive and automatic surface water monitoring programme is proposed to monitor for any leachate breakouts. Ultimately, any surface water with evidence of leachate will be held in the ponds to allow for treatment or management. No discharge would occur from the ponds until

monitoring demonstrates that the water quality is suitable for discharges, protecting the downstream environment from the potential adverse effects of the leachate.

The above measures are considered to appropriately manage leachate generation and treatment, and as such the effects associated with leachate are expected to be no more than minor.

9.9 Potential effects of low probability but high potential impact events

The definition of "effect" in the RMA includes effects of low probability but which have a high potential impact. There are a range of such effects which could occur at the proposed landfill. These risks will be managed throughout the life of the landfill by a combination of measures to avoid the event or effect, as well as contingency measures to be implemented should the event occur. The adequacy of the proposed controls in managing the identified risks, by reducing the likelihood of the event occurring and/or the consequences of an event, is evaluated in the Risk Management Assessment (Technical Report S).

A Site Emergency Management Plan will be prepared as a condition of consent (see condition 156), which will include detailed management approaches to address emergency management, including avoidance measures as well as responses.

As set out in the Risk Management Assessment, on the basis that these measures are implemented, the risks have been appropriately mitigated such that the residual risks of emergency events are tolerable.

9.10 Terrestrial ecology

9.10.1 Introduction

The construction of the landfill will involve clearance of vegetation and earthworks, which will result in loss of vegetation and habitat, and potential effects on native fauna and flora located within these areas and the immediate surrounds. An off-set and compensation package has been developed to address the effects on terrestrial ecological values that cannot be avoided or minimised. The package has focused on providing new habitat to replace habitat that has been lost and that will buffer and increase connectivity between existing habitats. In addition these habitats will be enhanced through pest control and protected through legal covenants.

It is noted that the project footprint areas and associated effects on ecological values are based on concept design at the time of finalising this application. It is anticipated that as the consent process proceeds, the project footprint will be further developed and refined. Any material changes to the footprint will be subject to a separate additional assessment process.

9.10.2 Vegetation and habitat

The key components of the project that will result in vegetation and habitat loss for terrestrial fauna are the landfill footprint, the access road and the stockpiles. The avoidance of areas of high ecological value has been an inherent part of the design. The project design has avoided all scheduled SEAs and WMAs, and all but approximately 80m^2 of the NSMAs identified by the AUP on the WMNZ landholdings. However, some vegetation and habitat loss is unavoidable outside of these areas. The project will result in the direct loss of the following vegetation and habitat types:

- 86.88 ha of plantation forestry;
- 17.3 ha of pasture;
- 9.11 ha of wattle forest;
- 4.62 ha of native regenerating forest (non-SEA);
- 0.86 ha of native mature forest (non-SEA);

- 0.85 ha of native wetlands (non-SEA); and
- 0.48 ha of exotic dominated wetlands.

In addition to direct habitat loss, indirect effects on habitats and associated species are also likely to occur including edge effects and potentially noise, light or dust disturbance. Condition 49 requires that a Vegetation Management Plan be prepared, which will set out measures to ensure the footprint of works is minimised to the extent possible, and that the surrounding vegetation is protected.

To off-set or compensate for vegetation loss, the following revegetation is proposed to create habitat for species that have been affected by the project and build connectivity between areas of existing vegetation:

- Revegetation of 9.9 ha of native terrestrial vegetation to off-set the residual effects of vegetation removal and associated habitat loss of 0.87 ha of non-SEA mature forest and 4.62 ha of non-SEA regenerating forest.
- Revegetation of 4.63 ha of native wetland vegetation is also proposed within the WMNZ landholdings. This will off-set the residual effects of vegetation removal and associated habitat loss of 0.85 ha of non-SEA wetland vegetation and 0.49 ha of non-SEA exotic dominated vegetation. Wetland revegetation will occur within existing degraded exotic dominated wetlands

Both terrestrial and wetland revegetation efforts will generally focus on replacing plant species that have been affected by the project and optimising ecological benefits through improving ecological connectivity between habitat types and protecting significant habitat types through buffer and margin plantings. Forest and wetland revegetation will generally follow the methodology below:

- Site preparation, including weed management and stock exclusion fencing where necessary;
- The placement of felled logs into revegetation sites to improve biodiversity values;
- Planting of eco-sourced native species;
- Plant maintenance including weed management and infill planting where necessary; and
- Covenanting to ensure long-term protection of revegetated habitats

Given the extensive revegetation proposed, the residual effects on vegetation and habitat are considered to be minor.

9.10.3 Native fauna

The potential effects of the project on fauna generally relate to habitat loss and the fragmentation resulting from the removal of vegetation, as well as potential harm to any fauna present within this habitat (if they cannot readily disperse themselves, e.g. breeding birds; or if they are not detected during salvage and relocation activities). A range of native fauna have been identified as present or likely to be present across the WMNZ landholdings, including low levels of long-tailed bat activity, North Island fernbird, spotless crake, Hochstetter's frog, several lizard species, rhytid snails, and peripatus.

To avoid potential effects on native fauna, the design and layout of the landfill avoids as far as practicable the habitats that native species are known to frequent. As a result of this design methodology, almost all of the wetland and forest habitat present within the WMNZ landholdings that supports native fauna is located outside the project footprint. A range of measures will be implemented to manage potential effects on native fauna where works are occurring, including:

- Where non-scheduled wetland habitats cannot be avoided, measures will be implemented to mitigate potential effects. These include works in wetlands not occurring during peak fernbird,

Australasian bittern and spotless crake breeding season (August to January inclusive) to avoid the potential loss of eggs and chicks.

- To mitigate potential effects on bats, the project will adopt a bat tree-felling protocol to avoid or minimise direct harm to roosting bats and most importantly maternal bat roosts, which may include several or more adult female and juvenile bats.
- Where disturbance of potential lizard, frog or invertebrate habitat is unavoidable, salvage and relocation operations will be implemented to mitigate potential direct effects on the species. This will be undertaken prior to vegetation removal, with the proposed relocation site also being subject to habitat enhancement prior to relocations occurring. This is subject to identifying appropriate habitat for relocation of fauna, particularly Hochstetter's frogs, which will be worked through with DOC and other relevant parties.
- For residual effects on fauna that cannot be avoided or mitigated, an extensive ecological mitigation and off-set programme will be implemented, including pest control, and habitat creation and enhancement which will provide benefits for native fauna to off-set the adverse effects of the project.

In summary, taking into account the management measures and off-setting proposed, and once appropriate relocation sites have been identified, it is considered that the overall effects of the project on native fauna will be minor.

9.10.4 Conclusion

The avoidance of ecological effects wherever possible has been an inherent part of the landfill design process and layout of the project. The project design has avoided all scheduled SEAs and WMAs present on site, and all but a very small portion of the NSMAs. Management plans that are focused on avoidance or mitigation of potential ecological effects will also be implemented during the construction of the project. These include a tree-felling management plan for birds and bats and salvage and relocation plans for lizards, Hochstetter's frogs, and invertebrates.

However due to the nature and scale of the project, some adverse ecological effects are unavoidable and therefore a key component of the project is the extensive ecological compensation and off-set package. This package will provide ecological benefits over time through creation of new habitat and enhancement of existing habitat through infill planting and pest control.

Overall, taking into account the management measures and off-setting proposed, it is considered that the overall effects of the project on terrestrial ecological values will be minor.

9.11 Freshwater ecology

9.11.1 Introduction

Effects of the landfill project on freshwater ecology can be split into two categories – short term effects on freshwater fauna and habitat during the initial construction work; and long term effects associated with permanent or long term changes to stream habitat and water quality.

9.11.2 Initial construction works

9.11.2.1 Freshwater fauna

During the initial construction works, activities such as culvert placement and stream in-filling will be carried out, which can result in adverse effects on freshwater fauna, such as stranding, injury or mortality. Indirect effects such as effects on water quality are discussed in the sections below.

To avoid potential effects on fauna, the design and layout of the landfill avoids as far as practicable the habitats within which native freshwater fauna are known or likely to be present. As a result of this design methodology, the freshwater systems within the WMNZ landholdings with the highest ecological value have been avoided.

Where streamworks are required, the direct effects on freshwater fauna can be minimised and mitigated by implementing the proposed Native Freshwater Fish and Fauna Management Plan (NFFFMP) (Condition 56) prior to streamworks being undertaken. A combination of fish recovery methods such as electric fishing, nets, traps, slow dewatering and sorting through dewatered materials will be applied in different habitats as appropriate. With the implementation of the NFFFMP, the direct effects of the project on freshwater fauna will be minor.

9.11.2.2 Sedimentation from initial construction earthworks

As described above, earthworks activities have the potential to degrade water quality through the discharge of sediment laden water to freshwater systems. High levels of sediment within streams can have negative effects on freshwater habitats by clogging small spaces, altering food sources for fauna and directly affecting aquatic macroinvertebrates.

As discussed in Section 6.2 above, erosion and sediment control measures will be implemented to mitigate the potential sedimentation effects resulting from earthworks. The implementation of erosion and sediment controls will result in low magnitude effects, however, due to the sensitivity of the receiving environment, the overall effect of sedimentation from earthworks on freshwater habitat within the WMNZ landholdings is considered to be moderate (although short term).

9.11.2.3 Vegetation clearance

Vegetation clearance has the potential to affect stream ecology through exposing soil, increasing erosion and sedimentation. The storage of vegetation as chip or mulch can also result in 'wood waste leachate' which has a high biochemical oxygen demand (BOD) and dissolved organic matter.

To mitigate the potential effects on stream ecology of vegetation clearance, a Vegetation Management Plan is proposed as a condition of consent (Condition 49). This will include procedures for minimising the area and duration of soil exposure associated with vegetation clearance, minimising mulched material and ensuring stockpiling of mulch is located away from streams. Considering the implementation of vegetation clearance protocols, the overall effect of vegetation clearance on freshwater ecology is expected to be minor.

9.11.3 Long term effects

9.11.3.1 Fish passage

A number of culverts, bridges and other ancillary works within streams will be carried out as part of the project development. These have the potential to restrict fish passage in freshwater systems, particularly poorly designed culverts which are perched, too long or too steep. This can lead to effects associated with preventing some species from migrating to complete their life cycles, and isolating and fragmenting populations of other species.

To avoid installing barriers to fish passage, conditions of consent have been offered to ensure that, where appropriate, fish passage is provided. There are a number of culverts along the alignment of the access road where there will be no habitat upstream of these culverts, or where the steepness of the terrain would limit fish passage. In these instances, the provision of fish passage is not considered necessary due to negligible benefits of doing so.

To compensate for effects on fish passage, as part of the mitigation package for the project, a number of existing barriers to fish passage such as perched culverts are proposed to be removed or upgraded, and for other fish passage barriers to be remediated to provide increased fish passage.

Overall, taking into account the mitigation measures proposed, which will improve fish passage in some areas of the WMNZ landholdings, the effects of the proposal on fish passage is considered to be less than minor.

9.11.3.2 Potential operational stormwater effects

The potential effects of operational stormwater on ecology primarily relate to increases in stormwater quantity and degraded stormwater quality. Increases in impervious surfaces can change the velocity and volume of stormwater runoff within a catchment, which can result in erosion and habitat modification in streams. Contaminants entrained in stormwater runoff have the potential to impact fauna and ecosystem health within the freshwater environment. There are a variety of potential contaminants associated with different activities across the site.

Stormwater detention and treatment is proposed to mitigate these potential effects, including stormwater ponds, filter strips and a polishing wetland. The proposed mitigation measures are consistent with best practice from Auckland Council Guideline Document GD01 and/or the New Zealand Transport Agency 'Stormwater Treatment Standard for State Highway Infrastructure', May 2010.

The implementation of stormwater treatment and controls will result in low magnitude of effects, however, due to the sensitivity of the receiving environment, the overall effect of stormwater quantity and quality on freshwater ecology within the WMNZ landholdings is considered to be moderate.

9.11.3.3 Permanent loss of stream habitat

The potential ecological effects of stream reclamation relate to the permanent and irreversible loss of stream habitat, direct mortality of species within these systems (if they are not relocated) and creating barriers to fish passage. The construction and operation of the proposed landfill will result in the infilling of approximately 15.4 km of intermittent or permanent stream. Almost all of the permanent stream loss, approximately 9.5 km, will be within the landfill footprint in the Eastern Block.

In order to avoid potential effects on freshwater systems, many design options were considered and refinements to the location and extent of the project footprint were undertaken. The proposed layout and design of the landfill minimises stream loss as far as practicable, although the loss of some streams is unavoidable for a project of this scale and nature (i.e. a large landfill within a valley system). Where stream infilling is required, identified areas of high ecological value such as NSMAs have been avoided as far as practicable, and only approximately 80m^2 of NSMAs have been affected.

Overall, taking into account the points above, it is considered that the permanent loss of streams associated with the project will have significant adverse effects on streams within the project footprint, due to the high ecological values of streams, the length of stream impacted and the impact being irreversible.

A number of sites have been identified within the wider WMNZ landholdings to off-set or compensate the residual effects of permanent stream loss. The proposed lengths of stream to be planted and enhanced within the WMNZ landholdings totals 14.7 km of stream.

A further programme of stream enhancement will be undertaken across the Hōteo catchment over the life of the landfill, resulting in approximately 30 km of additional off-set and compensation works over the lifetime of the project, to take the total enhancement of streams to approximately 46.2 km.

Taking into account the proposed package of off-set and compensation, the residual effects post-mitigation are anticipated to reduce to less than significant.

9.11.4 Conclusion

In summary, the project is anticipated to have effects on a range of freshwater ecology values. Effects have been avoided to the extent practicable through the design process. A range of mitigation, compensation and off-set measures are proposed throughout the life of the project to address effects that cannot be avoided.

These measures will reduce the potential adverse effects of the project, resulting in anticipated effects for most fresh water ecological values which range from negligible to low up to moderate. However, stream loss is unavoidable, and the effects of stream habitat loss will be significant within the project footprint. WMNZ proposes an ongoing programme over a period of 35 years to provide stream enhancement across the Hōteo catchment as a condition of consent in response.

9.12 Landscape and visual amenity

9.12.1 Landscape effects

The project will involve construction and operation of a landfill for an extended period of time into a generally undeveloped landscape setting. This will result in changes to landscape character and resources. To determine the effect of these changes, an assessment of the project on landscape values has been undertaken by Boffa Miskell (Technical Report H).

During site establishment and initial construction works, the greatest adverse effects on the landscape resources will be more than minor due to impacts on the streams within Valley 1 and the topography due to construction of the main access road in the Southern Block. Moderate adverse effects are also anticipated on the landscape character of the Southern Block during this period of works. Minor adverse effects are anticipated on the streams within the Southern Block, however the remaining effects on landscape resources and landscape character will be less than minor to negligible.

During ongoing operation, and post operation, moderate adverse effects (more than minor), will remain on the topography of the Southern Block and streams in the Eastern Block. All other effects on the landscape resources and landscape character are anticipated to be either minor or less than minor. Minor beneficial effects are anticipated on the vegetation within some site areas. This would be a direct result of the proposed mitigation planting, which involves establishing native revegetation that will replace some areas of existing pasture and forestry.

9.12.2 Visual amenity effects

The visibility of the project will be defined by its visual catchment, which is the area or extent from which all or part of the project is visible. The visibility of the project will be affected by topography and elements within the landscape such as buildings, fencing and vegetation that may screen or obscure views of the project.

Changes to an outlook can impact on visual amenity. The project is predominantly located in a working landscape that accommodates farming and forestry practices. These land uses provide an ever-changing context that the developing project will be seen against.

To understand the effects on visual amenity throughout the life of the landfill, a number of representative viewpoints have been selected and the potential visual effects have been assessed (including through the use of modelling) at different stages of operation, being current views, site establishment, year 5 of operation, year 35 of operation and post operation (Technical Report H).

Effects of viewing audiences will vary throughout the life of the project, as a result of different activities. The duration and level of effect will also change as the project evolves from initial construction through to progressive filling of the landfill, and ultimately to final cap and closure. Visual effects on most viewing audiences will reduce after site establishment as mitigation measures such as hydroseeding and revegetation begin to establish. As the project progresses, the later phases (i.e. phases 4 to 6) may become partially visible to some viewing audiences and temporarily increase adverse visual effects. Screen planting established around the perimeter of Valley 1 will assist in obscuring portions of the visible fill. Furthermore, progressive capping and vegetation establishment across these phases will manage these effects and contribute to the integration of the project post operation.

The greatest level of adverse visual effects are expected to be on three residential properties located adjacent to Springhill Farm, where effects during site establishment and initial construction will be more than minor. This is primarily a result of the establishment of Stockpile 1. Following this initial phase of work, the effects resulting from the ongoing operation of the project will be reduced on these residences to a moderate to minor effect throughout the life of the project.

Many viewing audiences in Wellsford township and environs will experience no effects as the project will not be visible. A limited number of properties to the north of Wellsford may attain views of the project, at a distance of more than 4 kilometres. For these properties, minor adverse visual effects are expected during the initial site establishment, remaining minor or less than minor for most of the project life. However, moderate adverse effects may occur in periods when uncapped fill is observable, during phases 5 and 6.

9.12.3 Conclusion

In conclusion, some areas of the WMNZ landholdings are recognised as being sensitive to change, and these areas have been avoided in the design as far as practicable. Landscape and visual mitigation, primarily in the form of substantial revegetation and reestablishment of these natural landscape elements are proposed.

Viewing audiences will be affected throughout the life of the project from different activities and for different durations. The most affected parties are the residents located adjacent to the Springhill who will experience moderate-high adverse effects during the site establishment and initial construction works (although none of these residents will ever be able to see any of the waste placement activities themselves, rather they will see stockpile establishment and use). As the project progresses, mitigation measures such as hydroseeding, revegetation and screening will become more effective, reducing effects on residents located adjacent to Springhill Farm to moderate, and reducing effects on other viewing audiences.

The scale of the change within the landscape will continue to be noticeable during the operation of the landfill to many viewing audiences, resulting in adverse effects that range from less than minor to moderate. Notwithstanding this, the outlook for the majority of viewing audiences will remain characterised by the forestry cycles occurring within this wider outlook, and it is considered that as these changes continue to occur, the project will remain observed alongside these activities, reducing the prominence of the landfill activities.

9.13 Cultural values

The WMNZ landholdings fall within the rohe of Ngāti Manuhiri, who have prepared a Cultural Values Assessment (CVA) for the project. This has been provided to and considered by WMNZ.

The below table sets out the potential effects on cultural values arising from the project as identified in the CVA by Ngāti Manuhiri, and WMNZ's interim response to the issues raised in Ngāti Manuhiri's CVA. The potential cultural effects are broken down into seven key themes as identified by Ngāti

Manuhiri; whenua (land), wai (water), hau (air), biodiversity, wāhi tapu and taonga, social, economic and cultural wellbeing, and future management. Where this assessment refers to the concerns of mana whenua, this reflects WMNZ's interpretation of those concerns as expressed in the CVA. WMNZ acknowledges that Ngāti Manuhiri may have additional concerns, not encapsulated in that CVA.

WMNZ will be engaging further with Ngāti Manuhiri after lodgement to undertake a more detailed considerations of the company's proposed response to the matters raised in the CVA, importantly to identify what other concerns exist that were not captured by the CVA, and to understand whether any refinements to the project or the proposed conditions of consent might be required.

Whilst WMNZ has only received one CVA for the project to date, engagement with other iwi has also been occurring consistent with the requirements of best practise, and in accordance with the obligations in the AUP and in the RMA. Similar areas of interest and concern have been raised at hui with other iwi, in particular the potential effects on water bodies such as the Hōteo and the Kaipara Harbour. WMNZ will continue to engage with other iwi and will respond to any issues raised as the consenting processing continues. If other CVAs are provided by Mana Whenua, WMNZ will undertake the same process with those groups.

Table 9.1: WMNZ's interim response to issues raised by Ngāti Manuhiri

	Advocated action	Response
	Land (Whenua)	
1	In the unavoidable event of loss of natural/native habitats; • All practicable steps are taken to rescue or preserve taonga (as identified and agreed with Ngāti Manuhiri); • The habitat is replaced, locally, at a scale greater than 1:1 (as agreed with Ngāti Manuhiri); • The replaced habitat is enhanced over that lost (if possible); • Loss of all vegetation (including exotic) within the project area to be replaced with only native species – not pine.	Regarding these matters: • WMNZ has agreed to adopt Ngāti Manuhiri's proposed accidental discovery protocol. • Ecological compensation package offers more than 1:1 over the life of landfill. • The proposed area and extent of offset / compensation of habitat is greater than the area and extent lost. • An ecological compensation and enhancement package will ensure replacement of all loss of native vegetation. The proposal is approximately neutral on exotic pine tree vegetation (replacement = loss). As discussed with Ngāti Manuhiri on site on 11 April, the plantation forestry is pre-1990 forest, and it needs to be replanted under the ETS. However, the planting area stays out of the margins of wetlands and watercourses.
2	Prior to any physical works (including accessways), physical onsite archaeological assessments are required to be undertaken alongside Ngāti Manuhiri representatives. • Ngāti Manuhiri are concerned that undiscovered taonga lies in the subsurface, particularly; • Within remnant bush areas that may be cleared; • Within or adjacent waterways; • Along ridgelines; • On decades old farmland that has never previously been assessed.	WMNZ will invite Ngāti Manuhiri to undertake field inspections on the site to determine whether there are any particular areas of the site where undiscovered taonga lies in the subsurface. In addition, WMNZ has agreed to adopt Ngāti Manuhiri's proposed accidental discovery protocol.

