TOITŪ TE WHENUA

LAND INFORMATION NEW ZEALAND

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146 TE MAWHAI ROAD, TE AWAMUTU

FORMER TOKANUI HOSPITAL DEMOLITION AND REMEDIATION REMEDIAL OPTIONS REPORT

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TOITŪ TE WHENUA – LAND INFORMATION NEW ZEALAND
FORMER TOKANUI HOSPITAL DEMOLITION AND REMEDIATION
REMEDIAL OPTIONS REPORT
EXECUTIVE SUMMARY

Introduction

The former Tokanui Psychiatric Hospital (the Site) is approximately 80 hectares (ha) in area and is located approximately 14km southeast of Te Awamutu, Waikato. It contains 74 buildings, a decommissioned wastewater treatment plant, swimming pool, eight substations, closed landfill (also referred to as the 'existing disposal site') and substantial roading and underground infrastructure and services.

The former Tokanui Hospital is managed by Toitū Te Whenua Land Information New Zealand (LINZ) on behalf of the Crown in the Treaty Settlements Landbank. Land held in the Landbank is Crown land which has been declared surplus and can be used as cultural or commercial redress in Tiriti o Waitangi Settlement claims.

The Tokanui Hospital is a deferred selection property in the Ngāti Maniapoto Deed of Settlement (the Deed) and forms part of the Maniapoto Settlement Claims Act 2022, which gives effect to the Deed. The Tokanui situation is unique as no other property included in a Treaty settlement has required demolition and remediation on this scale, or required a commitment to undertake remediation in a deed of settlement.

Under the Deed, Ngāti Maniapoto and the Crown have agreed to a standalone process within the Property Redress Schedule, Part 9: Tokanui Hospital Deferred Selection Process, which details specific requirements for the demolition and remediation of the Site before it is available for transfer to the Ngāti Maniapoto Post Settlement Governance Entity (PSGE), Te Nehenehenui Trust (TNN). LINZ is the Government agency responsible for delivering this project.

The land is presently in a damaged state, arising from the hospital buildings and associated infrastructure still present on it. Many of the former Tokanui Hospital buildings remain, and these buildings are generally in very poor condition. While a range of potential site contamination issues have been ruled out through earlier investigations, the primary contamination issues relate to localised contamination of soil around the building perimeters (forming a 'halo' around the buildings) from lead-based paint and/or asbestos.

Accordingly, the Deed requires that before offering the land to Ngāti Maniapoto, the Crown must demolish and remove buildings and structures, and remediate the land, leaving it in a grassed state.

More specifically in relation to contamination, under Section 9.3 of the Deed, the Crown has agreed to use best endeavours to remediate the Site to:

(a) 85% of the Site area (being the total land area of the Tokanui Hospital deferred selection properties) to "the rural residential remediation standard" (defined as "an acceptable standard or standards for rural residential use chosen in accordance with Contaminated Land Management Guidelines No. 2 Hierarchy and Application in New Zealand of Environmental Guideline Values (Revised 2011) (CLMG 2), or derived through a site-specific risk assessment); and
(b) A contiguous area not exceeding 15% of the total Site area to "the managed remediation standard" (defined as "an applicable standard or standards for recreational use chosen in accordance with CLMG

2, or derived through a site-specific risk assessment, but where use may be subject to controls (for example, in relation to excavating, erecting buildings, or domestic gardening)".

The Deed sets out a process that, prior to demolition and remediation, commits the Crown to a number of reports including a Detailed Site Investigation (DSI) and Remedial Action Plan (RAP).

A Preliminary Site Investigation (PSI) and DSI were completed by GHD Ltd with input from HAIL Environmental Ltd (HAIL), followed by a supplementary DSI[1] by Fraser Thomas Ltd (FTL) and HAIL, as well as a Site-Specific Risk Assessment undertaken by HAIL over the course of 2022 – 2024.

The findings of these investigations have been used to inform and enable the future decision-making regarding remediation and management of contaminated soil as a result of the Site's past use as a hospital. As such, LINZ has instructed HAIL and FTL to undertake an Assessment of Remedial Options with this work being reported on in a Remedial Options Report (this report).