	Advocated action	Response
3	All landfill related plans are to be reviewed with Ngāti Manuhiri for feedback and input.	WMNZ has been working with Ngāti Manuhiri to date. This will be ongoing and WMNZ will ensure that a full copy of the consent application and AEE is provided to Ngāti Manuhiri.
4	Retaining resources or material within the area they have whakapapa to is a preference, rather than export or removal, with the exception of contaminated soils which, if cannot by remediated on site, need to be safely and appropriately disposed of. Ngāti Manuhiri to be advised if any contaminated soils are discovered to discuss appropriate method for mitigation or removal (e.g. from farm).	WMNZ's preference is to use onsite soils in the construction of the landfill. There may be the need to use imported soils during the landfill operation for daily and intermediate cover and possibly final cap (if onsite materials are insufficient or of poor quality). Any contaminated soils discovered on site will be disposed of in the landfill itself.
5	Utility services to be aligned within accessway/roading networks (to limit additional ground disturbance).	This will occur wherever practicable.
6	Retention of natural overland flowpaths and volume wherever possible, including around landfill valley, stockpiles and clay take areas.	This will occur wherever practicable.
7	Avoidance of building infrastructure within natural flood plains (e.g. bin exchange area is a potential risk according to maps. Flooding could see refuse directly entering waterways).	This will occur wherever practicable. In particular, the bin exchange area needs to be adjacent to State Highway 1, which is within a flood plain. Risks of flooding have been thoroughly and conservatively assessed in the Stormwater Report (Technical Report P), and the bin exchange area will be above the 1 in 100 ARI flood level, and with making an appropriate allowance for climate change (i.e. future flood levels rising).
8	The use of robust and environmentally sustainable materials (e.g. natural flocculation products during construction and operation, where appropriate and effective).	WMNZ agree to this and have included a preference for organic flocculants in condition 26 of the proposed conditions.
	Water (wai)	
9	Recognition and support from government, local authorities, organisations, corporations and community that Ngāti Manuhiri are Mana	WMNZ cannot comment on actions of other parties.

	Advocated action	Response
	Whenua with customary title/rights to the waterways.	WMNZ's consultation with Ngāti Manuhiri has and will continue to recognise their Treaty Settlement which affirms their mana whenua. WMNZ will continue liaison with other mana whenua who also claim to have an interest in nearby areas and waterways, e.g. Hōteo River and Kaipara harbour.
10	Ensuring that spiritual and cultural concepts are recognised and accommodated in water management. For example: • Recognition that waterways have mauri and wairua of their own; • Recognition that waterways are also a food resource/breeding areas and that water management places a high priority on protecting and enhancing their food producing capacity; • Highest achievable stormwater treatment are maintained at all times (over and above minimum consent rules); • No building infrastructure within flood plains or flood prone areas; Do no exacerbate existing downstream flow/flooding issues.	These matters are acknowledged and respected by WMNZ, and are addressed in the environmental controls contained within the consent conditions. The potential flood risk is addressed in row 7 above. In respect of the potential exacerbation of downstream flooding from raising the level of the bin park area, this has been assessed as negligible (i.e. less than 1mm additional flooding).
11	Preferentially, no loss of natural waterbodies.	There will be some unavoidable loss of the beds of the streams within the project footprint, as explained in detail in the AEE. WMNZ is committed to the capture and relocation of native fauna to appropriate sites, and enhancement of these new sites / habitats. WMNZ will work with Ngāti Manuhiri and DOC to identify the most appropriate sites for relocation, which are likely to be on or very close to WMNZ land. WMNZ is also proposing a programme of stream enhancements within the Hoteo Catchment.
12	In the unavoidable event of loss of or impact on natural waterbodies: • All practicable steps are taken to rescue or preserve taonga (as identified with Ngāti Manuhiri); • The waterbody habitat is replaced, as locally as possible (as agreed with Ngāti Manuhiri);	

	Advocated action	Response
	The replaced habitat is enhanced over that lost (if required/possible).	
13	No replanting of pine trees within project area as this impacts on the waterways in future when harvesting mobilises sediment and slash in a repeating cycle.	Refer row 1 above.
14	Highest standards of sediment and erosion controls during construction (exceeding not just 'meeting' Council guidelines). Inspection of S&E controls by Ngāti Manuhiri prior to bulk earthworks commencing.	An adaptive monitoring and management approach has been proposed for erosion and sediment control during the construction works, which is in additional to the requirements of GD05. Ngāti Manuhiri will be invited to visit the site during construction and invited to provide any comment, however any formal approval process would need to remain with Auckland Council's compliance officers.
15	No leachate entering waterbodies at any time (including groundwater). Monitoring and reporting required.	WMNZ intends that there will be full containment and collection of leachate. A rigorous regime of monitoring and reporting is detailed in the proposed conditions of consent.
16	All steps taken to ensure loose rubbish/litter does not enter water environments from either landfill or trucks.	The Landfill Management Plan will include a section on prevention and management of litter. Good landfill practice of daily cover and litter fences around the working face minimise the amount of windblown litter. In addition proposed conditions 68 and 69 provide controls on litter, including requiring trucks and bins which have potential for generating windblown litter to be enclosed or covered.
17	Promotion/use of pervious surfaces where appropriate.	WMNZ will be retaining pervious areas wherever possible, however in some areas there are environmental benefits for using impervious surfaces, such as highly trafficked surfaces in order to minimise dust nuisance. The percentage of the total site that would be covered by impervious surface would be negligible.
18	Promotion/use of water capture, re-use and water saving devices in all new infrastructure buildings.	WMNZ will be reusing water from stormwater ponds for the site's water needs (no surface water take from any stream is proposed). In addition, as part of its building consents (for offices, workshop and staff facilities) WMNZ will give consideration to the storage and use of roof water to complement other water sources (i.e. groundwater and stormwater ponds).

	Advocated action	Response
19	Robust assessment of instream/wetland water quality and biodiversity during and post construction and future operations.	Rigorous consent conditions are proposed which require extensive water quality monitoring, ecological survey, and assessment and management of works affecting any stream or wetland, for both the construction and operational stages.
20	If absolutely required, a preference for construction of bridges or arch culverts to cross waterways (as opposed to culverts).	Inevitably some waterways will be crossed. WMNZ is proposing a combination of bridges and culverts. The preference for bridges has been recognised, with a bridge proposed for the Waiteraire Stream crossing. Fish passage will be provided through culverts on the advice of a qualified and experience ecologist.
21	Protection and enhancement of natural waterways through: • Riparian infill planting with appropriate natives and exotic weed removal; • Increased riparian margins (not just the minimum); • Enhancement, re-instatement of wetlands; • Stock exclusion of all waterbodies through fencing; • Fish passage throughout waterways to be maintained including the removal of existing fish passage barriers or provision of fish passage devices; • Avoidance of chemical weed control adjacent waterbodies; Planting plans to be reviewed by Ngāti Manuhiri or nominated specialists.	In response: • Riparian infill planting will be considered when identifying opportunities for stream enhancement as part of the proposed ecological offset and compensation package. • Width of riparian planting will vary - for areas within proposed plantation forestry, the width will generally be to the minimum standards required by the NESPF. However, in other areas, such as along the Hoteo River, the riparian margin widths will be well in excess of what is typically considered to be the minimum to provide ecological benefits. • Proposed enhancement and reinstatement of wetlands is described in the Ecological Assessment (Technical Report G). • Stock will be excluded from waterbodies by fences. • Fish passage will be provided through culverts on the advice of a qualified and experience ecologist. Some existing barriers to fish passage are also proposed to be removed. • Chemical weed control adjacent to waterways will be minimised, and avoided wherever possible. WMNZ propose to liaise with Ngāti Manuhiri on the planting plans and species mixes developed in accordance with the consent conditions and technical reports submitted with consent applications. WMNZ will also discuss the potential for Ngāti Manuhiri to contract to WMNZ for the development of a plant nursery and the planting programme.

	Advocated action	Response
	Air (hua)	
22	Measures/protocols to minimise heavy earthwork equipment or waste truck discharges of excessive contaminants to air during construction works and ongoing landfill operation.	WMNZ has a preference for Tier 4 engines with greatly reduced particulate and NOx emissions. WMNZ is also planning to trial electronic mule trucks for hauling bins between the bin exchange area and the working face. Plant and equipment will be in sound mechanical condition, thereby avoiding plant and equipment with excessive discharges.
23	Appropriate and adequate dust suppression measures.	WMNZ will have water trucks and other measures to minimise dust as described in Section 9 of the AEE.
24	Odour suppression at landfill and bin exchange.	There will be controls on odorous waste accepted. Odour suppression equipment will used in areas that may cause offensive and objectionable odour. Odour modelling has shown that there is a very low risk of unplanned odour events which would cause offsite odour effects.
25	Midge/insect management at landfill and bin exchange. Natural treatments vs chemical preferred.	WMNZ's experience is that closed bins of the type proposed, regular yard cleaning, prompt compaction of waste, and full daily cover will not lead to insect infestations. The Pest Control Plan for Landfill Operations will be developed to address insects and other pests. The actual treatment will be based on proven methods, the majority of which do require chemical treatment
26	Native vegetation planting for screening of infrastructure, stockpiles, clay take areas and/or landfill.	Proposed screen planting is provided in the landscape technical report. WMNZ may use fast-growing exotics to enhance the native screen planting for an initial term.
27	Stabilisation of stockpiles and clay take areas.	Stockpiles and the clay borrow area will be progressively stabilised when not being actively worked.
28	Minimal low energy, low intensity, directional and controllable lighting.	Lighting within the project footprint will be designed to meet the Auckland Unitary Plan permitted activity standards and WMNZ's requirements for safety. Lighting of the roundabout on State Highway 1 will have to meet NZTA requirements.

	Advocated action	Response
	Biodiversity	
29	Protection of natural habitats/ecosystems including bush, riparian and waterbodies (tributaries, wetlands).	Protection of native habitats and ecosystems will be provided by a range of measures including covenanting of areas, new riparian margins around wetlands, and new riparian planting along Hōteo River and Waiwhiu Stream, as described in the Ecology reports.
30	Avoid any native vegetation removal.	Native vegetation removal cannot be avoided during the project. However, the design has minimised native vegetation removal and proposed compensation has been offered in the Ecology reports.
31	Avoid removal of any large trees (native or exotic) that may provide bat roosts.	Removal of large trees will be avoided where practicable. Where removal is required, there will be protocols put in place to prevent disturbance of roosting bats.
32	No encroachment into existing SEAs	All SEAs have been avoided by the design of the project.
33	Active policy to enhance/enlarge/link SEAS where possible.	Linkages are promoted via the terrestrial ecology compensation proposals, which include a great deal of infill planting and protection by covenant of key areas which are not protected now.
34	Avoid disturbance of natural waterways or overland flowpaths.	Minimising disturbance of waterways has been central to the project design process.
35	Enhancement of existing wetland habitats.	The proposal includes infill planting and planting of wetland margins. Fencing, stock exclusion and pest control will also improve wetland habitats.
36	Increased planted native riparian margins.	New areas of riparian planting and increased riparian planting margins are proposed as part of the ecological offset and compensation package.
37	Mammalian pest control throughout project area.	The landfill operation will have a specific pest control plan. In addition, the wider area ecological compensation package will have a detailed pest control plan of its own.
38	Covenant wetlands and remnant native bush.	More than 40 ha of native bush and wetland will have covenants placed on them as part of the project. The form of that covenant developed in consultation with Ngāti Manuhiri.
39	Fully fence wetlands and remnant native bush to exclude stock.	Any areas of the property used for grazing will be securely fenced to retain stock within those areas.

	Advocated action	Response
40	Preferentially, no loss of native species (particularly if rare or threatened in any way).	Some loss may occur, however this will be mitigated by proposed salvage and relocation of fauna, habitat enhancement, and pest control.
41	No pine re-planting.	Refer row 1.
42	Enhancement of natural habitats/ecosystems to the benefit of native flora and fauna • In the event of loss of an entire valley and stream habitat loss for the landfill, as mitigation, the remaining project area to have infill planting of locally sourced native flowering and fruiting trees and plants only, ongoing exotic weed removal and pest control.	WMNZ is proposing to undertake a significant programme of ecological mitigation and compensation. Preference will be given to locally-sourced seed stock and plants. In addition, WMNZ will have a pest and weed management plan.
43	Establishment or enhancement and protection of ecological corridors as mitigation for landfill and associated infrastructure and works. • Including native bush corridors connecting remnant or re-planted bush; • Ensure fish passage; • Fish or reptile translocations to be undertaken as required; • Vegetation removal to occur outside of bird breeding seasons if applicable, as a preference.	In response: • Refer row 21 • Refer row 21 • Relocations will be undertaken by specialists as called for in the management plans required by the proposed consent conditions and DOC requirements, however opportunity will exist for the involvement of Mana Whenua in that work. • Conditions are proposed to avoid bird breeding season where practicable, or otherwise ensure appropriate measures are in place to minimise effects on breeding birds.
44	A full assessment of all existing native biodiversity (resident or transient) within affected habitats/ecosystems, as a baseline measure for the health and capacity and to inform future monitoring.	Extensive field investigations have occurred in the preparation of the consent application, and further work will be done in stages as the landfill progresses.

	Advocated action	Response
	Wāhi tapu and Taonga	
45	Avoidance of all known or discovered wāhi tapu and taonga sites within project area.	The project design has avoided all known and discovered sites. As none were currently known to be on the site, this influenced the selection of this site for the project. WMNZ will invite Ngāti Manuhiri to undertake field inspections on the site to determine whether there are any particular areas of the site where undiscovered taonga lies in the subsurface. In addition, WMNZ has agreed to adopt Ngāti Manuhiri's proposed accidental discovery protocol.
46	Protection of all wāhi tapu and taonga currently known or discovered within project or downstream affected areas. • Full on-site archaeological assessment of affected areas as identified or agreed with Ngāti Manuhiri; • Archaeologist to be accompanied by Ngāti Manuhiri representative.	
47	Ngāti Manuhiri enabled to effectively exercise their role as kaitiaki. • Full, early consultation with Ngāti Manuhiri Settlement Trust/Manuhiri Kaitiaki Charitable Trust with regard to the presence of potential archaeological sites, wāhi tapu, sites of significance and taonga whether recorded or not.	
48	The use of Discovery Protocols which take effect if cultural material (including koiwi or bone) is uncovered though earthworks, ground disturbance, or natural erosion.	
49	Ongoing monitoring of receiving environments, shared and assessed with Ngāti Manuhiri as a means of protecting the mauri.	Ngāti Manuhiri, as mana whenua, will hold a seat on the Community Liaison Group. That group will receive and discuss copies of all monitoring reports filed with Council.

	Advocated action	Response
	Social, Economic and Cultural Wellbeing	
50	All costs associated with ceremonies associated with upholding Ngāti Manuhiri tikanga and spiritual wellbeing (e.g. ground breaking / blessing), future monitoring, site visits, design elements, consultation and/or meetings by Ngāti Manuhiri and representatives are to be met by the appropriate entity.	All reasonable costs associated with Ngāti Manuhiri ceremonies will be met. WMNZ would welcome the opportunity to discuss other likely costs and how they can be met or contributed to.
51	Ensuring that the cumulative effects of activities and development upon Ngāti Manuhiri, taonga and environments are fully recognised and avoided, mitigated or compensated for.	The WMNZ proposal, including mitigation and compensation, intends to recognise, avoid and mitigate effects to the extent practical and includes off-set and compensation (not monetary) for residual effects as described in the ecological mitigation package.
52	That 'cultural responsiveness' be a measure that enters into making and tendering contracts: • Potential opportunities for Rangatahi through education, work experience or employment; • Ngāti Manuhiri to be advised of potential commercial opportunities for investment.	WMNZ look forward to a long term relationship with Ngāti Manuhiri. The development of the Auckland Regional Landfill will itself offer employment and commercial opportunities in the region. These could be through local businesses, construction opportunities, commercial landscaping opportunities, etc. Contracts will undergo competitive tender processes, and there will be opportunities for Ngāti Manuhiri to become a registered service provider to WMNZ . WMNZ will propose a Community Trust, and Ngāti Manuhiri will be represented on that Trust.
53	Direct involvement and resourcing of Ngāti Manuhiri in design of new infrastructure.	Technical designs of infrastructure will be undertaken by external appropriately qualified professionals. WMNZ are open to discussing expertise available within Ngāti Manuhiri.
54	Plant or reserve naming to reflect and enhance Ngāti Manuhiri's cultural footprint and mana as Mana Whenua – supporting the Council's Auckland Plan outcome of "a Māori identity that is Auckland's point of difference in the world".	WMNZ would welcome the opportunity to discuss this aspect further with Ngāti Manuhiri. While matters like this are not ones easily amenable to consent conditions, they could be the subject of a separate Memorandum of Understanding with Ngāti Manuhiri.

	Advocated action	Response
55	Waste Management NZ project staff and contractors to attend a cultural induction with Ngāti Manuhiri prior to any works commencing if requested by iwi.	Senior WMNZ staff would attend a cultural induction with Ngāti Manuhiri.
	Future Management	
56	Ongoing engagement and consultation with Ngāti Manuhiri throughout the lifetime of the landfill project. • Regular kaitiaki site visits scheduled by Ngāti Manuhiri throughout operation lifetime of landfill, resourced by Waste Management NZ Limited; • A Community Liaison Group is formed (including Mana Whenua) and regularly meets with Waste Management NZ Limited; • Waste Management NZ Limited keeping abreast and appraised of latest environmentally friendly technologies and landfill practices and sharing this information with Ngāti Manuhiri; • Promoting and advocating for policy change if appropriate (e.g. landfill waste reduction).	In response: • WMNZ proposes that Ngāti Manuhiri kaitiaki to visit the site once each year or as otherwise agreed. • A Community Liaison Group (CLG) is proposed, and would include Ngāti Manuhiri. The CLG concept has worked well at WMNZ's other landfills in Auckland. • WMNZ is committed to keeping abreast of the latest environmental technologies, however these emerging technologies will often be subject to commercial sensitivity or confidentiality clauses which mean that they cannot be shared. • WMNZ has always taken an interest in formulation of waste policy, and will continue to do so.
57	Robust monitoring with Ngāti Manuhiri to receive regular reports on receiving environment health.	A robust and extensive monitoring programme is included in the proposed conditions of consent. WMNZ proposes that any report to Council of monitoring results required by consent conditions must also be sent to the CLG. Ngāti Manuhiri will be represented on the CLG.
58	• New infrastructure contributing to good cultural and environmental outcomes through the sustainable use of resources, energy efficient materials and construction methods. Earthen, recycled or other sustainably sourced materials (e.g. organic	In response: • Office buildings and workshops on the site will be modest structures. Consideration will be given to the sustainable use of energy efficient materials. See row 10 regarding organic flocculant.

	Advocated action	Response
	flocculants) and careful design can enhance the overall value. • Ngāti Manuhiri fully support the inclusion of the solar/wind power; All new buildings to include latest sustainable innovations.	• Once the biomass within the landfill produces sufficient landfill gas, WMNZ will install power generation. This biomass is recognised as a renewable source of energy. • Site offices will be developed to enable the use of power produced on site.
	Discovery Protocols – in the event that koiwi, archaeological features or taonga are discovered or suspected to have been unearthed during construction activities.	
59	If koiwi, archaeological features, or taonga are exposed during development, earthworks should immediately cease in the vicinity (10m radius). It is important that any remains or artefacts are left undisturbed or *in situ* once discovered.	WMNZ agrees to adopt Ngāti Manuhiri's proposed accidental discovery protocol (see condition 9)
60	The site supervisor should take steps immediately to secure the area so that koiwi or taonga remain untouched and site access is restricted.	
61	The site supervisor will ensure that eating, drinking and smoking in the immediate vicinity is prohibited.	
62	The project manager will notify: 1 The New Zealand Police (in the case of koiwi/skeletal remains only) 2 Heritage New Zealand 3 Manuhiri Kaitiaki Charitable Trust 4 The Project Archaeologist (if applicable)	
63	Manuhiri Kaitiaki Charitable Trust will contact the appropriate kaumatua in order to guide and advise the parties involved as to the appropriate	

	Advocated action	Response
	course of action. Any associated costs should be met by the developer.	
64	The project manager will ensure staff are available on site to guide police (as appropriate) and kaumatua to the site.	
65	In the case of koiwi, site access should be restricted to other parities until police are satisfied the remains are not of forensic relevance.	
66	If the parties involved are satisfied that the koiwi or taonga are of Māori origin the kaumatua will decide how they are to be dealt with and will communicate this to the New Zealand police and other parities as appropriate.	
67	Activity on the site will remain on hold until the police (in the case of koiwi), the kaumatua and Heritage New Zealand have given approval for activity to recommence.	
68	The project manager shall ensure that kaumatua have the opportunity to undertake karakia and other cultural ceremonies and activities at the site as may be considered appropriate in accordance with tikanga Māori (Māori customs and protocols).	