The approach to this report is aligned with the decision-making process adopted by LINZ regarding the extent of horizontal infrastructure to be retained and how demolition waste will be managed set out in the Deed, and as agreed by the Minister of Land Information (BRF 23-169). As part of this process, engagement with mana whenua and TNN throughout project delivery, and in particular the contaminated land investigations, were undertaken through in-person hui, and by providing copies of the presentations and summary documents such as infographics to support technical reports. Through building engagement into the project delivery, LINZ was able to provide mana whenua and TNN with an informed understanding of the project as it progressed and to enable them to directly input feedback into investigations. This was to ensure the views or feedback on methodology, or next steps, were incorporated into the report findings. The feedback was then used to assist in decision-making on the preferred remediation option(s) for contaminated soil on the Site.

Objectives

The primary objective of this Remedial Options Report is to capture a robust analysis of the options assessed for managing soil with elevated contaminants present within the Site. A range of options for the management and disposal of contaminated soil from the Site were assessed using a holistic approach taking into account environmental, social, cultural and economic factors that meet LINZ requirements and Treaty Partner expectations, comply with industry best practice and government sustainability and broader outcome goals.

Site Specific Remedial Standards

The HAIL Site-Specific Risk Assessment established remedial standards that define what the Crown must do to meet the requirements of the Deed – one for rural residential use, and another for managed use of a contiguous part of the Site (maximum 15% of total area). Specifically, the remedial standards have been derived to pose minimal risk to food production, to people who live on the land, and to soil quality. In relevant parts of the block, the standards also seek to protect water quality and wetland values including the associated mahinga kai (traditional value of food resources and their ecosystems). The resulting values are tabulated below.

[1] The Supplementary DSI results have been analysed to inform the remedial options and an associated technical report is under preparation at the time this report was finalised.

Site-specific Soil Contaminant Remedial Standards

Scenario	*Wetland*[1]	*Rural residential*[1]	*Managed*[1]
Arsenic	9	9	70
Cadmium	0.3	0.9	10
Chromium	100	150	150
Copper	50	280	280
Lead	70	120	460
Mercury	3	3	3
Zinc	150	350	450
DDT[2]	1	2	2
ACM[2]	0.01 %	0.01 %	0.01 %
AF/FA[2]	0.001 %	0.001 %	0.001 %
Fuels and Oils	No odour or staining	No LNAPL[2]	No LNAPL[2]
Benzene	0.11	0.11	0.11*
BaP_{eq}[2]	6	6	35
Hazardous Wastes	Absent	Absent	-

Notes:

1. All concentrations milligrams per kilogram dry weight, except asbestos % weight for weight, fuels/oils and hazardous wastes.
2. DDT, dichlorodiphenyltrichloroethane, is an insecticide banned in the 1970s. ACM refers to fragments of asbestos-containing materials, up to 7 mm in size. AF/FA is asbestos fines and fibrous asbestos. BaP_{eq} is a way of expressing the toxicity-weighted concentration of a group of chemicals called polycyclic aromatic hydrocarbons (PAHs) that are formed by incomplete burning of organic materials. LNAPL (light non-aqueous phase liquid) is a groundwater contaminant such as petrol, diesel or oil that is less dense than water and not very soluble in water.

***Only within 100 m of surface water.**

Overall, the combined soil sampling undertaken across the Site indicates that it is generally **not contaminated**, with the principal contamination issues being limited to asbestos and lead from building materials in localised areas surrounding buildings. Investigations to date have found nothing that is likely to compromise the Deed; rather, the contaminants that are present are limited in extent and can readily be remediated or managed. Soils around several buildings will require some remediation to meet the adopted standards, while limited remediation or management is also required in a small number of localised hotspot areas.

Contaminated Soil Volumes

Contaminated soil volumes were broken down into the categories shown below. In this report, soils exceeding the site specific rural residential soil remedial standard but not the managed remedial standard are referred to as "low level" contaminated soils, while soils exceeding the managed remedial standard are referred to as "moderate level" contaminated soils. No "high level" contaminated soils have been found on the Site.