9.14 Archaeology

The landfill development will involve bulk earthworks, which has the potential to impact on archaeological features. As such, a desktop and field study was undertaken by Maatai Taonga (Technical Report K) to determine whether any archaeological features are present within the WMNZ landholdings. No archaeological sites are recorded on the property, and the study did not identify any evidence of potential archaeological values within the proposed footprint of the project. Further, due to the nature of the site soils and terrain, Māori archaeological sites or settler cottages are unlikely to be present. To manage the risk of uncovering unexpected archaeological features, the works will be undertaken in accordance with the accidental discovery protocol, as set out in condition 9. The proposed protocol adopts the recommendations of Ngāti Manuhiri in their CVA, and is consistent with the discovery protocol in the AUP. Overall, it is considered that the potential adverse effects of the Auckland Regional Landfill project on archaeological values will be less than minor.

9.15 Noise

9.15.1 Construction noise

The initial construction works will involve bulk earthworks, heavy machinery (including excavators, bulldozers, graders and haulage trucks) and other noise-generating construction activities. In general, due to the large separation distances from the majority of construction areas to surrounding receivers, construction noise is expected to comply with the construction noise standards under the AUP for much of the works.

However, modelling of potential 'worst-case' construction noise scenarios for the upgrade of Crowther Road indicated that if no mitigation measures were implemented, there was the potential for noise to exceed the standards at some receivers. This potential exceedance will be avoided through restrictions on plant operating within this area and the preparation of a Construction Noise Management Plan (CNMP) (Condition 42).

Additionally, conditions of consent have been proposed to limit timing of truck deliveries, and additional controls on works which will occur within 150 m of a receiver (Refer section 6.3). On the basis of the proposed controls, the potential adverse effects of construction noise are expected to be minor.

9.15.2 Operational noise

There will be a number of potential noise sources throughout the operation of the project, including earthworks and construction of new landfill cells, operation of the bin exchange area, operation of the energy generation centre and operations at the landfill's working face. Excessive noise can have adverse effects on surrounding residents' amenity. Marshall Day have undertaken an assessment of environmental noise effects associated with the project (Technical Report O). Predictions of noise levels at receivers have been made and those predictions conclude that under a range of potential worst case scenarios during the project's operation, noise levels will comply with the relevant permitted activity standards for the rural zone. Further, for most receivers, noise generated by the project may be perceivable but will be less than the ambient noise levels. Therefore, for the majority of receivers, noise effects are considered to be negligible

The closest receiver, located at 1027 State Highway 1, is the most exposed to noise from the project, due to proximity to the site entrance and bin exchange area. Although compliance with the relevant standards will be achieved, this receiver may be able to hear the bin exchange area operations. However, this will be in the context of high ambient background noise for this receiver, associated

with traffic noise from State Highway 1. Further, a condition of consent has been offered to restrict the type of reversing alarm used by trucks accessing the bin exchange area at night, which was identified as a potential source of adverse noise effects (Condition 85). Therefore the noise from the bin exchange area is not expected to create nuisance and the adverse effects of operational noise on this receiver are expected to be minor.

9.15.3 Conclusion

Due to large separation distances between noise sources and receivers, and relatively high ambient noise levels in the existing environment particularly from the State Highway, overall, it is considered that the adverse noise effects associated with the project construction and operations will be no more than minor.

9.16 Human health effects

Contaminants in air and water can result in human health effects if people are exposed to them in sufficient quantities. It is noted however, that these effects can only occur in circumstances where there is a 'complete pathway' between the contaminants and a receptor, which requires:

- a source of contaminants (in the case of a landfill, potential sources of contaminants in air and water are principally LFG, combustion products, dust, and leachate that may seep through the lining system);
- a pathway via which the contaminant is transported (this could include seeping through the soil underlying the landfill lining system into groundwater and being transported to groundwater wells or surface water, and aerial transport of contaminants); and
- a receptor (i.e. someone who is exposed to the contaminant)

Regarding potential exposure from contaminants in air, as discussed above in Section 9.4.3, atmospheric dispersion modelling of combustion products from burning LFG has been undertaken which shows that, taking into account likely background concentrations, cumulative effects of these discharges from the project are expected to be well within relevant ambient air quality standards and guidelines at residential dwellings and will not cause any exceedances of NESAQ values beyond the boundary. Given the proposed control measures and separation distances between receptors and potentially dusty activities, a qualitative assessment of effects of dust emissions concludes that there is unlikely to be any discernible dust at sensitive receptors. Therefore, the adverse effects on air quality from dust emissions or the burning of LFG are considered to be less than minor.

In relation to potential exposure to contaminants in groundwater, modelling of contamination migration has been undertaken. This demonstrates that even if a worst case scenario of leachate concentrations is assumed (i.e. no attenuation of contaminants as the leachate passes through the lining system), concentrations of contaminants in groundwater will be several orders of magnitude below human health guideline values at all potential points of exposure. As such, the potential effects are considered to be less than minor

Further analysis of the potential health effects of the proposed Auckland Regional Landfill, including trace contaminants in fugitive LFG emissions, is currently underway and will be provided to Auckland Council as a supplementary report to this application.

9.17 Nuisance effects

9.17.1 Litter

Windblown litter can be a cause of nuisance to surrounding properties and the environment. Potential sources of windblown litter during the landfill operations are the tip face, litter caught in

litter fences and litter from trucks entering and leaving the landfill site. To avoid litter escaping the site, a number of measures will be implemented on site.

Specific controls are to be put in place and have been included as condition 68, which requires weekly patrols of the WMNZ landholdings, and the use of controls around the tipping face. These controls will be detailed in the LMP and will likely include the recovery of litter by staff on site on a daily basis through collections around the working face, litter fences around the tip face to catch litter and the use of daily cover. In addition, the use of closed bins by WMNZ trucks will avoid the potential for litter generation during the transportation of waste to and within the site (Condition 69). The combination of these measures are expected to avoid the potential nuisance effects of litter appropriately.

9.17.2 Vermin and weeds

Landfills can attract a range of vermin, including rodents, insects, wild cats and seagulls. In addition, weeds can be present within the waste and can then spread to the surrounding area. These can cause nuisance effects for neighbouring properties as well as ecological effects on native vegetation and fauna. To minimise pest and weed numbers, control measures will be undertaken around the landfill footprint and the bin park. Condition 186-187 requires a Landfill Operations Pest and Weed Management Plan to be prepared, which will outline measures to prevent populations from being established around the landfill. Control methods may include physical controls such as fencing or traps, or bait, which will be implemented for the duration of waste disposal activities on the site.

9.17.3 Conclusion

Due to the large setback distances of the landfill from surrounding properties and the proposed mitigation measures in the conditions and LMP, it is concluded that nuisance effects of litter, weeds and vermin associated with the Auckland Regional Landfill will be no more than minor.

9.18 Traffic

9.18.1 Construction traffic

The initial construction and site establishment works will result in traffic movements to and from the site which are additional to the existing traffic occurring in the area. Additional traffic movements can increase congestion on roads and increase safety risks. To determine the potential effects of construction traffic using the Crowther Road intersection, modelling was undertaken (see Technical Report M). The worst case traffic generation during this period (inclusive of the effect of co-incident logging activity accessing Crowther Road) is estimated as a total of up to 72 heavy vehicle movements (inclusive if inbound and outbound movements) and up to 200 light vehicle movements (inbound plus outbound) using the Crowther Road intersection per day, mostly travelling to the site from the south. Modelling demonstrated that there will be a negligible increase in congestion on State Highway 1 as a result of these movements. Further, the Traffic Assessment concludes that the existing design of the intersection, which includes a widened western shoulder, combined with the NZTA Dome Valley Safety Upgrades project[17] will provide safe and appropriate access given the short duration of its use for the site establishment and construction activities associated with the project.

As the WMNZ landholdings border State Highway 1, it is proposed to prepare a Construction Traffic Management Plan (CTMP) prior to the commencement of any construction activities (conditions 35-37). This will be prepared to the satisfaction of the NZTA as the road controlling authority of State

[17] The Dome Valley Safety Improvement include a proposed widened centre line at the intersection.

Highway 1. The purpose of the CTMP will be to avoid and mitigate the potential adverse effects of construction traffic generated by the project on State Highway 1. The CTMP will include details of construction dates and hours, nature and frequency of traffic movements, measures to avoid trips during peak hours on State Highway 1, temporary traffic management, and measures to avoid the interaction between construction traffic and school bus attendance.

The roundabout construction activity will be separately managed via construction traffic management plans in consultation with NZTA. WMNZ will work closely with NZTA to ensure appropriate measures are implemented during the construction of the roundabout to minimise any impacts on traffic flows or safety risks.

It is considered that with an appropriate CTMP prepared and any required construction traffic mitigation measures implemented, the site establishment and construction activities can be managed to ensure that any construction traffic effects are no more than minor.

9.18.2 Operational traffic volumes and routing

During the operational stage of the landfill, refuse trucks will be the main source of traffic generation associated with the project. As set out above, traffic generating activities can increase congestion and safety risks.

The 24-hour operation of the bin exchange area is an important design feature for reducing and spreading potential traffic effects during the landfill's operation. This allows for refuse truck movements to be spread out, and also to avoid peak travel times when State Highway 1 is busy. In addition, the design of the landfill's entrance is of particular relevance to managing the potential traffic effects, as it needs to ensure traffic using the road network are able to pass through the intersection efficiently and safely.

As described in Section 5.7.1, the main site access will be through a newly constructed roundabout on State Highway 1. This roundabout has been designed based on the latest NZTA design standards and guidelines referenced in the industry-standard AUSTROADS Guide to Traffic Engineering Practise series. In addition, the preliminary design has been audited by NZTA and confirmed as appropriate by the NZTA safety audit process. Detailed design of the intersection will also be subject to further safety audits to ensure the design provides for safe operation.

To assess the potential effects of the intersection on traffic congestion, modelling has been undertaken for projected traffic volumes in 2028 and 2060 (a long term future horizon year during which there would be the expected peak refuse truck volumes).

The performance of the roundabout has been modelled throughout the predicted life of the landfill, from first waste acceptance around 2028 through to 2060 when traffic movements associated with the project is anticipated to peak. The modelling shows the proposed roundabout will be readily able to accommodate the traffic volumes generated by the landfill operation, resulting in minimal delays. The intersection will continue to perform well with background traffic increases on State Highway 1, and has been designed to accommodate trucks coming from either the south or the north. Consequently, the intersection will perform regardless of whether the Warkworth to Wellsford motorway upgrade proceeds. If the Warkworth to Wellsford motorway does proceed, it will significantly reduce traffic volumes on the current State Highway 1.

The Risk Management Assessment (Technical Report S) identifies a moderate residual safety risk associated with the use of the intersection, on the basis that, while unlikely, an accident could occur. However, this residual risk is considered to be consistent with the residual risk of using similar intersections throughout the country, given the inherent risk of driver mistakes resulting in accidents. The intersection will be designed to meet all the relevant safety design standards, and appropriate signage and screening will be provided. The NZTA's established safety audit process has

been adopted through the preliminary stages of the project and will be continued through the detailed design phase of the approval of the roundabout design with NZTA. This process is designed to minimise the safety risk of establishing a new intersection and is intended to work closely alongside the NZTA safety improvements within State Highway 1 Dome Valley such that the residual risk of road crashes is considered to be minimal.

Overall, considering the anticipated traffic generation of the project and the design of the proposed roundabout, the effects of the landfill's operational traffic on the surrounding road network is considered to be no more than minor.

9.18.3 Conclusion

It is concluded that the potential traffic effects associated with both the construction and operation of the landfill will be no more than minor.

9.19 Conclusion

In summary, the proposed landfill will generate a number of positive effects. In particular the landfill will provide for regionally significant infrastructure in a centralised facility. The landfill will also increase employment and job opportunities in the Warkworth-Wellsford area and will be a significant contributor of renewable energy to the Auckland electricity supply. In addition, the provision of improved recreation access in the area through the creation of tracks will have positive social effects.

As discussed above, it is considered that the effects relating to stability, air quality, groundwater, surface water quality and quantity, industrial and trade activities, leachate, archaeology, noise, nuisance and traffic, groundwater noise, and construction effects will be minor or less than minor. This has been achieved through careful consideration in regard to the design of the landfill, the size of the landholdings secured by WMNZ, and mitigation measures offered as conditions of consent.

It is considered that the risk of low probability but high impact events will be appropriately managed by a combination of measures which are intended to avoid the event and/or the resulting effects occurring, as well as contingency measures to respond should an event occur.

In regard to cultural effects, Ngāti Manuhiri have provided a CVA which identifies a range of matters which are of significance to them, including effects on whenua, wai, hau, biodiversity, and wāhi tapu and taonga. WMNZ have committed to working closely with Ngāti Manuhiri (and other iwi as with an interest in the Hōteo River). This relationship will continue over the life of the project. WMNZ have adopted the accidental discovery protocol put forward by Ngāti Manuhiri as a proposed condition of consent, and have tried to address Ngāti Manuhiri's concerns through the project design wherever practicable.

With regard to landscape character and visual amenity, changes will be noticeable to a limited number of viewing audiences, resulting in adverse effects that range from less than minor to moderate. Notwithstanding this, the wider outlook for the majority of viewing audiences will remain characterised by the working landscape, which includes forestry cycles. As the project is viewed within this changing landscape, the visual and landscape effects are considered acceptable.

The avoidance of ecological effects (both terrestrial and freshwater) has been an inherent part of the landfill design process and layout of the project features. The project avoids areas of significant ecological value such as the identified SEAs in the Southern and Waiteraire Tributary Blocks and the wetlands within the Western Block and will only affect 80 m^2 of the NSMAs. However due to the nature and scale of the project, some adverse ecological effects are unavoidable and therefore a key component of the project is the ecological compensation and off-set package. This package will provide ecological compensation over time through creation of new habitat and enhancement of

existing habitat through infill planting, stream improvement works, and pest control. Post-implementation of the proposed mitigation, off-set and compensation measures, the residual adverse effects on freshwater ecology are considered to be less than significant, and minor in relation to terrestrial ecology.

10 Assessment of alternatives and best practicable options

10.1 Introduction

WMNZ has carried out a robust and detailed assessment of alternative sites, designs and methods before arriving at the form of the Project as described in this AEE. This Section summarises the alternatives considered by WMNZ in respect of those activities with the greatest level of adverse effects, including the identification of the best practicable option for mitigating or minimising any adverse effects. This is in response to Schedule 4 of the RMA, those objectives and policies of the AUP that direct that reclamation is to be avoided unless there are no practicable alternatives, and s105 RMA that, in the context of an application for a discharge permit, requires an assessment of "any possible alternative methods of discharge, including discharge into any other receiving environment".

10.2 Alternative disposal methods

Large centralised landfills are becoming the predominant form of waste disposal technology in New Zealand. Smaller localised facilities were used historically, but these facilities have largely been closed and replaced with centralised, more highly engineered sites around the country, particularly in large metropolitan areas, driven by the requirements of the RMA and economies of scale for larger operations.

As described in Section 3.5, while alternative methods for waste disposal are used in other countries, in New Zealand the different legislative and policy setting, relatively small waste volumes and costs of alternative methods, all mean that alternative waste disposal methods have not been adopted on a large scale in New Zealand.

All of the disposal methods described in Section 3.5 result in by-products that need to be disposed of and which themselves can have adverse effects on the environment. Accordingly, many of the alternatives to landfill that have been adopted in other jurisdictions still require landfill in some form to manage residual materials including reject/unsuitable materials, ash and char. When waste is incinerated it gives off greenhouse gases such as carbon dioxide, and toxic substances such as arsenic, mercury and dioxins. Toxic emissions must be captured, and the technology required to do so is highly specialised and very costly to both install and operate (i.e. high capital expenditure and operational expenditure).

Landfills are better able to adapt to variable quantities of waste over time, compared to other methods such as waste to energy. As such, they are better able to adapt to either reducing waste volumes should advances in recycling or reuse be made or fluctuations in the rates of waste delivery that usually occur in parallel with economic cycles.

For those reasons, landfills continue to be the preferred disposal method in New Zealand for solid municipal waste.

10.3 Existing landfills

As described in Section 3.4, the vast majority of Auckland's waste disposal requirements are currently serviced by Redvale in the north, Whitford in the east and Hampton Downs to the south (outside of the Auckland region). Once Redvale closes in 2028 (or earlier depending on waste volumes), Whitford will be the only Class 1 landfill within the Auckland region. In 2016, 1.646 million tonnes of domestic and commercial waste were sent to landfill in the Auckland region. Whitford's designation conditions limit it to 155 refuse trucks per day once the Whitford Quarry ceases

operations[18], corresponding to a maximum refuse quantity of 350,000 tonnes per annum. As such, if volumes to landfill remain consistent or increase from 2016 volumes, Whitford Landfill would only be able to provide under its current consent for approximately 20% of Auckland's annual demand for waste disposal.

A portion of Auckland's waste is currently sent outside of the region to Hampton Downs, a large landfill in the north Waikato area. This site holds consents for the receipt of waste until 2030, and is consented for 30 Mm^3 of waste. Information is not publically available regarding the filling rates at this landfill to ascertain what capacity might be currently left.

Auckland generates approximately one third of all of New Zealand's waste[19]. While some of Auckland's waste is already being disposed of outside of the region, and this is likely to continue, it is not appropriate to heavily rely on disposal of most of Auckland's waste in adjacent regions. Further, increased transport distance of waste results in other adverse effects, including increased emissions of carbon dioxide and other vehicle pollutants, increased congestion effects on the road network, and potential increased road accident costs.

10.4 Site selection process

The Wayby Valley site was chosen as a result of extensive site identification and selection process. The process followed and the key selection criteria used are outlined in Appendix D, and summarised here. Under Schedule 4 of the RMA, an assessment of environmental effects (AEE) must include information on possible alternative locations or methods for undertaking the activity if it is likely that the activity will result in any significant adverse effect on the environment. Due to the nature of landfilling as an activity, it is important that alternatives have been appropriately considered as part of any consent application.

Site selection for this project began with preliminary site identification work in 2007, 2009 and 2014 which identified potential sites worthy of closer consideration. The key drivers for the site selection process were related to the overall project objective, namely to find a site to establish a regional landfill, including ancillary waste activities that support its operation. To enable this objective to be fulfilled a site needs to be found and the appropriate resource consents need to be secured. While looking at options for a site the following key drivers had to be considered, namely a site:

- large enough to provide a regional facility for Auckland and enable security of operation for the landfill into the future;
- that is readily accessible from the State highway network to enable suitable access without disruption to communities on minor roads;
- with adequate buffer distances to neighbouring properties;
- with suitable geology that did not present any fatal flaws;
- without identified (publicly available through desktop analysis) areas of cultural significance;
- with suitable terrain and topography;
- with suitable planning overlays and zones, particularly avoiding sites that might be within areas of archaeological or ecological significance as flagged through planning documents; and
- without significant complexity of land ownership and title encumbrances to enable acquisition of the land.

[18] Prior to the quarry's closure, truck numbers are limited to a lower average.
[19] Ministry for the Environment (2003) 2002 Landfill Review and Audit.

This approach to site identification is consistent with the Technical Guidelines for Disposal to Land (2018). Of particular relevance to this assessment are the proposed guideline recommendations with respect to geological requirements and in particular constraints around high permeability soils, sands and gravels, active faults and karst geology. In the site selection process any areas of high permeability or active faults were avoided.

Given the extent of development in Auckland, the site selection process was particularly complex, as it is difficult to find sites which have sufficient buffers from surrounding land uses and environmental receptors. It is unlikely that any site will meet all criteria. Therefore, the assessment of the suitability of a site for a landfill becomes a balance of trade-offs. These key drivers were ranked in terms of a constraint hierarchy, which was applied as part of the site identification process as follows:

69 Primary constraint – any potential site must be located within or accessible from a corridor 2 to 5 km wide aligned along state highway routes north and north-west of Auckland and within an acceptable haulage distance north and north-west of the harbour bridge. Any land area outside these corridors has not been considered due to known consenting issues related to truck traffic and community disturbance on secondary roads.

70 Secondary constraints (weighting = 3 to 5):

- Site size / development potential (weighting 4)
- Buffer availability (weighting 5)
- Land title complexity / number of owners (weighting 3)
- Specific PAUP (as it was at the time of the assessment) constraints such as proximity to or impingement on a listed site of cultural significance, an area of outstanding natural landscape (ONL), a significant ecological area (SEA) and water courses (weighting 3)

71 Tertiary constraints (weighting = 1 or 2):

- Geology / natural containment / hydrogeology (weighting 2)
- Topography (weighting 2)
- Engineering complexity (weighting 2)
- General planning constraints (weighting 1)

Landfills are typically located within valley systems, as they provide a much more efficient use of land for waste disposal. If flat land is utilised, the waste must be placed at a much lower grade than the grades which can be achieved within a valley system, and as such, a much larger area of land is required in order to accommodate the same volumes of waste. In addition, locating a landfill on flat land could result in different types of significant adverse effects, with increased concerns about landscape effects as the landfill would likely be highly visible, and the overall stability of the landfill as the sides are not supported by the surrounding topography. As such, a valley system was preferred for this project.