Estimated Contaminated Soil Volumes (solid measure)

Contamination Level Classification	Contaminated Soils Description	Contains asbestos	Estimated Volumes (m^3)
Low Level	Exceeds site specific rural residential soil remedial standard but not the managed remedial standard.	Yes	**593**
		No	**384**
Moderate Level	Exceeds site specific managed remedial standard.	Yes	**824**
		No	**602**
		TOTAL	**2,403**
		PROVISIONAL ALLOWANCES	
Estimated halo scrape post-building demolition[2]		Some	**869**
Estimated building subfloor space scrape, post-building demolition[3]		Some	**1,930**
Inferred asbestos contaminated soil around asbestos watermains[1]		Likely	**328**
		TOTAL INCLUDING PROVISIONAL ALLOWANCES	**5,530**

Notes:

1. Assumed that on average a 100mm wide ring of soil around the asbestos watermains that are to be removed from the Site is contaminated with asbestos. Testing will be undertaken at the time of watermain removal of this soil to confirm the volume of soil requiring removal. This is addressed further in the separate Demolition Management Plan for the Site.
2. Provisional allowance made for soil scrape around all buildings, post-demolition and post-contaminated soils removal, comprising 1m wide strip x 150mm deep, excluding areas already remediated.
3. Provisional allowance made for soil scrape across the subfloor space of all buildings excluding those with concrete floor slabs, post-demolition and post-contaminated soils removal comprising building footprint areas x 150mm depth.

Options considered

Eight options were initially considered with a screening process reducing this to five options, of which one is a combination option. All options are listed below, including a summary in relation to how soil with different levels of contaminants is handled in each option, site specific constraints relevant to each option, and which options were rejected from further consideration.

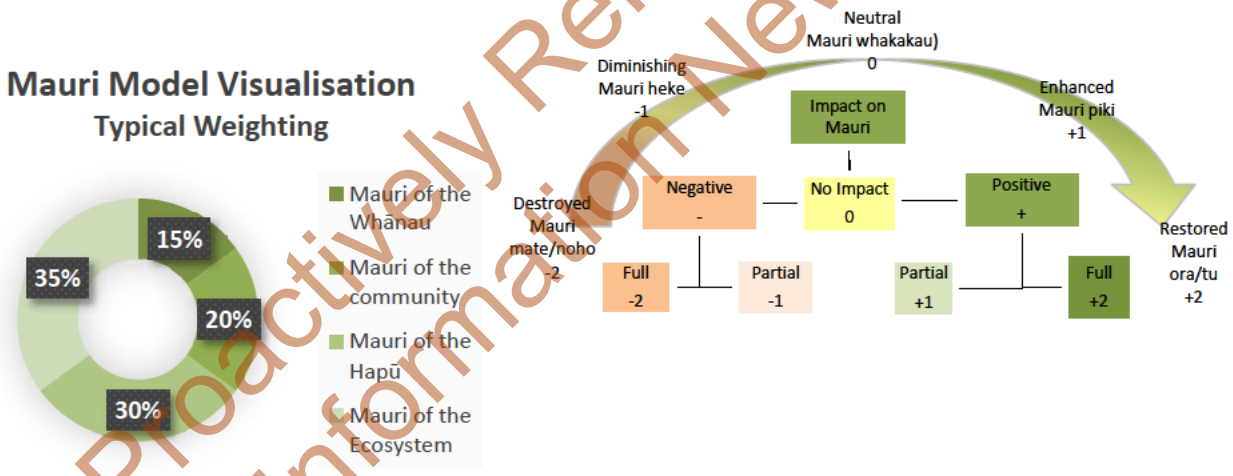
Options Screening

Option	Name	Low-Level Contaminated Soil		Moderate-Level Contaminated Soil	Site Specific Constraints
		No Asbestos	With Asbestos		
1	Reuse as Backfill	Yes	No	No	Industrial area preferred site, to minimise potential Highly Productive Land (HPL) issues
2	Blending	Yes	No	Potentially (if asbestos free)	If blending moderate level soils to low level status, will result in larger volume of low-level contaminated soils, with possible HPL issues
3	Stabilisation	Not applicable – rejected for further consideration			
4	Bioremediation / destruction	Not applicable – rejected for further consideration			

5	New containment cell on-site	Yes	Yes	Yes	Industrial area is preferred location – avoids alluvial soils, HPL and stormwater issues
6	Utilise existing disposal site(s)	Yes	Yes	Yes	Northern site within 65m of cluster of residential houses and ~40m from farmhouse on adjacent property
7	Off-site disposal	Yes	Yes	Yes	None
8	Combination	Varies			

Options Evaluation

The evaluation assessment approach was developed as a hybrid approach tailored to the Site, based on the following tools: Multi-criteria analysis (MCA), ISO18504:2017 Soil Quality – Sustainable Remediation, Sustainable Remediation Forum - United Kingdom (SuRF-UK), Mauri model and a range of Māori environmental assessment and performance indicator tools developed by Landcare Research. This hybrid approach was adopted to align with assessment criteria provided to TNN and Joint Ministers[2]. Ministerial support of this criteria was provided in BRF 23-169 Tokanui Hospital: Decision-making process and criteria in January 2023. The assessment was undertaken looking at environmental, social, cultural, economic criteria, with different weightings and a scoring system, consistent with the Mauri model, as explained in the following diagram. The indicative weighting was applied to support the priority order detailed in BRF 23-169 and has been updated following several hui with mana whenua in relation to the options presented in this report.