It is highly likely that any large valley system within the Auckland Region which may be suitable for development as a landfill, will have streams present due to the terrain and climatic conditions in Auckland (subtropical with high rainfall).

The Wayby Valley site was identified as the preferred site for the landfill development following this extensive site selection process. The Wayby site scored highly in the assessment due to:

- its proximity to the state highway;
- availability of buffer to sensitive receptors;
- potential development capacity;
- limited number of landowners to secure the landholding from;
- avoidance of sites of identified cultural significance, SEAs and other identified features in the AUP (or PAUP as it was then); and

- appropriate underlying geology (i.e. no fatal flaws) with conditions which could be addressed through additional engineering.

10.5 Alternative designs or project layouts within WMNZ landholdings

10.5.1 Design process

Once the WMNZ landholdings had been identified and were able to be acquired, a range of designs and methods for the development and operation of the landfill were considered before arriving at the design and location within the WMNZ landholdings of the Project footprint as described in this AEE. There have been numerous changes made to the project design and footprint through an iterative process in order to further avoid and minimise effects of the project on the environment to the extent practicable, whilst still allowing for the effective and efficient landfill operations. The below section summarises the design features which have been adopted in order to avoid and/or minimise the environmental effects of the project. The design principles are described in more detail in the Engineering Report (Technical Report N). A key driver during the design phase was to avoid areas on the site identified as SEAs, WMAs, and NSMAs within the AUP, as well as minimising the footprint of works while still achieving the key design principles.

10.5.2 Landfill footprint and choice of valley

The overall WMNZ landholdings identified from the site selection process contains two major valley systems. Conceptual layouts were prepared for a landfill footprint in each of the valleys, and both valleys were found to be suitable, with a similar airspace capacity available in each.

In conjunction with considering which valley to develop, possible access routes were also being considered (see below). The favoured route from that exercise was through the Southern Block. Consequently, Valley 1 was favoured for development of the landfill footprint due to:

- Both valleys presenting similar opportunities for landfill development.
- Both valleys had a similar length of stream present within the valley, and both contribute to the same tributary to the Hōteo, so there would not be a significant difference in the length of stream impacted.
- Valley 1 is closer to the preferred access route, minimising travel distances on site and associated infrastructure construction. Additional access road length would likely require additional stream reclamation or culverting, and longer infrastructure.
- To travel to Valley 2 would have greater fuel consumption requirements due to the need to either drop into Valley 1 and climb the intervening ridge, or to travel to the head of Valley 2 around Valley 1.

10.5.3 Landfill phasing

There are broadly two options for phasing a landfill within a valley system – either starting operations from the bottom of the valley and working up, or starting at the top of the valley and progressively forming cells down the valley. In regard to ultimate loss of stream habitat both scenarios result in the same outcome in relation to quantity of loss. The main difference is that with a top down approach the loss of larger streams and habitat is progressive over time, rather than immediate loss of the main tributaries at the bottom of the valley.

For this project the bottom up filling approach has been recommended for the following reasons:

- Health and safety in design
- Improved access in the early stages of the landfill development

- Benefits for leachate management

These are described in more detail in the Engineering Design Report (Technical Report N).

10.5.4 Landfill access road

Selection of a suitable access road route from State Highway 1 entrance to the working face was undertaken in two stages. The key design principle was to ensure the road grades were not too steep for safe and efficient operation of large fully loaded waste trucks. Other key considerations were minimising effects on the surrounding road network, minimising the ecological and visual effects, and avoiding off-site exposure to noise. Due to the nature of the terrain, impacts on streams were unavoidable and would occur under any of the alignments. The key focus during this phase was to identify alignments that would avoid major streams and SEAs, NSMAs and WMAs.

The first stage identified a range of potential options at feasibility level including:

- Access from Wayby Valley Road via Wilson Road to the north of the site.
- Access off Crowther Road and Wilson Road from the north.
- Access off Spindler Road and up the valley to the site.
- Access across the Western Block.
- Access up the valley on the Southern Block.

Considerations regarding each of these options were:

- Wilson Road south was determined not to be feasible due to an extremely steep portion of the road exceeding design criteria for waste vehicles. There was no practicable way to reduce the slope of this portion of road.
- Similar difficulties were present with grades on the potential road alignment from the north.
- The Spindler Road option was not carried forward primarily due to this being a quiet rural road with a number of houses/properties that would have been affected by the road being at this location.
- A range of options were considered for crossing the Western Block. All potential alignments across the Western Block would have been very visible from State Highway 1 heading south from Wellsford, and from areas in Wellsford. There would be widespread exposure to truck noise. They would also have significantly increased heavy vehicle volumes on Wayby Valley Road.
- The Southern Block was favoured as it provided a route that was largely out of view. Also, it was an area of existing plantation wattle forest, reducing the area of native bush to be affected. In addition, this option provided access straight off State Highway 1, minimising traffic effects on the surrounding less heavily trafficked roads.

Once the Southern Block had been selected as the preferred route, three options were considered for a road alignment through the valley. The options are shown on Figure 8 (Appendix C). All options started at the same location off State Highway 1, then:

- Option 1 followed the left bank of the stream and wound around the head of the valley without crossing the stream. This route would have been entirely within regenerating native vegetation, and would impact on a similar length of stream tributaries as option two. This option would largely avoid the NSMA.
- Option 2 was more-or less along the alignment of the current design, crossing the stream to link with a spur near the eastern end of the valley. This option avoided the most native vegetation out of the three options, largely avoided the NSMA, and would have a similar impact on tributaries as option one.

- Option 3 crossed the Waiteraire Stream from the left bank to the right and climbed the side of the Southern Block valley to join a spur near the western end of the valley then followed the ridge to Valley 1. This option would have been highly visible as it followed the ridgeline and would have required significant earthworks volumes to achieve an acceptable grade. The extent of stream loss would have been less than the other two options, as once the alignment reached the ridgeline it would have been above the stream headwaters in the valley. However it would have required filling and vegetation clearance within the NSMA area.

Option 2 was selected for meeting the objectives of low visibility, achieving suitable grades for waste vehicles while minimising the earthworks required and the impact on the NSMA stream.

Once the basic route had been selected it was refined as follows:

- Grades were altered to reduce some of the steeper sections to make it more suitable for waste vehicles.
- A bridge was added at the bottom of the access road to avoid the need for installing a culvert into the Waiteraire stream.
- Some of the bends were removed to make it safer for the trucks using the road.
- Consideration was given to realigning the road to minimise impacts on the side valley tributaries draining to the NSMA stream. WMNZ required the alignment be as straight as possible due to safety concerns. Moving the road up or down the side valley to try and reduce the volume of cut required did not result in significant changes to the cut volumes (and therefore footprint of works on streams) without compromising the grades and design parameters for the road.
- The up-valley stream crossing was moved approximately 45 m to the east with the effect of reducing the length of the culvert under the fill from about 120 m to 60 m, and reduced the encroachment in to the NSMA to an area of no more than approximately 80 m².

10.5.5 Soil stockpiles

A supply of soil is integral to landfill operation, providing a supply of daily cover, intermediate cover and final cover. The project has been developed to allow for a cut-to-fill balance over the life of the landfill. However, due to site and operational constraints it is not possible to sequence the excavation of material to align with the timing of when soil is needed for cover, as much of the excavation will need to occur in the early stages of the project when the access road and initial landfill cells are formed.

The alternative to having on-site soil stockpiles would be to truck the excess cut off-site, and then import cover as required. This would require approximately 5 million cubic metres of soil to be brought in over the operational life of the project, significantly increasing the traffic volumes associated with the project. It would also require a source of soil, creating an additional off-site area of earthworks (and the corresponding environmental effects) associated with the project. There would also be a risk to surety of supply of soil, which could have significant implications for management of a range of potential adverse effects, including odour, landfill gas capture, and management of leachate quantities.

As such, large volumes of soil need to be stockpiled within the WMNZ landholdings over the life of the landfill, requiring relatively large areas of land. Investigation of suitable stockpile areas included the following:

- Within Valley 1 where the landfill is located: This area was considered preferable as it would be within the catchment of the overall landfill and would reduce the overall project footprint. However, the landfill itself occupies most of the useable land within the catchment. The small

valleys remaining above the perimeter road do not provide sufficient volume to meet the stockpile requirements.

- Within Valley 2. This valley would be suitable for all stockpiling requirements at the head of the valley, however, the valley is currently precluded from consideration due to commercial agreements with the forestry owner restricting access into this area.
- Within the Southern Block in the area of the access road. This is a relatively narrow valley with any remaining side valleys being insufficient to meet requirements. Consideration was given to using the upper reaches of this valley, upstream of where the access road crosses the stream, for stockpiling purposes. This was discarded because of the NSMA downstream and a desire to avoid causing effects on this feature.
- Two sites were considered on the Western Block. The first was at the head of the valley to the north east of where the main access road enters the landfill valley, to the west of the office area. This was not pursued due to the significant wetland downstream and the potential effects on the wetland. Also, it provided only limited stockpiling capacity.
- The other site in the Western Block was the head of the valley now identified as Stockpile 1. This was favoured due to the large potential volume, avoidance of significant ecological features and proximity to the landfill footprint. It was considered that the visual effects of this site could be managed.
- An additional stockpile was required as Stockpile 1 does not provide sufficient capacity for the operational needs of the landfill. The head of the valley adjacent to Valley 1 to the south was identified. This also provided a large volume and is close to the eastern portions of landfill development, with limited visibility from off-site. While it is upstream of the Sunnybrook Reserve, it is some distance downstream through plantation pine forest, and the footprint of the stockpile comprises a small percentage of the catchment contributing to the Sunnybrook reserve.
- Other areas within the WMNZ landholdings that were available for consideration[20] and that could provide the required volumes of storage were not investigated, as they would have impacted on native vegetation, the southern block NSMA, or on the wetland management areas.

10.5.6 Bin exchange area

For the bin exchange area to achieve its operational needs, it requires a large flat area close to the intersection with State Highway 1. No flat land was available further up the Southern block valley without requiring a significant cut to create the platform, which would have been highly visible and would likely have encroached on streams. The area of land selected requires filling above the floodplain but avoids encroaching on the SEA, the Waiteraire stream or any stream tributaries, and is largely screened from State Highway 1. Any remaining visual/landscape effects can be further mitigated through additional screen planting.

10.5.7 Clay borrow area

A source of clay is vital for landfill operation, as it forms a key component of the lining system. An area within the Western Block has been identified as having the appropriate geology (Northern Allocthon). While the area of Northern Allocthon extends beyond the area identified, the initial area

[20] Large areas of the WMNZ landholdings were not available for consideration, due to their proposed ongoing use for forestry purposes and limited land available within the Western Block to provide sufficient off-set under the Emissions Trading Scheme for the loss of forestry land .

of clay borrow has been delineated to avoid stream channel to the extent possible, and in particular the main channel through the western block has been avoided. The extent of the clay borrow has also been limited in order to retain existing vegetation within the Western Block.

10.6 Alternative methods for discharges

10.6.1 Types of discharges

Discharge permits are being sought in respect of stormwater runoff from earthworks; stormwater runoff from the access road and operational areas of the project; discharge of contaminants to land; discharges of odour, land discharges of landfill gas and combustion by-products to air. Detailed consideration has been given to methods for addressing any potential adverse effects of these discharges, and appropriate methods have been adopted (including through design and construction methods) to ensure effects are appropriately managed. Further details are presented in the Air Quality Impact Assessment (Technical Report D), Engineering Report (Technical Report N) and Stormwater and ITA Assessment (Technical Report P). A summary is provided below.

10.6.2 Leachate management

As described in the Engineering Report (Technical Report N), leachate is proposed to be managed in the early stages of the landfill operations by recirculation into the waste (working face) and off-site treatment. Once sufficient LFG is available on site, a new evaporator will be installed on site for leachate evaporation. As such, discharge permits are sought for discharge of contaminants to land (the landfill working face) and discharge of evaporation products to air (including via the flare). The residual sludge from the leachate evaporator will be disposed of within the landfill.

A wide range of alternative options were considered for leachate management. These are discussed in more detail in the Engineering Report (Technical Report N), and are summarised below:

1 *Collection of and then discharge to a local wastewater treatment plant.* The leachate flow from the Auckland Regional Landfill would dominate the inflow to the Wellsford plant and the high ammoniacal nitrogen (NH_4-N) and chemical oxygen demand (COD) concentrations in the leachate are unlikely to be able to be appropriately managed at the existing treatment plant at Wellsford. Therefore this option was not pursued. However, in the early stages of the landfill's operation, leachate will be taken to a wastewater treatment plant with sufficient capacity and appropriate technology to treat the leachate.

2 *Treatment on site and discharge to a watercourse.* A high level of treatment would be required, such as reverse osmosis. Due to consenting risk of obtaining the necessary approvals for such a discharge, this option was not explored further.

3 *Treatment and discharge by irrigation outside the landfill footprint.* Following treatment, the remaining liquid would be irrigated to land. This would require significant levels of treatment, intensive management to ensure no uncontrolled discharges, and a large area of land. As such this option was not progressed.

4 *Treatment and discharge by irrigation to the landfill cap.* This option is preferable to option 3, as irrigation would occur within the lining system area of the landfill, providing protection for the underlying groundwater. However, as it will take a long time for a sufficient area of landfill cap to be available, and as such this is not proposed as an option for managing leachate at this stage.

10.6.3 Stormwater discharges

During the development of stormwater treatment design for the project, a key principle was to retain water within its catchment wherever possible, rather than diverting across ridgelines and into

new receiving environments. This was to maintain baseflows to downstream channels and minimise changes to the natural hydrology of the catchment as far as possible.

For the landfill valley, the following alternatives could have been considered:

- Clean stormwater could have been diverted around the treatment system at the bottom of Valley 1. However, due to the narrowness of the lower reaches of the valley, there was insufficient room for a suitably sized diversion drain. As such, it was determined that it was better to send all of the catchment's water through treatment to avoid uncontrolled discharges during normal flow events (up to 95% rain event).
- Ponds could have been sized in accordance with the relevant guidelines. Instead, ponds were sized based on the maximum available storage, and are well in excess of the volumes typically required based on general good practice.
- A polishing wetland is proposed in addition to the treatment ponds to provide additional treatment for organic chemicals and dissolved heavy metals, as well as providing a final polishing step for sediment during normal flow events (up to 95% rain event). The polishing wetland has been located offline to minimise the need to reclaim more stream.

Stormwater treatment for the access road has been proposed as filter strips at frequent intervals along the length of the access road. This was chosen over alternatives such as ponds or wetlands for the following reasons:

- Due to the steepness of the terrain, there is limited space for stormwater ponds, which would not be able to be sized appropriately to provide sufficient treatment along the road alignment. As such, the stormwater would need to be diverted to a large single pond at the bottom of the catchment, which would divert flows out of the multiple tributaries along the side of the Southern block valley. A large area of vegetation clearance would be required to create the pond.
- The filter strip design will distribute flows along the NSMA stream, to minimise changes to natural hydrology. The other benefit is that it minimises earthworks and vegetation clearance required to install controls. Excess flows will be discharged into the closest downstream culverts, which are located in existing tributaries to avoid creating new overland flows.
- The filter strips will provide treatment in line with best practice.

Rain gardens have been proposed for the bin exchange area over more engineered options such as sand filters, to better align with water sensitive design principles. Treatment provided by these rain gardens is in line with best practice. The rain gardens will discharge into the nearest stream to keep water within the natural contours. Alternative discharge points would more significantly alter the natural hydrology. Rain gardens have been located within the building platform, rather than locating them within the flood plain.

Treatment ponds for both stockpiles and borrow have been located offline to minimise impact on streams. The treatment will be sized in accordance with best practice. Alternatives would be to use other methods, such as online ponds, but this was discarded due to the increased impact this would have on streams on the WMNZ landholdings.

10.6.4 Erosion and sediment control

The construction works will be undertaken in accordance with the Sediment and Erosion Control Assessment (Technical Report R), which requires preparation of site specific sediment control plans for different activities and areas, as well as on-going monitoring. The monitoring will provide feedback to enable an adaptive approach to be used. Additional controls or measures will be used where there is a greater risk of sediment discharges and/ or monitoring indicates that additional

controls are required. Providing an adaptive approach is considered to be above the basic industry standard for best practice.

The alternative options would be less than the best standard and as such were not considered.

10.6.5 Discharges to air

The project requires consents for a number of discharge types to air. WMNZ proposes to implement best practice management of discharges to air, including meeting the requirements of the National Environmental Standard for Air Quality. The National Environmental Standard limits the range of alternatives which can be considered regarding discharges to air, as it requires landfill gas to be captured and burnt. However, the default for achieving compliance with the Standard is to burn the gas in a flare. Instead WMNZ have opted to use the gas to generate electricity, a beneficial use of the landfill by-product. Other options which are not being considered at this time could include burning the gas for heating of glasshouses or treating the gas for off-site combustion (bio-methane potential).

Under all available options, the gas must be burnt in order to comply with the Standard and best practice. The consent will be subject to a review condition, which will allow for consideration of alternatives over the life of the operations.

Further, WMNZ are very experienced landfill operators, and achieve very high rates of landfill gas capture compared to many other landfills in New Zealand. This is due to operational practices used on site, and innovative approaches to gas well design amongst other measures.

10.7 Summary

As described in this section, a range of alternatives have been considered prior to arriving at the project as it is described in this application, including:

- Alternative disposal methods;
- Alternative locations within the Auckland region;
- Alternative layouts and siting of project components within the WMNZ landholdings; and
- Alternative methods and locations for discharges of leachate, stormwater, sediment and discharges to air.

11 Notification

Section 95A of the RMA is relevant when a consent authority is considering whether a consent application should be considered with or without public notification.

The applicant requests that the application be publicly notified. In accordance with section 95A(2)(a) and 95A(3)(a), public notification is therefore mandatory.

12 Consultation

12.1 Introduction

WMNZ has consulted with mana whenua and a range of stakeholders and interest groups on the proposal, including landowners, utility operators and other interest groups. Consultation and engagement with stakeholders commenced following approval from the Overseas Investment Office (OIO) to acquire the land, due to confidentiality agreements associated with the land sale prior to the OIO approval. Once OIO approval was confirmed, WMNZ met stakeholders in person wherever possible and held four public open days which attracted a range of interested people. A webpage has also been set up for the project with information and a number of frequently asked questions (FAQs).

Consultation and engagement will continue throughout the consenting, construction and operation phases of the project. A summary of the consultation undertaken to date is provided in the following sections. A log of all consultation undertaken to date and other relevant consultation documentation is included in Appendix E.

12.2 Iwi and hapu

A number of iwi groups have mana whenua interests over the area of the WMNZ landholdings. These are identified on the Auckland Council Geomaps database as:

- Ngāti Manuhiri;
- Ngāti Whātua o Kaipara;
- Ngāti Wai;
- Ngāi Tai ki Tāmaki;
- Ngāti Maru;
- Ngāti Te Ata;
- Ngāti Whātua Ōrākei;
- Te Kawerau ā Maki; and
- Te Rūnanga o Ngāti Whātua;

Some of these iwi groups have a particularly strong interest in the area. In particular, Ngāti Manuhiri are most affected by the project due to the project's proximity to the Hōteo River, which is subject to a statutory acknowledgement. Ngāti Rango and Ngāti Whatua also have a significant interest in the area due to the proximity of their marae and their long association with the area and the Kaipara Harbour.

On 14 June 2018 these groups were notified via a letter and email of WMNZ's consideration for a large site development north of Auckland in an area that would be of interest to them. The letters advised that the block of land was within the Hōteo River catchment and that WMNZ would phone them as soon as the OIO provided approval for the land acquisition.

After receiving OIO approval on 11 September 2018, WMNZ contacted Ngāti Manuhiri, Ngāti Rango and Ngāti Whatua on 19 September 2018 via telephone and followed this up with written confirmation that WMNZ had received OIO approval to acquire land in the Wayby Valley area. They were advised that the project was a proposal to design and construct a landfill for the Auckland Region and that WMNZ would like to arrange a time to discuss the proposal in further detail. Subsequently initial meetings have occurred to discuss the proposal.

12.2.1 Ngāti Manuhiri

The site is located within the rohe of Ngāti Manuhiri. The rohe of Ngāti Manuhiri encompasses Bream Tail/Mangawhai to the north and extends south to the Okura river mouth south of Whangaparāoa. The easterly boundary takes in the islands of Little Barrier, Kawau, Tiritiri Matangi, Panetiki, the Mokohinau islands and Great Barrier. The western boundary starts in the North at Patumakariri, Kaipara, Moturemu, Arapareira, Makarau through to Oteha / Takapuna. The rohe of Ngāti Manuhiri is identified in the Auckland Council Geomaps database. Te Awa Hōteo (the Hōteo River) was an important traditional resource of Ngāti Manuhiri, and it remains a water body of major cultural, spiritual and historic significance to the iwi. It is subject to a statutory acknowledgement as part of the Ngāti Manuhiri Deed of Settlement with the Crown dated 21 May 2011.

Working with Ngāti Manuhiri is a key element of the wider project, and WMNZ are working to build a partnership with Ngāti Manuhiri. Engagement to date has been positive and constructive, allowing WMNZ to understand the values of Ngāti Manuhiri and also for Ngāti Manuhiri to gain an understanding of the project and participate in its development. Engagement will continue throughout the life of the project.

WMNZ met with Ngāti Manuhiri at WNNZ's head office on 12 October 2018 following their request for a separate meeting. WMNZ presented details of the proposal including the need for a landfill, location, key features of the landfill, and how a modern landfill and energy park operates. Ngāti Manuhiri indicated that they are interested in a business-like partnership and it was established that a further meeting would be held at their discretion to present the proposal in further detail to the Ngāti Manuhiri Settlement Trust.

On 4 December 2018, WMNZ met with the Chair of the Ngāti Manuhiri Settlement Trust. WMNZ explained the proposal in an overview form. Ngāti Manuhiri agreed to assist with a Cultural Values Assessment (CVA). WMNZ proposed a site visit to both Redvale Landfill and Energy Park and Kate Valley.

On 17 January 2019, WMNZ met with the Ngāti Manuhiri Settlement Trust in their Warkworth Offices. This gave WMNZ a further opportunity to explain the proposal to Trustees and staff and to hear and discuss initial questions in relation to the source of waste, water quality, environmental health, ecology and proposed mitigation. Ngāti Manuhiri explained the cultural sensitivity of the area and the significance to them of the Hōteo River.

On 30 January 2019, WMNZ met with an environmental representative of Ngāti Manuhiri to further describe the project and initiate the preparation of the CVA. This was followed up with a site visit on 14 February 2018. Draft copies of the Archaeology and Ecology survey and findings reports were provided.

On 11 March 2019, WMNZ hosted an environmental representative of Ngāti Manuhiri at Redvale landfill. Technical experts engaged on this project by WMNZ presented their specialist areas to Ngāti Manuhiri and answered questions on the proposal. A CVA report was subsequently provided by Ngāti Manuhiri to WMNZ.

On 11 April 2019, the Chair of Beijing Capital Group NZ Investment Holding Limited together with the WMNZ Managing Director and members of the Executive Management Team met with Ngāti Manuhiri Chairman, Trustees and Management on the proposed landfill site to further develop and confirm the relationship at the appropriate level.

12.2.2 Ngāti Whātua o Kaipara

The site is located within the rohe of Ngāti Whātua. The area runs from the Tāmaki River in the South to Maunganui Bluff on the West Coast in the North and to Whangarei Harbour on the East Coast. Ngāti Whātua o Kaipara (NWoK) is a legal umbrella for five hapu or marae including Puatahi

marae (Ngāti Rango) which is at the estuary of the Hōteo River. NWoK regard Te Uri O Hau (TUoH) as their whanau, but TUoH are not included in the NWoK treaty settlement. NWoK acknowledged that it was also appropriate for WMNZ to also talk to Ngāti Rango directly.

On 22 March 2019 WMNZ met with representatives from Nga Maunga Whakahii o Kaipara Development Trust which is the legal entity for administering the Ngāti Whātua o Kaipara Claims Settlement Act 2013. WMNZ explained the proposal in an overview form. NWoK were most interested in the potential effects of sedimentation in the Kaipara Harbour and contaminants leaking into waterways. A link to the brochure on WMNZ's website was provided.

On 4 April 2019 WMNZ hosted a visit by NWoK the Redvale Landfill to explain the project in more detail and to relate it to an existing landfill operation. The next step will be to arrange a visit to the WMNZ landholdings and to provide copies of the technical reports when finalised.

12.2.3 Ngāti Rango

WMNZ were advised in May 2019 that the group wishes to be referred to as Ngāti Rango.

Following up on direct contact in June and September 2018, WMNZ met representatives of Ngāti Rango at Redvale Landfill on 01 March 2019. WMNZ presented the project proposal and there was some general discussion around the disposal of Auckland's waste.

Ngāti Rango were proposing two hui and advised that invited guests would include Nga Maunga Whakahii, Te Uro o Hau, Ngāti Manuhiri and WMNZ.

WMNZ were subsequently invited to a tribal hui by Ngāti Rango/Rongo of Ngāti Whātua on 23 March 2019. At that hui, WMNZ were offered an opportunity to discuss the need for a landfill, historical learnings from landfill practices, alternatives to landfills and the importance of high quality environmental protection. WMNZ heard concerns mainly focused around potential adverse effects on the extensive stream and river system and aquifer and the Hōteo River which flows to the Kaipara harbour.

On 18 May 2019 WMNZ hosted Ngāti Rango for a visit to Redvale Landfill and a presentation on the proposed landfill. WMNZ engaged in discussion on the need for landfill, the site selection criteria, and the measures to protect the environment. Ngāti Rango remain particularly concerned about the long term legacy that remains when the landfilling is finished.

12.2.4 Other iwi and hapu groups

WMNZ sent a letter and email to the other iwi groups listed below on 12 November 2018 to notify them of the OIO approval to acquire land for a landfill.

These other iwi groups have identified that they have an interest in the area of the project site according to the Auckland Council website, and according to feedback received by WMNZ up to this date in the case of the last three on this list. The iwi and hapu contacted were:

- Ngāti Whātua o Kaipara;
- Ngāti Wai;
- Ngai Tai ki Tamaki;
- Ngāti Maru;
- Ngāti Te Ata;
- Ngāti Whātua Orakei;
- Te Kawerau a Maki;
- Te Runanga o Ngāti Whatua;

- Te Uri o Hau;
- Ngāti Whanaunga;
- Ngāti Maunga Whakahii o Kaipara.

In response to this notification, on 14 November WMNZ received an email from Ngā Maunga Whakahii o Kaipara Development Trust (Ngāti Whātua o Kaipara). This email expressed that as the legal entity that governs the operations and management of Ngāti Whātua o Kaipara, and as the site is a significant area within their settlement rohe, they request a hui to address the proposal, along with Ngāti Manuhiri and Te Uri o Hau. These requests have been superseded to some extent by meetings between NMWoKDT and WMNZ, and by a public hui convened by one of their hapu (Ngāti Rango) on 23 March 2019 attended by WMNZ, although the door always remains open for other hui to be held.

On 1 April 2019, WMNZ received a phone call from a legal representative of Kaipara Moana Negotiations Reference Group comprising:

- Te Roroa
- Ngāti Whatua o Kaipara (including Nga Maunga Whakahii o Kaipara)
- Ngāti Whatua o Orakei
- Te Uri o Hau
- Te Runanga o Ngāti Whatua

They were given copies of correspondence between WMNZ and their members.

On 2 April 2019, WMNZ were approached by Te Runanga o Ngāti Whatua requesting further consultation. WMNZ made phone contact on 5 April and received confirmation from their Chief Executive that Te Runanga o Ngāti Whatua had authority to speak on behalf of all Ngāti Whatua between Auckland and Whangarei. Their concerns were confirmed as being mainly sediment in the Hōteo River, potential leakage from landfill liners and potential impact on the Kaipara moana. Te Runanga o Ngāti Whatua propose a meeting in their office and would invite Ngāti Whatua Orakei and Te Uri o Hau. At the date of finalsing this consent application, WMNZ and these groups were close to finalising dates to meet.

On 4 April, WMNZ had separate discussions with representatives of Ngā Maunga Whakahii and Ngāti Rango at Redvale Landfill and are in the process of setting up a site visit to the proposed new landfill site for NMWoK to discuss our proposal further.

On 4 April WMNZ also made contact with Ngāti Whatua Orakei, referencing earlier correspondence. Through this communication WMNZ received confirmation that Ngā Maunga Whakahii o Kaipara were the official mandated iwi in the South Kaipara region for Ngāti Whātua and the discussion confirmed the need to include Te Uri o Hau and Te Rūnanga o Ngāti Whātua in engagaments to ensure the interests of the mandated bodies of Ngāti Whātua are heard.

It is understood that Te Uri o Hau, Te Rūnanga o Ngāti Whātua and the separate Kaipara Harbour Integrated Mangement Group (KHIMG) have a number of members in common, and WMNZ have indicated WMNZ's willingness to meet them in any combination they choose. At the date of finalising this consent application, the parties were close to agreement on a date to meet.

12.3 Owners and occupiers of surrounding properties

Landowners and occupiers located in close proximity to the site were identified as key stakeholders by WMNZ. WMNZ began engaging with these stakeholders from 21 September 2018, once OIO approval for the acquisition of Springhill Farm was confirmed.

The sections below outline the consultation WMNZ has undertaken with these landowners and occupiers to date. These stakeholders have been grouped geographically into Matariki Forests (to the east of site), neighbours to the north west of the site, and neighbours to the south. As noted above, WMNZ have endeavoured to initially meet these stakeholders in person whenever possible.

12.3.1 Matariki Forests

Rayonier Matariki Forests owns and manages over 70 forests, covering more than 120,000 hectares throughout New Zealand. It is a subsidiary of Rayonier, an international forestry company, which has been in operation since 1923 and which owns approximately 2.6 million acres in the United States and New Zealand. They own and operate the forestry estate to the north, east and south of the WMNZ landholdings. The Eastern Block of the WMNZ landholdings was secured from Matariki following OIO approval.

WMNZ have been working closely with Matariki for several years to establish and agree on the sale agreement and how the ongoing forestry operation within the WMNZ landholdings will operate alongside the landfill operation. Matariki's main interests have been related to access within the site and onto State Highway 1 to ensure efficient ongoing operation of their forestry activities. They have reached a mutual agreement on this which is documented as part of a private forestry rights agreement.

12.3.2 Neighbours to the north west of the site

Following the OIO decision in September, WMNZ actively sought to make contact with nearby identified neighbours. Details of this consultation are included in the consultation log (Appendix E).

Initial contact was made through phone calls where contact numbers were available. During these phone calls, WMNZ explained that approval from OIO to acquire the land for a proposed landfill had been granted and that WMNZ sought to meet face to face to discuss the project in further detail.

Between the period of 21 September 2018 and 9 October 2018 WMNZ met in person with 10 neighbours located in this area. WMNZ explained the details of the project including the reason for a landfill, location and key features of the landfill, how modern landfills work and benefits for the community. Stakeholders were provided an information brochure which included contact details should they have any further queries. The main topics of interest for these neighbours were as follows:

- The future use of the airfield;
- The ability to continue horse riding on the site;
- Hazardous materials in the landfill and the affect they could have on the environment;
- Odour pollution;
- Noise pollution from traffic and the landfill operations;
- Leachate and the potential effect it could have on water quality;
- Concerns about the increase in traffic on State Highway 1;
- The potential to transport waste by rail;
- Loss of property value; and
- A desire to have protection and covenanting on the native bush.

12.3.3 Neighbours to the south of the site

Similar to the stakeholders north-west of the site, WMNZ contacted neighbours to the south from 21 September 2018. Initial contact was made through phone calls where contact numbers were

available. During these phone calls, WMNZ explained that approval from OIO to acquire the land for a proposed landfill had been granted and that WMNZ would be open and willing to meet face to face to discuss the project in further detail.

Between the period of 21 September 2018 and 9 October 2018 WMNZ met with nine neighbours located in this area. WMNZ explained the details of the project including the reason for a landfill, location and key features of the landfill, how modern landfills work and benefits for the community. Stakeholders were provided an information brochure which included contact details should they have any further queries. In summary, the main topics of interest for these neighbours were as follows:

- Concern about the increase in traffic on State Highway 1;
- Flooding down the Waiteraire Stream; and
- Impact on the groundwater and Waiwhiu River.

12.4 Wider public

The following forms of engagement and consultation with the wider public has also been undertaken to date by WMNZ.

12.4.1 Website

WMNZ established a page on its website specifically for providing information regarding the proposed Auckland Regional Landfill. The webpage was initially published on 24 September 2018 with subsequent updates as the project has progressed further. The website includes information on the following:

- Information about the OIO announcement;
- Information about WMNZ;
- Information about the current Redvale landfill in Dairy Flat;
- A section for people to register for updates;
- A section for providing questions or feedback;
- An electronic version of the Landfill Proposal Introductory Brochure;
- Information about public open days;
- Electronic versions of the posters displayed at the open days;
- A section which addresses a number of frequently asked questions (FAQs); and
- Information about the consent application.

The website also lists contact details for WMNZ and an 0800 phone number. The frequently asked questions have been updated as new areas of interest emerge. The website will be maintained throughout the consent processing and during construction of the project, to provide interested parties with up to date information on the project and a supplementary channel to get in touch with WMNZ.

12.4.2 Public open days

As part of the consultation process, WMNZ hosted four public open days at Springhill Farm.

Details of these public open days were as follows:

- Wednesday 17 October, 3pm-7pm;
- Saturday 27 October, 9am-1pm;

- Thursday 29 November, 3pm-7pm; and
- Saturday 1 December, 9am-1pm.

Over 200 people attended across the four days. The purpose of these public open days was for WMNZ to present information regarding the proposal, and for the public to ask questions and provide their feedback on the project. WMNZ staff as well as technical specialists from Tonkin + Tayor and Stantec were available to answer questions about the proposal. Forms were available for people to place feedback and ask questions.

A series of posters with content about the proposed Auckland Regional Landfill were displayed to outline the proposal and inform attendees. This content is shown in Appendix E of this report. Following the public open days, the poster content was published on the website described in Section 12.4.1.

The primary concerns raised by the general public at the open days included:

- Potential for pollution to the environment including noise and odour;
- Hazardous waste in the landfill;
- Stormwater management and ability to contain leachate;
- Increased traffic through the Dome Valley and alternatives such as waste by rail;
- Environmental impact on the Hōteo River and flooding in the area;
- Impact on native bush;
- Odour and noise pollution from construction of the landfill;
- Why there is a need for a new landfill;
- Alternative methods of waste management such as incineration;
- Loss of property value; and
- Benefits for the community.

12.4.3 Public Phone number

A designated phone number was set up for people to call and enquire about the proposed landfill. The phone line is manned by WMNZ staff, who have replied within a day to any messages left. The topics callers were interested in included finding out about potential benefits for the community and details regarding the public open days.

12.4.4 Email address and electronic updates

WMNZ set up a designated email address for people to email feedback and ask questions, to be responded to by WMNZ staff. Topics of interest received via this medium included stormwater management, vehicle movements and management of environmental effects.

Emails were also sent to those that had registered for updates through the website and public open days. As at 20 May 2019, there were 66 individual email addresses registered to receive updates. WMNZ sent the following correspondence to this email list:

- On 10 October 2018 an email was sent to inform the recipients of the details for the first two public open days;
- On 24 October 2018 an email was sent to inform the recipients of the details for the second public open day;
- On 31 October 2018 an email was sent to inform the recipients that the poster content displayed at the open days was available on the Auckland Regional Landfill website;

- On 12 November 2018 an email was sent to inform the recipients of the details for the third and fourth public open days;
- On 20 November an email was sent to inform the recipients that frequently asked questions had been added to the Auckland Regional Landfill website. This email also reiterated details for the third and fourth public open days;
- On 3 December an email was sent to inform the recipients that WMNZ would continue to engage in consultation with iwi, local stakeholders and the community as documentation is prepared for the resource consent process. The email also outlined that WMNZ will be requesting that Auckland Council publicly notify the consent application; and
- On 11 December an email was sent to inform the recipients that the poster content from the third and fourth open days was available on the Auckland Regional Landfill website. Additional information about The Dairy Flat Community Trust was also provided.

12.5 Auckland Council

12.5.1 Governance

The site is located wholly within Auckland Council's jurisdiction as a unitary authority. Auckland Council is a unitary authority under the Local Government Act 2002 (LGA), meaning it is a territorial authority that also has the responsibilities, duties, and powers of a regional council.

A phone call was made to the assistant to the Mayor on 20 September 2018 to advise that WMNZ had received OIO approval to acquire land for a landfill development in the Wayby Valley Area and that consultation with iwi and neighbouring properties had commenced from 19 September 2018.

On the same day, a phone call was made to Dean Kimpton, Chief Operating Officer (COO) of Auckland Council to notify them of the proposal and that WMNZ would begin to plan for a resource consent application. Dean undertook to send a note to Stephen Town (CEO) and Mayor Phil Goff.

WMNZ first advised the Chair and Wellsford member of the Rodney Local Board of the proposed landfill development on 23 October 2018. Some members of the Rodney Local Board chose to attend the Open Days to find out further information. This was followed up with a presentation to the Rodney Local Board meeting on 13 December 2018 and a site visit by Rodney Local Board to Redvale Landfill on 19 March 2019.

12.5.2 Regulatory - Premium Consenting

Auckland Council's Resource Consents Department includes a Premium Consenting team, which processes consents for projects valued at over $50 million. A number of pre-application meetings have been held with AC's Premium Consenting - Resource Consent team, including meetings with AC's Principal Project Lead, and the assigned processing planner, as well a briefing meeting with AC's team of specialists that will be assessing and reporting on the application.

12.6 New Zealand Transport Agency

NZTA is the government agency tasked with promoting safe and functional transport by land, including the responsibility for driver and vehicle licensing, investigating rail accidents and administering the New Zealand state highway network. As the road controlling authority of State Highway 1, NZTA's views have been sought on the proposal.

Consultation with NZTA commenced in February 2017. These early discussions needed to remain confidential so as not to influence the property negotiations and OIO approval process.

During the course of 2018 WMNZ had a number of meetings with NZTA representatives (including some under a confidentiality agreement prior to OIO approval being obtained). These meetings were important due to the location off the State Highway and the NZTA's statutory responsibility for State Highway 1, and accordingly there needed to be early discussion around the options for the proposed intersection with State Highway 1 and its ability to be compatible with any safety upgrades or a future new motorway alignment.

During the process, NZTA confirmed their preference for a roundabout in this location over another method of accessing the site. Subsequently the proposed design was presented to NZTA for a Safety Audit, as described in Technical Report M.

As part of the meetings to date involving WMNZ's consultants and NZTA, the safety upgrades through the Dome Valley have been discussed and closely reviewed to ensure any proposed new roundabout design specifically for the Auckland Regional Landfill project would be compatible with the safety upgrades.

12.7 KiwiRail Holdings Limited

KiwiRail Holdings Limited (KiwiRail) is a state-owned enterprise responsible for the infrastructure and operation of rail in New Zealand. KiwiRail operate the Northern Rail line which runs from Auckland to Whangarei, and passes approximately 2.5 km away from the site at its closest point. WMNZ have worked with KiwiRail previously to trial 'waste by rail' in New Zealand, delivering waste from the Thames Coromandel District to Redvale Landfill. However, this trial was not successful in demonstrating commercially viable 'waste by rail' at that time.

Subsequent to interest and questions raised by stakeholders, WMNZ met with KiwiRail on 24 January 2019 to discuss the project and the possibilities of developing 'waste by rail' for the Auckland Regional Landfill site. The outcome of the meeting was that at this stage it is unlikely that 'waste by rail' could be accommodated on the Northern Rail Line due to commuter rail timetables in Auckland, limits on train tonnage and insufficient heights of existing tunnels. KiwiRail also noted that they currently only work with 'point to point' freight, which would cause difficulties with loading and unloading trains. In Auckland, trains can only be loaded at Southdown, which is already a high congestion area. Unloading trains at Wellsford, if KiwiRail were prepared to increase infrastructure to accommodate this, would increase traffic and congestion within central Wellsford. KiwiRail advised they would not consider a new siding at Wayby Station Road.

The Ministry of Transport is currently working on a business case to upgrade rail infrastructure in Northland. If the Government decides to proceed with the investment there would be opportunity to grow rail services and consider the potential for waste by rail. In the interim, WMNZ and KiwiRail will remain in contact to identify opportunities should they arise.

WMNZ and KiwiRail will continue to work together in future to identify opportunities to explore waste by rail.

12.8 Auckland Transport

Auckland Transport (AT) is a Council Controlled Organisation and is responsible for Auckland's transport network, including roads, footpaths, public transport, cycle networks and parking. Of particular relevance to the Auckland Regional Landfill project, AT is the Road Controlling Authority for the Auckland region, and as such is responsible for the administration of unformed legal roads. WMNZ's landholdings encompasses a number of unformed legal roads, including one which is within the proposed landfill footprint. As discussed in Section 8.2.6, WMNZ are seeking that the road be stopped under the Local Government Act 1974. This is a separate process outside the scope of this resource consent application. WMNZ have contacted AT to discuss the project and in particular the

paper road stopping. At the time of lodging this consent application, WMNZ were close to arranging a meeting time with AT.