Within each criteria, a number of indicators were developed for evaluation, along with a number of sub-headings to help explain what each indicator[3] covered. For the cultural indicator criteria views expressed in the Deed, CIA and the cultural induction provided by mana whenua were used to inform this initial assessment. Several hui have also been held with mana whenua over the course of the overarching project delivery, feedback has been incorporated into investigations and used to inform scoring considerations. An additional "deliverability" assessment was also included, which involved a Yes/No/Likely/Unlikely assessment of the ability to deliver on the Crown's commitments under the Deed, taking into account the prescribed

[2] Joint Ministers refers to the Minister of Finance, Minister for Land Information and Minister for Treaty of Waitangi Negotiations, as defined in 9.1.16 of the Property Redress Schedule of the Deed.

[3] An indicator is a single characteristic that represents a potential or actual effect which can be compared across options to evaluate their relative performance. Indicators need to be measurable in some way that is sufficient to allow evaluation (adapted from SuRF-UK, 2011).

timeframes and delivery risks in terms of significant constraints and consentability. High level (budget) cost estimates were also included for each option. The results of this assessment are summarised in the following table.

Options	Option 1: Backfill Reuse	Option 2: Blending	Option 5: New Containment Cell Onsite	Option 6: Utilise Existing Disposal Site(s)	Option 7: Off-site Disposal
Indicator (weighting, %)	**Weighted Scores**				
Environmental (35%)	0.0	0.0	0.6	0.7	0.2
Social (20%)	-0.2	0.1	-0.1	0.2	0.1
Cultural (30%)	-0.2	0.2	0.2	0.5	0.6
Economic (15%)	0.1	0.2	-0.1	0.0	0.1
Total	**-0.3**	**0.6**	**0.7**	**1.4**	**1.0**
Ranking	5th	4th	3rd	1st	2nd
Deliverability Assessment					
Significant Site Constraints	None	Minor	Minor	Minor	None
Consentability	Somewhat complex	Somewhat complex	Somewhat complex	Somewhat complex	Less complex
Provisional Costs – confirmed contaminated soil only (minimum)					
Contaminated Soil Remedial Costs ($M)	[redacted]				
Contaminated Soil Ongoing O&M ($M) – Cumulative costs over 10 yrs*					
Total					
Provisional Costs – confirmed + potential contaminated soil (maximum)					
Contaminated Soil Remedial Costs ($M)	[redacted]				
Contaminated Soil Ongoing O&M ($M) – Cumulative costs over 10 yrs*					
Total					

Note: For option 6, 1st cost is for Option 6A, 2nd for Option 6B. * excluding ongoing closed landfill O&M costs, estimated to be [redacted] over 10 years.

Assessment results of the contaminated soil remedial options, based on LINZ, FTL and HAIL inputs show:

- The preferred option is Option 6 – utilising the existing disposal site with a total score of 1.4. This option presents an opportunity to add the low and moderate level soils to the existing landfill, while undertaking separate remedial works planned by LINZ at the same time (improved capping, groundwater diversion and flood risk reduction). This will result in decreased negative environmental, social and cultural effects of the existing disposal sites, compared with the existing situation, in a cost-effective way.

- The second preferred option is Option 7 – off-site disposal with a total score of 1.0. This option removes low and moderate level contaminated soil from site but shifts the problem to another rohe (home area of a particular Iwi). It also incurs negative associated transport environmental effects, including importing suitable soil to backfill the cavities the contaminated soil was taken from, which may be considered a wasteful use of a valuable resource. It is also worth noting that Option 7 does not include the significant upgrades to the closed landfill and would only see minimal repairs undertaken for the Crown to remain compliant with existing consents conditions.
- The third preferred option is Option 5 – new on-site containment cell, with a score of 0.7.
- The fourth preferred option is Option 2 – blending, with a score of 0.6.
- The fifth and least preferred option is Option 1 – backfilling, with a score of -0.3.

Conclusions and Recommendations

The assessment undertaken shows that Option 6 - disposing the contaminated soil present on-site to the existing disposal site is the preferred option, followed by off-site disposal (Option 7). There may be some merits in blending some of the contaminated soil, but this would likely result in increased overall costs.

This report is based on the best information, currently available at the date of issuing this report. This report is considered sufficient for LINZ to determine how contaminated soil will be remediated and managed to meet the requirements of the Deed, and proceed with developing a Remedial Action Plan (RAP) on that basis. The RAP will be used to support the resource consent application for the remediation works.

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FORMER TOKANUI PSYCHIATRIC HOSPITAL DEMOLITION AND REMEDIATION
REMEDIAL OPTIONS REPORT

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GLOSSARY

CONTAMINATED MATERIALS	Hazardous building materials that pose some level of risk to human health and/or the environment, such as asbestos or lead-based paint, which potentially affects materials handling, haulage and/or disposal requirements. *Please note, management of contaminated soil as part of the demolition and remediation project follows the remedial standards process as outlined in the Tokanui Hospital Deferred Selection Process.*
CONTAMINATED LAND	Contaminated land is defined by the Ministry for the Environment as sites at which hazardous substances occur at concentrations above background levels and where assessment indicates it poses, or is likely to pose, an immediate or long-term risk to human health or the environment.
DEED OF SETTLEMENT (DEED)	The Ngāti Maniapoto Deed of Settlement signed by Maniapoto and the Crown, which was signed on 11 November 2021 and given effect by the Maniapoto Settlement Claims Act 2022, which came into force on 28 September 2022.
DEFERRED SELECTION PROPERTY	Is as defined in s154 of the Maniapoto Settlement Claims Act 2022. It means a property described in subpart A or C of part 4 of the property redress schedule for which the requirements for transfer under the deed of settlement have been satisfied.
DEMOLITION AND REMEDIATION WORKS*	The physical works required to carry out the demolition and remediation of each Tokanui Hospital deferred selection property (excluding any new disposal site or existing disposal site on that property) as described in paragraph 9.16
EXISTING DISPOSAL SITES*	The two existing sites (as described in the existing disposal consents) located on one of the Tokanui Hospital deferred selection properties that the Crown historically used to dispose of waste; indicated as 'Existing disposal sites' on the plan (subject to survey) 'Tokanui Hospital deferred selection properties' in part 7 of the attachments
GOVERNANCE ENTITY	The Ngāti Maniapoto post settlement governance entity, Te Nehenehenui Trust
HORIZONTAL INFRASTRUCTURE*	The roading and accessways, foundations and services that the Crown, with the consent of the relevant Ministers as required, decides must be retained on the relevant Tokanui Hospital deferred selection property, in accordance with paragraph 9.9 of the Deed. .
MINISTERS*	The Minister of Finance, Minister for Land Information, and Minister for Treaty of Waitangi Negotiations
NEW DISPOSAL SITE*	A site which may be located on part of a Tokanui Hospital deferred selection property, such location to be determined in accordance with paragraph 9.9, where the Crown may, as part of the demolition and remediation works, dispose of contaminated and/or non-contaminated materials and waste in accordance with paragraph 9.12.
NON-CONTAMINATED MATERIALS	Building materials that do not contain any contaminated materials, as defined above and may be suitable for reuse and/or recycling.
PURCHASED TOKANUI HOSPITAL DEFERRED SELECTION PROPERTY*	Means a Tokanui Hospital deferred selection property that is also a purchased deferred selection property.
SETTLEMENT DATE	Is defined as s12 of the Maniapoto Settlement Claims Act 2022, being 24 November 2022.
VERTICAL BUILDING STRUCTURES*	All above-ground built structures on a Tokanui Hospital deferred selection property, excluding horizontal infrastructure
DENOTES DEFINITIONS RELEVANT TO THIS REPORT COPIED FROM THE TOKANUI HOSPITAL DEFERRED SELECTION PROCESS, SUBPART A: DEFINITIONS.	