12.9 Vector

Vector maintains the electricity and fibre distribution network in the area surrounding WMNZ's landholdings. During routine contact with Vector in relation to WMNZ's current electricity export from Redvale, attention was drawn to the Vector Electricity Asset Management Plan 2018-2028. As a result, WMNZ gave Vector an estimate of its programme for electricity generation from the Auckland Regional Landfill. On 21 September 2018 Vector confirmed that their '33kV subtransmission network can accommodate 15MW injected at our Wellsford zone substation'. In response to a further request from Vector, on 18 December 2018 WMNZ provided more details on programme, proposed power line route (overhead power lines alongside existing lines beside State Highway 1) and power demands (deficit in early years, surplus for export in later years).

12.10 Watercare

On 16 January 2019 WMNZ made contact with Watercare who manage the potable water supply and sewage treatment plant for Wellsford. WMNZ subsequently met with Watercare on 8 March 2019. It was discussed that Wellsford's water take point and treated water discharge point on the Hōteo River were both upstream of the proposed landfill's discharge point into the Hōteo River and the two activities should have no effect on each other. Watercare does propose to take water in future from groundwater, on opposite side of the river from the landfill. Both parties agreed to share monitoring information.

12.11 Auckland Regional Public Health Service

On 24 January 2019 WMNZ contacted the regional public health representative based at the Auckland District Health Board (ADHB), and met with them in person on 20 May 2019. WMNZ responded to questions with regard to how WMNZ proposed to control vectors for spread of disease affecting humans including rats, gulls, dust and combustion exhaust emissions. ADHB asked to see the final health risk assessment which is being prepared by WMNZ's consultants and is to be available in the period soon after the consent application lodgement.

12.12 First Gas

First Gas operate the Wiri-Marsden Point gas pipeline which runs across the Western Block. On 29 November 2018 WMNZ met with their field representative on the site and the proposed scope of WMNZ's project was explained. No concern was expressed bearing in mind that the landfill proposal did not enter or affect the Designation corridor. First Gas sought and was given clearance by WMNZ to proceed with repairs to a section of their pipeline on the Springhill farm. First Gas later provided details of a contact at NZ Refining who work closely with First Gas since their pipelines run in parallel.

12.13 NZ Refining

On 27 March 2019 WMNZ met on site with a field representative of NZ Refining, who manage the Marsden Point-Wiri liquid fuel pipeline. Plans of the proposed landfill were provided, particularly around State Highway 1 where earthworks for the proposed roundabout could come close to the Designation corridor. Refining NZ said they willingly worked to resolve any issue brought to them by developers, made easier if it occurs before work starts. The pipeline underpass crossing State Highway 1 was highlighted as a particularly important stretch to avoid - WMNZ think that the proposed works for the landfill can readily be organised to stay away from it.

12.14 Department of Conservation

The Department of Conservation (DOC) is the government agency tasked with conserving New Zealand's natural and historic heritage. DOC manages a number of reserves in the surrounding area including Sunnybrook Reserve which neighbours WMNZ's landholdings. The OIO conditions require WMNZ to consult with DOC on opportunities to enhance recreational values in the Sunnybrook Reserve.

On 31 January 2019, WMNZ met with DOC to discuss recreational opportunities on Sunnybrook, as well as to discuss the project and WMNZ's work to survey the existing ecological values present on site. DOC expressed an interest in WMNZ's proposed pest control for the site, due to concerns about potential predators. DOC also wanted to understand WMNZ's proposed planting initiatives, wetland protection, sediment and stormwater control and relocation of fauna.

WMNZ have provided DOC with a copy of the methods and findings of the ecological survey works, and will continue to work with DOC to develop and confirm at least two opportunities for enhancing recreational value in Sunnybrook.

On 30 April 2019 WMNZ have also had an additional meeting with DOC in relation to their OIO application and subsequent processing of it and there has been dialogue in relation to wildlife permits.

12.15 Walking Access Commission Ara Hīkoi Aotearoa

The New Zealand Walking Access Commission Ara Hīkoi Aotearoa (WAC) is a Crown entity tasked with leading and supporting the negotiation, establishment, maintenance, and improvement of walking access. The OIO conditions require WMNZ to consult with the WAC on opportunities to enhance recreational values in the Sunnybrook Reserve, create mountain bike tracks, and provide walking and cycling access along the Waiwhiu Stream.

On 12 February 2019 WMNZ met with WAC and discussed the proposal and WMNZ's landholdings. WAC were interested in WMNZ's proposed approach to the network of unformed paper roads on the property, as WAC is interested in protecting these to provide public access.

WAC were keen to align with DOC and work with WMNZ to confirm opportunities for enhancing recreational value in Sunnybrook and at least two tracks, as well as the final alignment and details of access along the Waiwhiu.

A site visit with a WAC officer was conducted on 8 May to determine the practicability of a walking track along the west side of the Waiwhiu Stream. Unfortunately it was not possible to gain access down to the stream due to thick undergrowth. WAC asked WMNZ to help pursue permission for access for investigations on foot through Matariki Forests (outside of WMNZ landholdings) and asked WMNZ to provide an estimated forestry harvesting programme. Consultation on these issues and 'paper roads' is ongoing.

12.16 Other stakeholders

12.16.1 Mahurangi East Residents and Ratepayers Association Inc.

The Mahurangi East Residents and Ratepayers Association Inc. (MERRA) is a community group that advocates for and promotes the interests of its members and by extension the entire Scott's Landing and its surrounding area of Mahurangi East.

WMNZ received an email from MERRA on 22 January 2019 which raised concerns about the proposal, and specifically the potential increase in heavy vehicle traffic on State Highway 1. MERRA advocate a waste-by-rail option as part of (or a condition of) consents, noting that they consider that such a proposal would have the following benefits:

- potential synergies with the Regional Development Fund proposal to upgrade the northern rail line to Northport/Whangarei.
- potential cost savings over the life of the landfill
- the proximity of the northern rail line to the Spring Hill site
- the Government's decision to defer the Warkworth to Te Hana motorway construction
- the potential environmental, road maintenance and road safety benefits that a waste-by-rail operation would deliver

WMNZ met with MERRA on 11 February 2019 to discuss the landfill proposal and share feedback from discussions with KiwiRail. WMNZ confirmed that they were committed to considering rail as a future option should this be available and the consent application would not be bound to the exclusive use of road or rail transport.

Subsequently, at the invitation of members of MERRA, WMNZ presented the landfill proposal to the Warkworth Area Liaison Group on 06 March 2019.

12.16.2 Royal New Zealand Air Force

The Royal New Zealand Air Force (RNZAF) have an interest in the use of the airfield. A formal request to use the airstrip for helicopter training purposes was received via email and they were advised that it is closed until further notice because there is no one on site. No further correspondence was received.

12.16.3 Springhill Aviation

WMNZ spoke with Springhill Aviation on 27 September 2018 to inform them of the project because of their interests with the airfield. Springhill Aviation advised they would have a club committee meeting and submit their feedback. To date, formal feedback has not been received, but the nature of the earlier contact was that they will be interested to hear when the airfield is re-opened.

12.16.4 Deer Stalkers Association

The Deer Stalkers Association were notified by WMNZ by a phone call on 1 October 2018 because of possible hunting activity by their members in Matariki Forest. They were advised that no one should be entering the Matariki Forest site without permission as there will be an increase in activity on the site. The contact person advised an announcement would be made in their newspaper.

12.16.5 Ministry for the Environment

An email was sent to the Associate Minister for the Environment, Hon Eugenie Sage on 17 September 2018 to advise that WMNZ had received OIO approval to acquire land for a landfill development in the Dome Valley Area, and that consultation with iwi and neighbouring properties would be commencing from 19 September 2018.

12.16.6 Politicians

WMNZ has met government and local politicians to explain the landfill proposal.

WMNZ met Marja Lubeck (Labour Party list MP for Rodney) on 7 December 2018 in Warkworth. WMNZ explained the site selection process that had been followed, the best practices adopted at modern landfills and the expected benefits of the project to the local community and to Auckland.

WMNZ met Greg Sayers, Rodney Councillor on the Auckland Council through his attendance at Open Days (Oct / Nov 2018) and at the meeting with the Warkworth Area Liaison Group (6 March 2019). Through these opportunities, WMNZ has explained the site selection process, best practice proposed to be adopted for this landfill proposal and the benefits to local community and Auckland.

12.17 Summary of feedback received

Over the course of the pre-lodgement period, WMNZ has proactively engaged in public consultation with a strategy aimed at reaching all potentially interested parties and giving them opportunities to obtain information about the proposed landfill and related issues.

As a result, WMNZ has received feedback from stakeholders covering a diverse range of topics. Some key themes repeatedly arose. These are summarised in the table below (Table 12.1) with a reference to the response made in the application to the matters raised, including reference to the relevant supporting information in the application for each topic. A full record of all consultation undertaken to date is included as Appendix E.

Table 12.1: Summary of feedback received

Key theme		Raised by	Summary of feedback received	Summary response
The role of landfills	**The location**	Public open day attendees	• Why should Rodney be the dumping ground for all the waste from urban Auckland? • Have alternative sites been considered?	Section 10 of the AEE and Appendix D summarise the site selection process that WMNZ has gone through to identify the proposed project site. A number of alternative sites were considered prior to selecting this site. The proposed landfill will replace Redvale Landfill, which is also located in northern Auckland. The location is important to avoid needing to truck waste out of Auckland or increased trucking distances to the south.
	The need for a landfill and alternatives to landfilling including new technologies (eg. incineration)	Public open day attendees	• Question as to whether alternative technologies have been considered • Landfills perceived as old technology.	A discussion of the need for landfill capacity in the Auckland Region and alternatives to landfill is contained in Section 3 of this AEE.
Effects on residents and users of surrounding area	**Benefits for the local community**	Public open day attendees	• What benefits will there be for the local community? • Will there be work opportunities?	The project will provide job opportunities for the local community and additional opportunities for local suppliers, as described in Technical Report I. In addition, the project will result in improved public access to walking trails and cycle ways in the area and future electricity generation from LFG. Further, the project will provide a secure waste disposal facility - significant infrastructure for the Auckland Region.
	Loss of property value	Neighbours to the north west, public open day attendees	• Will the landfill result in a loss of property values?	As set out in Technical Report I, the Environment Court has accepted that property values should be considered a reflection of, not in addition to, any potential adverse effects of a project to avoid double counting of the effect.
	Future use of Springhill Farm and access for the public	Neighbours to the north west	• Neighbours were interested in the ability to continue horse riding at Springhill Farm	Options for walking and mountain biking tracks are being developed in consultation with DOC and WAC, as described above.

Key theme		Raised by	Summary of feedback received	Summary response
			• Interest in access into the Forestry Block.	A final decision has not yet been made regarding access onto the former Springhill Farm, however, due to health and safety concerns, this would need to be controlled.
	Future use of the airfield at Springfield Farm	Neighbours to the north west, RNZAF, Springhill Aviation	• Interest in future ability to use the airstrip	A final decision has not yet been made regarding access and use of the airstrip. WMNZ will continue to discuss with relevant stakeholders. The airstrip is currently consented, but is temporarily closed.
	Odour pollution	Neighbours to the north west, public open day attendees	• General concerns regarding the odour produced by the proposed landfill	WMNZ has intentionally acquired a large landholding and located the landfill footprint in the middle to provide a 1km buffer to the nearest residence. Measures to manage odour are described in Section 9 of this AEE, and in more detail in the air quality assessment (Technical Report D).
	Noise pollution	Neighbours to the north west, public open day attendees	• Noise pollution from traffic and landfill operation	WM has intentionally acquired a large landholding to provide a 1km buffer from the landfill footprint to the nearest residence. Expected noise levels and measures to manage noise are described in Section 9 of this AEE, and in more detail in Technical Report L.
Suitability of the site for a landfill	**Flooding**	Neighbours to the north west, public open day attendees	• Area receives very high rainfall and flooding. • A number of residents commented on a perceived correlation between timing of flooding and high tide in the Kaipara Harbour.	Potential flooding effects associated with the project are discussed in Section 9 of the AEE. Detention of stormwater quantity has been included in the design of the stormwater treatment systems for the site, as described in Technical Report P. However, given the site is located 24m above sea level, there is unlikely to be any connection between tidal levels and localised flooding in the Dome Valley, and as such no further assessment of this has been undertaken.
	Instability	Neighbours to the north west, public open day attendees	• Reports of land instability in the area	The geotechnical interpretive report (Technical Report B) concludes that the key criteria for site selection, as set out in the Technical Guidelines for Disposal to Land (WasteMINZ, 2018) are met, and that potential instability risks can be managed through excavation and design of the landfill. As part of the resource consent process, robust geotechnical investigation work has been undertaken in order to determine ground condition suitability.

Key theme		Raised by	Summary of feedback received	Summary response
	Native vegetation	Neighbours to the north west, public open day attendees, iwi representatives	• A desire to have protection and covenanting on native bush.	As described in section 10 of this report, the development of the landfill design has sought to minimise impacts on native vegetation. The proposed protection and covenanting of native bush within the WMNZ landholdings is described in Section 5.8.5 of this AEE.
Effects of discharges from the landfill	**Stormwater and surface water quality**	Neighbours to the north west, public open day attendees, emails from public, DOC, iwi	• Concerned about risk of sediment reaching water courses including the Hōteo River and the Kaipara Harbour.	Stormwater treatment controls are proposed at the site, both during the enabling phase of construction works and during on-going operation. These are described in the Technical Reports P and R.
	Groundwater	Neighbours to the north west, iwi	• Concerns about potential effects of the landfill on groundwater quality.	The landfill lining system is described in Section 5.6.2 of this AEE and in more detail in the Engineering report (Technical Report N). The purpose of the lining system is to contain leachate within the landfill. The hydrogeology report assesses the potential effects of the landfill on groundwater quantity and quality (Technical Report E).
	Hazardous waste in the landfill	Public open day attendees	• Concerns about hazardous waste within the landfill and potential effects on the environment	The waste acceptance criteria are described in Technical Report O. Hazardous waste will not be accepted into the landfill.
Effects on receiving environments	**Effects on the Hōteo River**	Public open day attendees	• The Hōteo River is regionally and culturally significant. • The river is used for a wide range of purposes, including recreation, food gathering, etc • Concerns about potential impacts of the landfill on water quality in the river, and resulting impacts on users.	Technical Reports P and R describe the proposed measures during construction and operation of the landfill for minimising effects on water quality. Technical Report G assesses potential effects of the landfill on surface water systems, and in particular the Hōteo River and Kaipara Harbour.
	Effects on the Waiwhiu Stream	Neighbours to the south	• Concerns about potential impacts of the landfill on	

Key theme		Raised by	Summary of feedback received	Summary response
	and Waiteraire Stream		water quality in the river, and resulting impacts on users.	
	Risk to Kaipara Harbour	Public open day attendees	• The Kaipara is the second largest harbour in the southern hemisphere and provides habitat to spawning Snapper, scallops, oysters etc. Perceived risk to this food source from contaminants from the landfill.	Technical Report G assesses potential effects of the landfill and proposed mitigation of risks to the marine environment, and in particular the Kaipara Harbour. Technical Report E utilises fate and transport modelling to predict whether contaminants could travel outside of the landfill and expose potential receivers to contamination.
Transport	**Traffic volumes and safety**	Neighbours to the north west, neighbours to the south, public open day attendees, email from public	• Concerns raised regarding potential increase in traffic on State Highway 1, primarily in relation to safety • Dome Valley is known as a dangerous stretch of road • Concern that truck numbers will increase safety issues	Dome Valley safety improvements are being undertaken by NZTA, and will be complete prior to the construction of the Auckland Regional Landfill. The potential effects of truck volumes associated with the project are assessed in Technical Report M. The intersection with State Highway 1 has been designed in accordance with the relevant safety standards and has received a safety audit from NZTA.
	Potential to transport waste by rail	Neighbours to the north west, public open day attendees, Mahurangi East Residents and Ratepayers Association	• Is there an opportunity to use rail to transport waste, rather than increasing numbers of heavy vehicles on State Highway 1.	A meeting was held with KiwiRail to understand feasibility of transporting waste by rail, as described in Section 12.7. Waste by rail cannot be accommodated in the current infrastructure, but WMNZ will continue to work closely with KiwiRail on opportunities in the future.

13 Statutory assessment

13.1 Introduction

This section of the AEE assesses the project against the key provisions of the Resource Management Act 1991 (RMA) and comments on other relevant legislation. The assessment is based on the information presented earlier in this report and supported by the accompanying Technical Reports in Volume 2.

The structure of the assessment is to:

- First, identify the relevant matters under s 104D, i.e. the relevant adverse effects, and objectives and policies;
- Then, consider the threshold or gateway test under s 104D;
- Then, assuming that threshold test is passed, undertake the full evaluative assessments under s 104B; and
- Finally, assess the proposed activity against Part 2 of the Act, and against s 5 in particular.

13.2 Identification of relevant matters under Section 104D

13.2.1 Adverse effects, including proposed mitigation, off-set or compensation

The proposed landfill development covers a range of activities. These activities during both the construction and then operational phase, may result in actual or potential effects on the environment which need consideration and assessment under s104D and s 104. For the purposes of the s 104D assessments, the identification of relevant effects (as proposed to be mitigated, compensated or off-set) are set out in Section 9 of the AEE.

In summary, it is considered that minor or less than minor adverse effects will occur for air quality, groundwater, surface water quality and quantity, stability, industrial and trade activities, leachate, archaeology, noise, nuisance and traffic, groundwater noise, and construction effects. This has been achieved through careful consideration in regard to the design of the landfill (as described in Sections 5-7), the size of the landholdings secured by WMNZ, and mitigation, off-set and compensation measures offered as conditions of consent (Appendix G).

It is considered that the risk of low probability but high impact events will be appropriately managed by a combination of measures which are intended to avoid the event and/or the resulting effects occurring, as well as contingency measures to respond should an event occur. These measures are described in the Risk Management Assessment (Technical Report S).

The potential cultural effects are discussed above in Section 9.13. As noted in that assessment, the identification of effects has been based on WMNZ's interpretation of the CVA provided by Ngāti Manuhiri. As also noted in that assessment, the identification of effects (and scale and significance of them), must be considered as preliminary, pending the further consultation and engagement that WMNZ intends to undertake with Ngāti Manuhiri and other iwi groups.

With regard to landscape character and visual amenity, changes will be noticeable to a limited number of viewing audiences, resulting in moderate adverse effects on a limited number of residences in Wellsford and adjacent to Springhill Farm for some stages of the project. The majority of viewing audiences will experience minor or less than minor adverse effects. To mitigate the landscape and visual amenity effects, planting is proposed to provide screening of the project and treatment of exposed earthworks areas.

The avoidance of ecological effects (both terrestrial and freshwater) has been an inherent part of the landfill design process and layout of the project features (See Section 10). The project avoids areas of significant ecological value such as the identified SEAs in the Southern and Waiteraire Tributary Blocks and the wetlands within the Western Block and will only affect 80m^2 of the NSMAs. However due to the nature and scale of the project, some adverse ecological effects are unavoidable and therefore a key component of the project is the ecological compensation and off-set package (see Section 5.8.5). This package will provide ecological compensation over time through creation of new habitat and enhancement of existing habitat through infill planting, stream improvement works, and pest control. Post-implementation of the proposed mitigation, off-set and compensation measures, the residual adverse effects on freshwater ecology are considered to not be significant, and to be minor in relation to terrestrial ecology.

13.2.2 Relevant planning provisions

The AUP became operative in part on 15 November 2016. The AUP is a unitary plan, meaning that it covers not only the Regional Policy Statement, regional provisions and district provisions all within one combined plan, but it also is applicable across the entire Auckland Region, regardless of district. The Auckland Regional Landfill is subject to the provisions of the AUP, and as such the objectives and policies contained within the AUP are relevant for assessing the project under s 104D.

A full assessment of the project against the relevant objectives and policies in the AUP is provided in Appendix F.

13.3 Section 104D threshold test

13.3.1 Introduction

To pass the threshold test under s 104D:

- The adverse effects of the activity on the environment (other than any effect to which section 104(3)(a)(ii) applies) will be minor; or
- The application is for an activity that will not be contrary to the objectives and policies of the relevant plans.

On the basis of legal advice received, when considering the threshold test in s 104D, our assessment has proceeded as follows:

- In respect of the first limb, an assessment of whether the effects are more than minor has had regard to how any identified effects would be mitigated (including by way of consent conditions) and the assessment of those remaining effects has been undertaken on a "holistic basis, looking over the entire application and range of effects, not individual effects".
- In respect of the second limb, this assessment has also be undertaken on a holistic basis, recognising that there are usually "sets of objectives and policies running either way". Only if the proposal is contrary to an important (or central) set of objectives and policies would that proposal fail this limb of the threshold test. In the context of the unique circumstances of the AUP, the RPS objectives and policies have been considered relevant when undertaking a holistic assessment of the AUP's objectives and policies.

13.3.2 Holistic assessment of effects

An assessment of effects has been provided in Section 9 of this report, with the relevant effects (including the nature of any mitigation) summarised in Section 13.2.1 above.