TOITŪ TE WHENUA – LAND INFORMATION NEW ZEALAND
FORMER TOKANUI PSYCHIATRIC HOSPITAL DEMOLITION AND REMEDIATION
REMEDIAL OPTIONS REPORT

1.0 INTRODUCTION

The former Tokanui Psychiatric Hospital (the Site) is approximately 80 hectares (ha) in area and is located approximately 14km southeast of Te Awamutu, Waikato. It contains 74 buildings, a decommissioned wastewater treatment plant, swimming pool, eight substations, closed landfill (also referred to as the 'existing disposal site') and substantial roading and underground infrastructure and services. The buildings on the site contain some hazardous materials, including friable asbestos and lead-based paint and are in varying states of disrepair. The site location and extent is shown in Figure 1 below.

Figure 1: Site location and extent showing 4 deferred selection properties (refer section 4.3.1 for explanation)

The Site is currently managed by Toitū Te Whenua Land Information New Zealand (LINZ) on behalf of the Crown but has been held in the Treaty Settlements Landbank since 1999 following the hospital's closure in 1998. Land held in the Landbank is Crown land which has been declared surplus can be used as cultural or commercial redress in Tiriti o Waitangi Settlement claims. The Ngāti Maniapoto (herein referred to as Maniapoto) Deed of Settlement (the Deed), that was initialled in December 2020, acknowledged the cultural significance of the Site and the need for demolition and remediation of the Site before it can be offered to Maniapoto.

The Tokanui situation is unique as no other property included in a Treaty settlement has required demolition and remediation on this scale or required a commitment to undertake remediation in a deed of settlement. In April 2021, Cabinet agreed new operational funding for LINZ to undertake the extensive work required to enable the inclusion of the Site as a redress in the Maniapoto Treaty of Waitangi Settlement. The Deed was signed by Maniapoto and the Minister for Treaty of Waitangi Negotiations on 11 November 2021 and the Maniapoto Settlement Claims Act 2022, which gives effect to the settlement, came into force on 28 September 2022.

Under the Deed, Maniapoto and the Crown have agreed to a unique, standalone process – Schedule 9: Tokanui Hospital Deferred Selection Process (THDSP) - which forms part of the Property Redress Schedule2. The THDSP details specific requirements for LINZ to complete the demolition and remediation of the Site and a Memorandum of Understanding (MoU) signed by Te Nehenehenui Trust (TNN) and LINZ outlines the roles, relationship, accountabilities, responsibilities and expectations for the parties in relation to the delivery of the works.

The land is presently in a damaged state, arising from the hospital buildings and associated infrastructure still present on it. Many of the former Tokanui Hospital buildings remain, and these buildings are generally in very poor condition. While a range of potential site contamination issues have been ruled out through earlier investigations, the primary contamination issues relate to localised contamination of soil around the building perimeters (forming a 'halo' around the buildings) from lead-based paint and/or asbestos. Accordingly, the Deed requires that before offering the land to Maniapoto, the Crown must demolish and remove buildings and structures, and remediate the land, leaving it in a grassed state.

Under Section 9.3 of the deed of settlement property redress schedule, the Crown has agreed to use best endeavours to remediate the Site to:

(c) 85% of the total land area of the Tokanui Hospital deferred selection properties to "the rural residential remediation standard" (defined in Section 9.1.22 of the Deed as "an acceptable standard or standards for rural residential use chosen in accordance with Contaminated Land Management Guidelines No. 2 Hierarchy and Application in New Zealand of Environmental Guideline Values (Revised 2011) (CLMG 2), or derived through a site-specific risk assessment); and,

(d) A contiguous area not exceeding 15% of the total land area of the Tokanui Hospital deferred selection properties, to "the managed remediation standard" (defined in section 9.1.15 of the Deed as "an applicable standard or standards for recreational use chosen in accordance with

CLMG 2, or derived through a site-specific risk assessment, but where use may be subject to controls (for example, in relation to excavating, erecting buildings, or domestic gardening)".

The closed hospital landfills located to the east of the Wharekōrino Stream – 'the existing disposal sites' – will remain under Crown management and are not included in the remediation area. The Crown is responsible for the existing disposal sites in perpetuity.

The Deed sets out a process that prior to demolition and remediation, commits the Crown to a number of reports including a Detailed Site Investigation (DSI) and Remedial Action Plan (RAP). A Preliminary Site Investigation (PSI) and DSI were completed by GHD Ltd, followed by a supplementary DSI (report in progress) by Fraser Thomas Ltd (FTL) and HAIL Environmental (HAIL), as well as a Site-Specific Risk Assessment undertaken by HAIL over the course of 2022 – 2024. The findings of these investigations have been used to inform and enable the future decision-making regarding remediation and management of contaminated soil as a result of the Site's past use as a hospital. As such, LINZ has instructed HAIL and FTL to undertake an Assessment of Remedial Options with this work being reported on in a Remedial Options Report (this report).