That assessment concludes that there are some effects that, individually, represent a more than minor effect. If the s 104D assessment was undertaken on the basis that if any one of the effects

were more than minor, then the application would fail this threshold test. If however, the s 104D assessment were undertaken on the basis of any overall assessment of effects, then, depending upon the nature and scope of mitigation and compensation ultimately proposed (particularly with respect to freshwater ecology), then the overall effects of the project could be seen collectively as no more than minor. Because that mitigation and compensation has not yet been fully identified, and importantly because the consultation and engagement process has not yet been concluded, we are not able at this stage to definitively conclude that the project meets the first limb of s 104D (but as noted below, we do consider that the project will meet the second limb). This first limb of s 104D will continue to be reviewed through the application process, as further assessments are considered, and as the mitigation and compensation package is further developed.

13.3.3 Holistic assessment of objectives and policies

A full assessment of the proposal against the relevant objectives and policies has been undertaken, and is contained in Appendix F. This analysis has indicated a number of themes within the AUP's objectives and policies, which run 'either way' through the higher and lower level provisions. These themes are identified and discussed in Section 13.4 below.

Taking a holistic assessment of the objectives and policies, the following key conclusions are drawn:

- The proposal is generally consistent with (and not contrary to) the key relevant objectives and policies for infrastructure. These objectives and policies direct that adverse effects of infrastructure should be avoided, remedied and mitigated wherever possible, while recognising that adverse effects from infrastructure development may be inevitable, due to the nature, scale and locational requirements of infrastructure development. Importantly, these objectives and policies acknowledge that the nature of infrastructure means that infrastructure may need to be established in areas that are identified as having high natural, biophysical or cultural values.
- The proposal is generally consistent with (not contrary to) objectives and policies requiring the avoidance of Overlay areas. The WMNZ landholdings have a number of identified Overlays, including SEAs, ONLs, WMA, and NSMAs. The project design has avoided these with the exception of one minor intrusion into the NSMA in the Southern Block, which was unavoidable (refer Section 10 of this report).
- The proposal is not consistent with objectives and policies relating to stream reclamation. However, this needs to be considered in light of the higher level provisions of the AUP, which recognise that stream reclamation may be an unavoidable consequence of infrastructure development. As described in Section 10 of this report, any landfill development within the Auckland Region would be expected to result in stream-loss, and throughout the project design, efforts have been made to avoid stream loss, including changes to the project footprint which have reduced stream loss to the extent possible.

In summary, as would be expected for a non-complying activity, there are instances where the proposal does not fit directly with some individual objectives and policies. The nature of a landfill development within the Auckland Region will inevitably involve a large scale project within a valley system, resulting in considerable changes to the existing conditions. This is similar to any large infrastructure development. The AUP has recognised this across the Plan's provisions. Throughout the AUP, in both higher and lower level provisions, there are objectives and policies which recognise and provide for infrastructure development, including recognition that this may result in unavoidable adverse effects on natural values.

Our understanding is that the interpretation of "contrary" should be "repugnant to" or "opposed to", not simply that the proposal does not find support from the relevant policies and objectives. While there are some objectives and policies which the project is not consistent with, having regard to the nature of the project, the nature of mitigation, off-setting and compensation proposed, the

lack of any other practical alternative, and taking a holistic view of the AUP provisions, the application is considered to not be contrary to the objectives and policies of the AUP.

As such, it is considered that the application passes the second gateway test of Section 104D and can proceed for consideration under Section 104.

13.4 Overall evaluation under s 104

13.4.1 Introduction

Section 104 of the RMA sets out the matters to which a consent authority must have regard to, subject to Part 2 of the RMA, when considering an application for resource consent.

13.4.2 Relevant provisions of planning documents

13.4.2.1 Introduction

The proposal is subject to a range of planning documents including National Environmental Standards, National Policy Statements and the AUP. Details of these are set out below.

13.4.2.2 National Environmental Standards for Air Quality 2004

The National Environmental Standards for Air Quality (NESAQ) place restrictions on discharges of a number of combustion derived contaminants, as well as on discharges to air from landfills over 1 million tonnes.

The NESAQ requires landfills with more than 200,000 tonnes of waste in place and a design capacity of greater than 1 million tonnes to collect landfill gas and either flare it (to minimum standards) or use it as a fuel to produce energy. The NES applies to landfills where the waste in or to be included in the landfill is likely to consist of 5% or more (by weight) of matter that is putrescible or biodegradable. The NESAQ also prohibits the lighting of fires or burning of waste at landfills and the burning of tyres.

The Auckland Regional Landfill will have a design capacity of 25 million tonnes and therefore must meet the requirements of the NESAQ. The site will collect the landfill gas and use it to convert to renewable energy through generators. This practice is already undertaken at other existing WMNZ facilities including Redvale Landfill. The site will also have flaring capacity; these are available on site to destroy LFG in the event that a number of generators are unavailable as a result of an unscheduled breakdown or network outage.

Therefore the proposed landfill development is able to meet the requirements of the NESAQ.

13.4.2.3 Resource Management (Measurement and Reporting of Water Takes) Regulations 2010

The proposal includes an application for a water take permit, which will not exceed a rate of 0.55 litres/second. The Water Take Regulations must be considered if the water permit is 5 litres/second or greater. Therefore, the regulations are not considered relevant to the proposal.

13.4.2.4 National Environmental Standards for Electricity Transmission Activities 2009

The NES sets out a national framework of permissions and consent requirements for activities on existing electricity transmission lines. They do not apply to the construction of new transmission lines or to substations. Therefore, the NES does not apply to the installation of transmission lines to export electricity from the renewable energy facility, and therefore these regulations are not discussed further.

13.4.2.5 National Environmental Standards for Plantation Forestry 2017

The National Environmental Standards for Plantation Forestry (NES-PF) were introduced in 2017 and then updated in 2018. The purpose of the standards is to maintain or improve the environmental outcomes associated with plantation forestry activities and increase the efficiency and certainty of managing plantation forestry activities. The standards cover eight core plantation forestry activities that have potential environmental effects:

- afforestation (planting new forest)
- pruning and thinning to waste (selective felling of trees where the felled trees remain on site)
- earthworks
- river crossings
- forestry quarrying (extraction of rock, sand, or gravel within a plantation forest or for operation of a forest on adjacent land)
- harvesting
- mechanical land preparation
- replanting.

The NES-PF applies to any forest of at least one hectare that has been planted specifically for commercial purposes and will be harvested.

The harvesting of forestry currently on the site are to be separately undertaken by forestry operators in the area and do not form part of this application. There will however, as part of the application, be the planting of forestry on some areas of the Western Block. These are marked on plans attached in Volume 3. This planting will be carried out in accordance with the permitted activity standards under the NES.

13.4.2.6 National Environmental Standards for Contaminated Land 2011

The Resource Management Act (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 came into effect in 2012. The NES applies to assessing and managing the actual or potential adverse effects of contaminants in soil on human health from five activities, including soil disturbance.

As the subject site is currently undeveloped forestry and farmland, it is not considered likely that there will be any HAIL[21] activities on the site. Therefore the NES will not apply to the development of the landfill facility.

13.4.2.7 National Policy Statement for Renewable Electricity Generation 2011

The National Policy Statement for Renewable Electricity Generation 2011 (NPS) recognises the importance of renewable energy and will help New Zealand achieve the Government's target of 90 per cent of electricity from renewable sources by 2025. The NPS promotes a more consistent approach to balancing the competing values associated with the development of New Zealand's renewable energy resources when councils make decisions on resource consent applications.

Biogas is considered a source of renewable energy. As discussed in Section 2, WMNZ's current landfill holdings are major contributors to renewable electricity supply in the Auckland Region, and the renewable energy facility to be provided as part of this project will increase the contribution into

[21] The HAIL is the Hazardous Activities and Industries List, produced by the Ministry for the Environment. It lists activities and industries that are considered likely to cause land contamination due to hazardous substance use, storage or disposal

the local grid. Landfill gas is captured and then converted to energy through generators on the site. As the landfill fills overtime and the volume of waste increases, the quantity of gas being produced also increases, which allows for more generators to come online and more renewable energy to be fed back into the National Grid.

13.4.2.8 National Policy Statement for Freshwater Management 2014

The National Policy Statement for Freshwater Management (NPS Freshwater) came into effect in July 2014 and applies to the landfill given the activities proposed on the site. An assessment of the proposal against the relevant provisions of the NPS Freshwater is set out in Table 13.1 below.

Table 13.1: Assessment against NPS Freshwater

Reference	Objective/policy	Comment
Objective A1	To safeguard: a) the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems, of fresh water; b) the health of people and communities, as affected by contact with fresh water; in sustainably managing the use and development of land, and of discharges of contaminants.	The construction and operation of the landfill has been designed to try to avoid adverse effects on freshwater systems where at all practicable. The very nature of the activity does mean that there will be loss of freshwater streams. However mitigation measures are proposed to go towards off-setting this loss. A comprehensive monitoring programme is in place to provide a baseline of data regarding the current state of the freshwater systems in the project area. In addition, fauna surveys and fish surveys have been undertaken to get data about the species living within the local fresh water systems. The ongoing operation of the landfill facility will be managed carefully, with robust controls in place to manage sediment and other contaminants, to ensure that the life-supporting capacity is safeguarded.
Objective A2	The overall quality of fresh water within a freshwater management unit is maintained or improved while: a) protecting the significant values of outstanding freshwater bodies; b) protecting the significant values of wetlands	The design of the proposed landfill is such that the quality of surrounding freshwater systems should be maintained through containment of contaminants in the liner system and the use of sediment control ponds and wetlands. The Hōteo River and the stream within the Southern Block are recognised as outstanding water bodies, as are two wetlands within the Western Block. The stream within the Southern Block has been largely avoided, and throughout construction and operation, measures such as stormwater treatment and sediment control will protect the in-stream values. No works are proposed

Reference	Objective/policy	Comment
		in the vicinity of the Hōteo River or the scheduled wetlands. The wetlands will be protected by the establishment of indigenous buffer planting around the perimeter of the wetlands and the permanent protection of these wetlands and planting by legal instrument.
Objective B1	To safeguard the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems of fresh water, in sustainably managing the taking, using, damming, or diverting of fresh water.	The project will involve taking, using, damming and diverting of freshwater. Measures have been proposed to avoid, minimise or manage effects of these activities on fresh water. As outlined in Technical Report E, the site is not located within a High Use or Vulnerable Aquifer as identified in Council's database. WMNZ intend to take up to 50 m^3/day from a groundwater bore for use at the site and are applying for consent on this basis. There is expected to be no potential adverse effects on groundwater users associated with establishing a groundwater take from the regional aquifer.
Objective B3	To improve and maximise the efficient allocation and efficient use of water.	There is sufficient water available within the regional aquifer underlying the site to provide efficient allocation of water for WMNZ's proposed take. WMNZ proposes to re-use water within the stormwater ponds for the purposes of dust suppression, which is considered an efficient use of water.
Objective B4	To protect significant values of wetlands and of outstanding freshwater bodies.	There are a number of significant wetlands on the Springhill property. Some of these are scheduled under the Auckland Unitary Plan as SEA features and some are not, but have been observed through field observations as containing values of significance. These wetland features are proposed to be protected through the planting of indigenous buffer planting around the wetland perimeters and then the protection in perpetuity by legal instrument.
Objective CC1	To improve information on freshwater takes and sources of freshwater contaminants, in order to: a) ensure the necessary information is available for freshwater objective and limit setting and freshwater management under this national policy statement; and	As part of developing the application for lodgement, baseline monitoring has been undertaken at the site to give data on the state of existing freshwater systems. This enables the applicant to effectively monitor works at the site to ensure that there is not a degradation

Reference	Objective/policy	Comment
	b) ensure information on resource availability is available for current and potential resource users.	of the quality of freshwater through contaminant loading.

Overall, the proposal is considered to be consistent with the Freshwater NPS.

13.4.3 Auckland Unitary Plan

The AUP is a combined regional and district plan as provided for under s80 of the RMA and it also includes the regional policy statement. The plan is set out in a clear hierarchy of provisions, beginning with the regional policy statement provisions first. These objectives and policies set the high level framework and give the overview of the issues of the region. The subsequent objectives and policies within the regional and district provisions must give effect to these. In other words, the AUP is deliberately a vertically integrated plan, which is intended to be read and applied as such.

13.4.3.1 Regional Policy Statement

The Regional Policy Statement (RPS) is required by s59 to 62 of the RMA, to provide an overview of the resource management issues of the region and policies and methods to achieve integrated management of the natural and physical resources of the whole region. The RPS must also give effect to any national policy statement and it has a relationship with the Auckland Plan, as this plan prepared under the LGA sets a long term strategy for Auckland's growth and development.

The RPS provisions set out a number of issues of regional significance which are then developed further through objectives and policies. The RPS objectives and policies are concerned with managing effects, but also with supporting and enabling regionally significant infrastructure to operate efficiently to support the population. Of particular significance to this proposal are the following issues:

- Urban growth and form – Auckland's growing population increases demand for housing, employment, business, infrastructure, social facilities and services. Growth needs to be provided for, including the provision and use of infrastructure in a way that is efficient, effective and timely.
- Infrastructure, transport and energy – the quality of the environment and the well-being of people and communities are affected by the management of and investment in infrastructure.
- Natural resources – the combination of urban growth and past practices have placed pressure on land and water resources and reduced air quality.
- Issues of significance to Mana Whenua – recognising Treaty of Waitangi, protecting Mana Whenua culture and landscapes and recognising the interests, values and customary rights.
- Rural environment – protecting the finite resource of elite soils and minimising the loss of rural production land.

From these issues a number of objectives and policies that are relevant to the consenting of a new landfill are included. They are important as they set the over-arching framework for the regional and district rules that follow, with these provisions required under s67 and s75 of the RMA to give effect to the RPS.

A strong theme across many of the objectives and policies, particularly in relation to effects on water and ecological values, is that adverse effects from infrastructure are anticipated and are appropriate when there are no practical alternatives.

The below analysis groups the regional policy statement, regional plan and district plan provisions of the AUP into key themes and provides a summary comment on the proposal in relation to these key

themes. The specific objectives and policies of the AUP and a detailed assessment against those are set out in Appendix F.

Table 13.2: Key themes

Theme	Relevant objectives and policies	Comment
Urban Growth and Development		
Providing for population growth	B2.2.1(1) B2.3.1(2) B3.3.2(2)	The population of the Auckland region is expected to grow by approximately one million people (400,000 households) by 2040. Providing landfill capacity will help to cater for the growth in population, and the associated landfill waste generated by this expected population growth. The continuation of landfilling services within the Auckland region will ensure that the standard of living for the Auckland community remains high by allowing for safe ongoing waste collection and disposal within the Auckland region.
Health, safety and wellbeing of communities	B2.3.1(3) B3.2.1(2)	No public access to the landfill will be provided and there are no significant off-site health and safety effects. Potential adverse effects will be avoided, remedied or mitigated through the implementation of appropriate management and operation measures. Innovative measures, including the energy centre and use of electric vehicles will be used to address some of the potential adverse effects of the landfill. Provision of walking and cycling tracks within the broader WMNZ landholdings will contribute to the wellbeing of communities, enabling walking and cycling opportunities.
Infrastructure		
Future-proofing	B3.2.1(1) B3.2.2(9)	The design, consenting and development of large scale infrastructure is not a straight forward exercise, and often takes significant time. At the same time, ensuring the seamless provision of infrastructure is vital for the safe functioning of the region and society. For this reason, forward thinking and looking to the future in relation to the provision of infrastructure is vital and is recognised through these objectives and policies. The Auckland Region currently has two main landfills – Redvale Landfill and Whitford Landfill. Both of these landfills have limited remaining capacity. Waste is also transported to Hampton Downs, in the Waikato Region. To ensure the region's landfill infrastructure is effective (i.e. that the Auckland Region has a long term landfill), and to ensure that landfill facilities are resilient (i.e. to ensure that there is an alternative landfill in the event that either any new landfill or Hampton Downs becomes unavailable for any reason), planning for future landfill space is essential.
Enabling infrastructure	B3.2.1(3) B3.2.2 (1)	Infrastructure is enabled within the RPS provisions of the Unitary Plan. This is because it is recognised that infrastructure

Theme	Relevant objectives and policies	Comment
	B3.2.2 (6) B7.4.2(1) B7.5.1(2) E26.2.1(3) E26.2.1(4) E26.2.1(8)	has an important role to play in a resilient and well-functioning city. A key aspect of the enabling of infrastructure, is that the AUP seeks to *manage* effects of establishing and operating infrastructure rather than seeking to avoid effects. This is important and supports the enabling provisions which recognise the vital role infrastructure has to play. It provides direct recognition of the importance of infrastructure and it recognises that infrastructure can result in unavoidable effects. This is particularly relevant when considering the establishment and operation of the Auckland Regional Landfill. Ultimately the project will result in some adverse effects due to the location, size and nature of the activity. Some of these adverse effects are ones that ordinarily, in relation to a project which is not infrastructure, may be deemed to be unacceptable and contrary to objectives and policies. However, in the case of the proposed landfill, and its role as regional infrastructure, it is recognised that some effects that would otherwise be inappropriate may be acceptable in the context of the wider benefit that the project provides. If effects can be managed, then the development of infrastructure projects should be enabled.
Managing adverse effects	B3.2.1(3) B3.2.1(8) B3.2.2(6) B3.2.2(8) E26.2.1(9) E26.2.2(4)	The directive through the objectives and policies relating to the development and operation of infrastructure, is to avoid, remedy or mitigate adverse effects, rather than avoid solely. This is consistent with the objectives around the enablement of infrastructure and the recognition of it.
Functional, operational and locational requirements of infrastructure are recognised	B3.2.1(4) B3.2.2(3) D4.2(5) E14.2(4) E14.3(3) E15.3(7) E26.2.2(2)	For operational purposes, landfills are best located within valleys that are remote from other development. In the Auckland region in particular, this locational requirement will necessitate the loss of those freshwater systems that are invariably found in such remote valleys. A key aspect of the enabling of infrastructure is that the AUP seeks to *manage* effects of establishing and operating infrastructure rather than seeking to avoid effects. It also recognises that to enable it, often allowance must be given for the functional, operational and locational requirements of infrastructure, which are different to other types of development. This is important and supports the enabling provisions which recognise the vital role infrastructure has to play. It provides direct recognition of the importance of infrastructure and it recognises that infrastructure can result in unavoidable effects.
Positive benefits and enabling of infrastructure	B3.2.1(2) RPS 3.2.2(1) B3.2.2(6) E26.2.1(1) E26.2.2(1)	The establishment and operation of essential infrastructure results in important positive benefits to the safe and efficient functioning of the Auckland region. Municipal landfills form part of this essential infrastructure as they provide a necessary service to businesses and residents, by providing for the safe disposal of residual waste.