2.0 OBJECTIVES

The primary objective of this Remedial Options Report is to capture a robust analysis of the options assessed for managing soil with elevated contaminants present within the Site.

Specific objectives include:

1. To assess a range of options for the management of contaminated soil identified on the Site, using a holistic approach taking into account environmental, social, cultural and economic factors that meet LINZ requirements and stakeholder expectations, comply with industry best practice and government sustainability and broader outcome goals.
2. To undertake consultation in accordance with the RMA, whilst adopting the principles set out for communication and engagement in the MoU, thus providing mana whenua and the governance entity with relevant information concerning the process and outcomes of the remedial options assessment for contaminated soil, so as to enable them to have an informed view and provide feedback on the selection of the preferred remediation option(s) for contaminated soil on the Site.

3.0 SCOPE

The scope of work comprised:

(a) Summarising details of the Site, relevant aspects of its history, its environmental context and specialist investigations undertaken of the Site.

(b) Summarising best estimates of the nature, location, extent and severity of soil contamination identified on the Site.

(c) Review of sustainable remediation practices, presentation of a Conceptual Site Model (CSM) for the site and summary of the Site Specific Risk Assessment (SSRA).

(d) Remedial options assessment, considering the nature of the contaminants present, options considered and shortlisted options, site constraints and consentability analysis.

(e) Preparing cost estimates for shortlisted remedial options.

(f) Assessing selected options and alternatives using a multi-criteria assessment approach of the shortlisted remedial options taking into account environmental, social, cultural and economic factors, leading to identification of a preferred option(s).

(g) Recommending next steps.

The Remedial Options Report has been prepared in general accordance with the Ministry for the Environment (MfE) guidance document: *Contaminated Land Management Guidelines No. 1 (2021)* and prepared and certified by suitably qualified and experienced practitioners (SQEPs) as defined in the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS).

4.0 BACKGROUND INFORMATION

4.1 SITE HISTORY

The Site is part of 1,194ha of Māori land taken under the Public Works Act in 1910 for the Tokanui Hospital. The hospital opened in 1912 and closed in 1998 and the Site was transferred into the Treaty Settlements Landbank (managed by the Ministry of Justice at the time) to be used as redress to settle historical claims in 1999. The Site, along with the other properties in the landbank, transferred to LINZ in 2017.

The taking of the land and subsequent history while in Crown ownership is detailed in the historical account in clauses 2.183 to 2.189 of the Deed. Further history pertaining specifically to the delivery of the demolition and remediation project is provided in the Tokanui Psychiatric Hospital Archaeological Assessment (CFG Heritage, 2024), Preliminary Site Investigation (GHD, 2023), and the Cultural Impact Assessment (TAR, 2021).

4.2 MANIAPOTO: FUNDING TO REMEDIATE THE TOKANUI HOSPITAL SITE

In February 2021, Cabinet noted (MCR-21-MIN-0002) that, for the redress to be inserted into the Deed and before ratification of the settlement claims bill could commence, Cabinet needed to agree to new funding for LINZ to undertake the demolition and remediation project. Details regarding establishing remedial standards for soil contamination are described further in section 4.3.2 below.

4.3 MANIAPOTO CLAIMS SETTLEMENT ACT 2022 REQUIREMENTS

4.3.1 TOKANUI HOSPITAL DEFERRED SELECTION PROCESS OVERVIEW

As noted above, Maniapoto and the Crown agreed to a unique, standalone process for the demolition

and remediation of the Site as set out in Part 9 of the Property Redress Schedule, which forms part of the Deed. The process was developed using industry best practice standards and setting clearly defined terms. The Deed was signed by Maniapoto and the Minister for Treaty of Waitangi Negotiations on 11 November 2021 and the Maniapoto Settlement Claims Act 2022, which gives effect to the settlement, received royal assent on 27 September 2022. This Act binds the Crown to meeting the requirements of the Tokanui Hospital Deferred Selection Process.