Theme	Relevant objectives and policies	Comment
		While waste in itself is not a positive benefit, it is a modern day reality and requires safe and legislated disposal. The existence of a regional landfill underpins the economic operation of Auckland. The proposed Auckland Regional Landfill provides such a facility and will be constructed and operated in a way that it is managed appropriately, so that adverse effects are managed and positive benefits arise from the provision of this essential infrastructure.
Mana Whenua		
Recognition of the Treaty of Waitangi and Mana Whenua Values	B6.2.1 (1) B6.2.1 (2) B6.2.2 (1) B6.3.1 (1) B6.3.1 (2) B6.3.2 (2) B6.3.2 (3) B6.3.2 (4) B6.3.2 (6)	WMNZ has undertaken consultation with iwi in the region and continues to undertake consultation to ensure that their views regarding the proposal can be taken into account, are recognised and can be addressed where at all possible. The AUP and ArchSite do not specifically identify any known sites of cultural significance in the vicinity of the landfill. However, these two mechanisms do not provide a complete picture about the cultural landscape or mana whenua values. It is recognised by WMNZ that this can only be obtained through engagement and discussion with iwi and those with mana whenua. As described in Section 12 above, WMNZ are working closely with Ngāti Manuhiri with the intention of building a partnership with them. WMNZ has received a CVA from Ngāti Manuhiri, which WMNZ considers to be the starting point of a process to identify and respond to cultural concerns. In order to ensure that all potential cultural effects are identified and responded to, the following other iwi and hapu groups have been contacted by WMNZ in relation to the proposed landfill operation: • Ngāti Whatua o Kaipara; • Ngāti Rango; • Ngāti Wai; • Ngai Tai ki Tamaki; • Ngāti Maru; • Ngāti Te Ata; • Ngāti Whatua Orakei; • Te Kawerau a Maki; and • Te Runanga o Ngāti Whatua • Nga Maunga Whakahii This engagement has occurred via hui, meetings, visits to Redvale Landfill, discussions and social interaction, and will continue throughout the consent process.
Protection of Mana Whenua cultural heritage	B6.5.1 (1) B6.5.1 (2) B6.5.1 (3) B6.5.2 (2)	The CVA prepared by Ngāti Manuhiri discusses the overall site and locality and the areas of significance to Ngāti Manuhiri. Identified in the CVA are the key components of whenua (land), wai (water), hau (air), biodiversity, wāhi tapu and taonga,

Theme	Relevant objectives and policies	Comment
	B6.5.2 (8)	social, economic and cultural wellbeing and future management. The particular sites of significance within the locality includes the Ngāti Manuhiri maunga tapu (sacred mountains) of Tohitohi o Reipae (the Dome), Pukemomore (Conical Peak), Kikitangieo, Pae Kauri, and Maunga Tamahunga (Mt Tamahunga). The proposed landfill development includes modification of the whenua through substantial earthworks and physical works. Through the CVA Ngāti Manuhiri have advocated for taking all practical steps to rescue or preserve taonga (as identified by Ngāti Manuhiri), replacement of habitat, planting of native species and involvement of Ngāti Manuhiri in the process of developing the landfill. For more detail about WMNZ response to the CVA, and the proposed process of engagement moving forward, refer Section 9.13 above.
Natural Resources		
Stormwater management	B7.4.1(4) B7.4.2 (9) E1.3(8) E1.3(10) E1.3(11) E1.3(13)	The management of stormwater on the site both during the construction and operation of the landfill is vital for managing effects on freshwater systems. The site will be managed to ensure that any stormwater in contact with waste is treated as leachate, and that stormwater in contact with development areas will be passed through the sedimentation ponds to ensure treatment. These ponds have been sized for a 1 in 100 ARI.
Indigenous biodiversity	B7.2.1(1) B7.2.1 (2) B7.2.2 (1) B7.2.2 (5) E3.2(4) E3.2(15) E15.3(2) E15.3(3) E15.3(4) E15.3(7)	The WMNZ landholdings include areas of identified SEAs which have been avoided in the design of the proposed landfill. In addition to this the applicant has commissioned a comprehensive ecological assessment of the overall WMNZ landholdings, which is detailed in Technical Report G. In this report the findings of both desktop assessments and field work has been discussed, including the prevalence of indigenous biodiversity present on the site. The basis of the objectives and policies relating to biodiversity within the AUP, is to protect and maintain it where possible and to look to opportunities to enhance it within areas of degradation. The site contains a range of indigenous biodiversity, including both flora and fauna. This includes various native trees, wetland systems, Hoschetter's Frog, Long Tailed Bats, Peripetaus, and Fern Bird. As discussed in Technical Report G, the proposal includes a range of ecological enhancement and compensation activities. These measures will help to protect and maintain the indigenous biodiversity present on site.
Freshwater systems	B7.3.1 (1) B7.3.1 (2) B7.3.1 (3) B7.3.2 (1) B7.3.2 (4) B7.3.2 (5)	The AUP has a clear directive to enhance degraded freshwater systems, minimise loss of freshwater systems and avoid, remedy or mitigate adverse effects on freshwater systems. These directives flow from the RPS down through the regional plan provisions. While there is a strong theme on protection of fresh water – the provisions also run in partnership with those relating to infrastructure, which enable the development and

Theme	Relevant objectives and policies	Comment
	B7.3.2 (6) E3.2(1) E3.2(2) E3.2(3) E3.2(4) E3.2(5) E3.2(6) E3.3(1) E3.3(2) E3.3(3) E3.3(4) E3.3(7) E3.3(10) E3.3(11) E3.3(12) E3.3(13) E3.3(15) E3.3(16)	operation of infrastructure, despite the sometimes unavoidable adverse effects of it on the environment – including freshwater systems. The overall WMNZ landholdings contain a large number of freshwater systems both within the landfill footprint area and within the western and southern block. The quality of these systems varies depending on historical land use. Degraded water systems have been identified within Technical Report G. It is considered that as part of the works undertaken through the proposed ecological compensation and enhancement package that degraded water systems in the Western Block are likely to be enhanced through the removal of stock access and the establishment of new riparian planting. However it is recognised that within the landfill footprint in particular there will be a loss of freshwater systems through reclamation. This arises due to the establishment of landfill cells, a basegrade and liner system, which will then be utilised for waste placement. This loss of freshwater systems has been minimised where possible in the design process, while recognising that the nature of the activity and its role as vital infrastructure to the region, has meant that complete avoidance of freshwater system loss is not able to be achieved.
Air Quality	E14.2 (1) E14.2 (2) E14.2 (4) E14.3 (1) E14.3 (2) E14.3 (3) E14.3 (6) E14.3 (8) E14.3 (9) E14.3 (10)	The WMNZ landholdings are located within a rural area, which is characterised under the AUP as being a medium air quality environment. As set out in Technical Report D, the local ambient air is characterised by rural activities and discharges and the State Highway, which is located within close proximity of the WMNZ landholdings. The air quality provisions of the AUP set out to manage both amenity effects and human health effects of activities. For the Auckland Regional Landfill, these effects include odour and dust, which are amenity effects and discharges from combustion and LFG.
Vegetation	E15.2(1) E15.3(1) E15.3(3)	The landholdings acquired by WMNZ cover an area of approximately 1020ha and include tracts of both native and exotic vegetation. The exotic vegetation mainly includes plantation pine forest and areas of wattle forest up through the southern block. Within the remainder of the property there is a mixture of pasture and scrub, and areas of established native vegetation. As part of the development of the proposal, areas of native vegetation have been avoided, and where possible enhanced through revegetation and additional planting. These areas are identified and described in Technical Report G. The AUP seeks to preserve as much native vegetation as possible, yet also provides for clearance of vegetation where necessary to enable the provision of infrastructure, such as the proposed Auckland Regional Landfill. The project is consistent with the provisions relating to vegetation, as where at all possible vegetation of significance has been retained and protected, including through the use of covenants and setbacks, while still enabling

Theme	Relevant objectives and policies	Comment
		the establishment of a vital piece of infrastructure for Auckland Region.
Rural Environment		
Rural character and amenity	E14.2(4) E14.3(2) E14.3(3) E14.3(6) E25.3(9) H19.2.1(1) H19.2.1(5) H19.2.3(1) H19.2.4(1)	The rural character of the area is a mixture of farmland, forestry and rural residential living. There is also large areas of native vegetation. Components of the surrounding rural character are highly modified and are also subject to change. The Landscape and Visual Assessment report contained in Technical Report H, provides an assessment of effects on rural character and concludes that effects on the majority of viewing audiences will be minor or less than minor. The site of the landfill has been specifically chosen to meet a number of parameters, one of them being minimisation of visual effects and the ability for the landfill to be screened. Visually, the proposed landfill footprint is well-contained by existing topography and vegetation, and any visual amenity effects would be limited to specific properties and specific parts of the landfill operation. Noise, dust and odour effects are mitigated through measures set out in the draft conditions (Appendix G).
Land disturbance	E11.2(1) E11.2(2) E11.2(3) E11.3(1) E11.3(2) E11.3(4) E11.3(5) E11.3(7) E11.3(8) E12.2(1) E12.3(1) E12.3(2) E12.3(3) E12.3(4) E12.3(5) E12.3(6)	The landfill will be developed and filled in phases, minimising the area of soil exposed at any one time. Overland flows on the site will be directed into sedimentation ponds prior to discharge. The nature and scale of the project requires large scale earthworks to be undertaken. Notwithstanding this, the landfill has been designed to utilise the natural landform of Valley 1 and the wider WMNZ landholdings, minimising the amount of earthworks required as far as practicable.
Environmental Risk		
Industrial and Trade Activities	E33.2(1) E33.3(1) E33.3(2) E33.3(3)	Areas of Industrial and Trade Activities will be carefully managed throughout the operation of the landfill, to ensure appropriate management practices. A draft Environmental Management Plan has been prepared which identifies the activities with the potential to generate contaminants and outline methods to avoid or minimise potential effects (Technical Report P).
Natural hazards and flooding	E36.2(1) E36.2(4) E36.2(5)	The landfill has been sited and designed to avoid areas subject to natural hazards, in particular, areas of seismic activity and floodplains. In addition, an Emergency Management Plan will be prepared, to ensure any natural hazard event is

Theme	Relevant objectives and policies	Comment
	E36.3(3) E36.3(4) E36.3(16) E36.3(21) E36.3(22) E36.3(23) E36.3(25) E36.3(26) E36.3(29) E36.3(30) E36.3(31) E36.3(32) E36.3(33) E36.3(35)	appropriately responded to. This will ensure the potential risks from natural hazards will be managed to the extent practicable.
Leachate management/waste management	E13.2(1) E13.2(2) E13.3(1) E13.3(2) E13.3(3) E13.3(4)	The Auckland Regional Landfill has been designed to meet the design requirements of the Landfill Guidelines. The landfill will be managed in accordance with good practice and in line with the proposed conditions and an LMP, which minimises the potential for adverse effects from landfill operation.

13.4.4 Other matters

13.4.4.1 The Auckland Plan 2050

The Auckland Plan is a spatial plan that sets the direction for how Auckland will grow and develop over the next 30 years. This plan was recently updated in 2018 to further build on what was done in the 2012 plan. The plan includes a number of outcomes and within these outcomes are directions and focus areas. Some of these have particular relevance to the proposed development of the Auckland Regional Landfill and therefore are discussed below to provide some wider context.

Direction 4 under the Environment and Cultural Heritage outcome is to 'Ensure Auckland's infrastructure is future-proofed'. It is essential that Auckland's infrastructure can withstand short-term shocks, such as natural hazards and can also work in the long-term, particularly in the face of longer-term climatic changes and a growing population. Landfills are critical infrastructure which will support Auckland's growth – as such, the provision of a regional landfill facility is well aligned with the infrastructure objectives of the Auckland Plan. It is important that Auckland maintains continuity of landfill space in the region, including allowing for potential requirements for mass disposal in the wake of a significant event such as an earthquake.

Further, while there are no directly relevant outcomes for waste, the Auckland Plan identifies several other matters of relevance, including directions which support development of homes and places, and opportunities and prosperity for Auckland's residents. To achieve the directions set out in the Auckland Plan, supporting infrastructure is critical. A modern well-designed landfill is the best available technology for dealing with residual waste which is not able to be recycled or diverted, providing a contained disposal location for wastes and therefore playing an important part in protecting receiving environments and enabling development of the Auckland region.

As such, the provision of waste infrastructure for the region is critical to support the overarching themes of the Auckland Plan.

13.4.4.2 Solid Waste Bylaw

Auckland Council's Solid Waste Bylaw was adopted by Council in 2012. The bylaw is part of a multi-pronged approach to reducing waste to landfill in the Auckland region. The bylaw provides for the collection, handling and disposal of waste and sets out licencing requirements. The Council is currently in the process of reviewing the bylaw.

Section 16(1) of the bylaw requires any person who operates a fill site, including a landfill, to obtain a licence to do so from the Council. WMNZ will obtain a licence from Council as part of a separate process.

13.4.4.3 Resource Management (Energy and Climate Change) Amendment Act 2004

The Resource Management (Energy and Climate Change) Amendment Act 2004 came into force on 2 March 2004. The Act removed the power of regional councils to consider the impacts of greenhouse gas discharges to air on climate change when making rules in regional plans or determining air discharge consents, except where necessary to implement a national environmental standard. As no relevant national environmental standard for restricting greenhouse gas emissions has been developed yet, the decision maker can only consider the effects on climate change to the extent that the use of renewable energy will reduce discharges into air or greenhouse gases in total, or in comparison to non-renewable energy (i.e., the effects of climate change per se cannot be considered). As such, while climate change and waste disposal is discussed in Section 2 of this report, the effects of greenhouse gases are outside the scope of matters to be considered in the assessment of this project.

13.4.4.4 Climate Change Response Act 2002

A number of the property titles on which the project will be sited are subject to notices under the Climate Change Response Act 2002 (CCRA), stating that all or part of the within land is pre-1990 forest land. Landowners who deforest pre-1990 forest must pay deforestation liabilities under the Ministry for Primary Industries' Emissions Trading Scheme (ETS), unless the landowner has an exemption or off-sets their deforestation. Under the ETS, deforestation is a change in land use out of forestry, and is not the same as harvesting.

To address the ETS requirements resulting from the change in land-use associated with this project, sections of the Springhill farm will be converted to forestry, off-setting the area of forestry which will be deforested in order to enable construction and operation of the landfill. As discussed previously the harvesting and afforestation activities will be undertaken by the forestry operator rather than by WMNZ.

13.5 Sections 105 and 107

Sections 105 and 107 are relevant to applications for discharges under section 15 of the Act.

Section 105 requires the consent authority to have regard to the nature of the discharge and the sensitivity of the receiving environment, the applicant's reasons for the proposed choice and possible alternative methods of discharge. These matters have been addressed throughout this report and technical reports, particularly in Section 4 which describes the receiving environments and Section 9 which assesses the effects on the environment. Section 10 provides a summary of the alternative methods considered for the project's discharges. The methods proposed are considered to be appropriate, will ensure adverse effects are avoided, remedied or mitigated, and are consistent with accepted best practice.

Section 107 restricts the granting of discharge permits in certain circumstances, namely if, after reasonable mixing, the contaminant or water discharged (either by itself or in combination with the same, similar, of other contaminants or water), is likely to give rise to all or any of the following effects in the receiving waters:

- The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
- Any conspicuous change in the colour or visual clarity;
- Any emission of objectionable odour;
- The rendering of fresh water unsuitable for consumption by farm animals;
- Any significant adverse effects on aquatic life.

The effects of the discharge are considered in Section 9 above and the technical reports. The discharges will not result in any of the effects listed above. Overall the discharges would meet the tests set out in section 107(1)(c) to (g).

13.6 Part 2 of the RMA

13.6.1 Assessment against Part 2

Part 2 of the RMA sets out the purpose and principles of the Act. The purpose of the RMA is to promote the sustainable management of natural and physical resources.

The Court of Appeal's decision on *RJ Davidson Family Trust v Marlborough District Council* [2018] NZCA 316 allows for the decision maker to refer back to Part 2 when deciding applications for resource consent under s104 in some circumstances. Whether and to what extent it will be appropriate for a decision-maker to resort to Part 2 will depend on the planning instruments engaged. An assessment of whether the AUP has been competently prepared has not been undertaken, as that is for the decision-maker to determine. For completeness, an assessment against Part 2 has been provided, to assist in the event that it is determined that a Part 2 assessment is required.

13.6.2 Section 5 – Purpose

Section 5(1) states that the purpose of the RMA is to promote the sustainable management of natural and physical resources, with sustainable management defined in Section 5(2).

The proposal is consistent with the overall purpose of the Act and the reasons for this assessment are summarised below:

- The landfill will enable people and communities of the Auckland Region to provide for their social, economic and cultural wellbeing and for their health and safety by providing a sanitary and contained facility for disposal of waste that cannot be reduced, reused or recycled.
- The life supporting capacities of air, water, soil and ecosystems will be protected by robust operating practices and monitoring regimes, consistent with best practice for landfill management.
- Potential adverse effects from the ongoing operation of the landfill will be avoided, remedied or mitigated through landfill design, construction management measures, and operational procedures (particularly as controlled through the LMP and proposed conditions of consent).

13.6.3 Section 6 – Matters of National Importance

Matters of national importance, which are to be recognised and provided for, are set out in Section 6 of the RMA. The following matters are of particular relevance to the Auckland Regional Landfill project:

a the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development.

b The protection of outstanding natural features and landscapes from inappropriate subdivision, use and development.

c The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna.

d The maintenance and enhancement of public access to and along the coastal marine area, lakes and rivers.

e The relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga.

The preservation of the natural character of the Hōteo River, Waiteraire Stream, Waiwhiu Stream and identified significant wetlands is a key matter of relevance to the proposed landfill development as required by s6(a) and (b) of the RMA. Potential effects of the project on the natural character of wetlands, rivers and their margins have been considered throughout the project's development, including via the alternatives assessment. The location and design of the proposed landfill has taken into account existing scheduled natural features, such as the wetlands and has been designed to avoid directly impacting on these features.

The project will mitigate adverse effects on natural character by minimising construction effects on natural stream environments where possible and mitigating both terrestrial and freshwater effects where possible. In particular, within the identified Natural Stream Management Area (NSMA) adverse effects on natural character have been avoided almost entirely locating the access road outside of the NSMA, and providing for a bridge over a tributary. Riparian planting and restoration of native vegetation is also proposed and will provide an opportunity to enhance the natural character values. The natural character of the Wayby wetlands and significant ecological areas on the site will be protected by avoiding activities in these areas, pest control within the WMNZ landholdings, and in perpetuity by covenants.

Public access will be enhanced through the project, by the construction of walking and cycling tracks within the WMNZ landholdings, including along the Waiwhiu Stream. Currently the site is not available for public access.

Subject to the caveats in Section 9.13, on the basis of the assessment undertaken and the information received as at the date of lodging this application, the proposal recognises the relationship of Māori with their ancestral lands and water and is consistent with section 6(e). Further consultation is underway and will be ongoing to better understand how this relationship can be recognised and provided for.

13.6.4 Section 7 – Other Matters

Section 7 of the Act sets out other matters to which particular regard must be had when exercising functions and powers under the RMA. Of particular relevance to this proposal are:

a kaitiakitanga;

aa the ethic of stewardship;

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;

i the effects of climate change; and

j the benefits to be derived from the use and development of renewable energy.

Having regard to these matters, the following points are noted:

- WMNZ are investigating how the project can provide for mana whenua kaitiaki to exercise kaitiakitanga, and as the consultation and engagement continues these opportunities can become fully developed and encapsulated in conditions and through other means.
- Amenity values and the quality of the environment will be managed through conditions of consent and the LMP. The landfilling operation is generally not visible off-site therefore the visual amenity of the surrounding area is maintained as set out in the landscape report attached to this application. Landscaping works progressively and upon the closure of the landfill will ensure that the landform fits within the existing environment and is consistent with the landscape character and amenity of the surrounding area.
- Landfill operations are controlled through the LMP and ensure that the quality of the environment is maintained and enhanced.
- The landfill will operate a gas generation plant, which converts LFG to energy and supplies this energy back to the national grid. This alternative use of LFG is a positive step in reducing effects of climate change and is a renewable energy resource.

In summary, it is considered that the proposal has had regard to the provisions of section 7 of the Act.

13.6.5 Section 8 – Treaty of Waitangi

Section 8 requires those exercising powers or functions under the RMA to take into account the principles of the Treaty of Waitangi. WMNZ is engaging with iwi to ensure that their culture and traditions, and their ancestral land and water are considered and that the principles of the Treaty of Waitangi are taken into account. The record of consultation is provided in Section 12 of this AEE.

14 Proposed conditions of consent

To assist the consent authority and submitters, WMNZ proposed a suite of key draft conditions (Appendix G). WMNZ recognises and expects that a full suite of conditions will be developed through the resource consent process.

Mitigation measures are recommended throughout the specialist reports and in the AEE above to ensure adverse effects are appropriately avoided, remedied or mitigated, or compensated or off-set. In some instances, these involve the preparation of management plans at a stage when further details of the construction method have been determined. The conditions proposed by the applicant capture the key mitigation measures and management plans addressed in the specialist reports and assessment of effects. These key conditions are intended to support the conclusions in the specialist assessments, and to provide certainty to Auckland Council for key issues. These are key conditions only, with further conditions to be added throughout the consent process. The conditions have been structured broadly by specialist area, and if consent is granted these conditions may be restructured in accordance with the consent authority's preferred consenting format.

15 Conclusion

This AEE report has been prepared on behalf of WMNZ to accompany a resource consent application to Auckland Council for the construction and operation of a new landfill in the Wayby Valley, north of Auckland.

The proposal involves an initial construction stage, including construction of an access road, bin exchange area, the landfill itself, environmental controls such as stormwater ponds, and ongoing operation of the landfill, including placement of waste, capture and destruction of LFG, leachate and ongoing environmental monitoring and controls.

The proposed works require consent as a non-complying activity overall under the Auckland Unitary Plan.

This AEE report draws the following conclusions:

- The works are consistent with Part 2 of the Resource Management Act 1991;
- The works are considered not contrary to the relevant objectives and policies in the Auckland Unitary Plan;
- Overall the proposal is a non-complying activity. The application meets the test of section 104D of the RMA.
- The proposal will have positive economic effects and will provide important infrastructure to support the growth of the Auckland region.
- The proposal will have more than minor effects on stream habitat and some residences visual amenity, and no more than minor effects on a range of other features of the environment including groundwater, surface water, air quality, traffic and landscape.

The proposal will have adverse effects on the environment that are more than minor. Furthermore due to the significance of this project to the Auckland region in both its size and economic contribution, the applicant requests that the application is publicly notified to enable the community to be informed of the project and provide feedback.

Accordingly we respectfully request that this resource consent application be notified. WMNZ also requests that the owners/ occupiers of adjoining properties and all stakeholders and interested parties, who have requested to be kept updated as part of the consultation process, are served notice of this application.

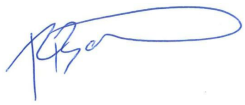
Proposed consent conditions are provided in Appendix G.

16 Applicability

This report has been prepared for the exclusive use of our client Waste Management NZ Ltd, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd

Report prepared by:



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