The following summarises the Crown's obligations in carrying out the remediation works. For information pertaining to the demolition and management of demolition waste, please refer to the Disposal Options Assessment (FTL, 2023) and the Horizontal Infrastructure Assessment (FTL, 2023). This outline is not intended to provide a full account of the requirement nor replace/override the terms of the Tokanui Hospital Deferred Selection Process. The Crown will:

- No later than two years following the settlement date, apply for all necessary consents required for the demolition and remediation works. For clarity, the deadline to apply for consents is 24 November 2024.
- Comply with all necessary consents and approvals for the demolition and remediation works.
- Remediate the land in accordance with the applicable remediation standard as referred to in paragraphs 9.3 and 9.7 of the THDSP.
- Ensure that, where the land has been damaged by the impact of the demolition and remediation works, it is left free of building debris, and is stabilised by grassing.

It is also worth noting that:

- The Crown is not required to remediate the existing disposal sites or any new disposal site constructed on any of the four deferred selection properties but must maintain valid consents for any ongoing monitoring of these sites.

4.3.2 REMEDIAL STANDARDS SELECTION PROCESS

As noted above, the Deed provides for:

(a) 85% of the total land area of the Tokanui Hospital deferred selection properties to be remediated to the rural residential remediation standard; and

(b) a contiguous area not exceeding 15% of the total land area of the Tokanui Hospital deferred selection properties, to be remediated to the managed remediation standard.

The rural residential and managed remediation standards were determined through a Tier 2 risk assessment undertaken by HAIL Environmental, as part of the separate Site Specific Risk Assessment (HAIL Environmental, 2024) and are described later in this report.

4.3.3 MEMORANDUM OF UNDERSTANDING

In May 2021, LINZ, representing the Crown, and the Maniapoto Māori Trust Board, as part of negotiating the terms of the Deed, agreed the terms of the "MoU in Relation to Remediation and Demolition of the Former Tokanui Hospital Site." The MoU was then signed by LINZ and the trustees

of Te Nehenehenui, the PSGE of Maniapoto (together, the Parties) on 4 March 2022. The MoU outlines the roles, relationship, accountabilities, responsibilities and expectations of the Parties with a focus on how information will be shared in relation to decision making on any proposed horizontal infrastructure to be retained and any proposed new disposal sites for non-recyclable demolition waste. Although not required for the contaminated soil remediation options assessment, the relationship principles agreed between the parties have been applied in this report.

4.4 TOKANUI HOSPITAL: DECISION-MAKING PROCESS AND CRITERIA (BRF 23-169)

In December 2022, the Minister of Land Information agreed the criteria to be used to assess and inform the disposal options assessment for the Site (BRF 23-169). The choice of criteria is important as it will ensure LINZ considers the right information as part of this options analysis. The briefing was forwarded to the Offices of the Minister of Finance and Minister for Treaty of Waitangi Negotiations and to TNN.

Whilst the Deed does not require the same approach to be used for the contaminated soil remedial options assessment, the same framework has been adopted in this report for consistency and transparency, as it has been found to work well to date.

The following criteria are unweighted and listed in order of priority and have been used as the basis of the options assessment undertaken in section 9 of this report.

Table 1: Disposal Options Assessment Criteria agreed to by Ministers

Criteria	Key Considerations
Strategic alignment	• Assessment of ability to deliver on the Crown's commitments under the Deed, taking into account timeframes and delivery risks • Government Procurement Rules (Rule 16: Broader Outcomes Framework)
Crown-Iwi Relationship	• Alignment with formal feedback from the PSGE, representing the views of all Maniapoto iwi, hapu and whanau
Social and environmental effects	• Assessment of effects of works on cultural, archaeological, sustainability and other environmental values, and health and safety of suppliers • Extent and severity of soil contamination
Value for money	• Cost to deliver project works • Future liabilities associated with the site are minimised

5.0 PREVIOUS INVESTIGATIONS

5.1 OVERVIEW

This section provides a brief summary of relevant investigations that have been undertaken, that have been reviewed as part of this remedial options assessment. The most relevant reports are covered in section 5.3, while other (generally earlier or complementary) reports are briefly summarised in section 5.2. Further information on many of these reports is found in the GHD PSI (2023). The investigations undertaken prior to 2021 were used to inform Cabinet's approval of new operational funding for LINZ to undertake the demolition and remediation project and uphold the Crown's commitment in the THDSP. Figure 2 shows the sequence of reporting and remediation and how this report fits into this.

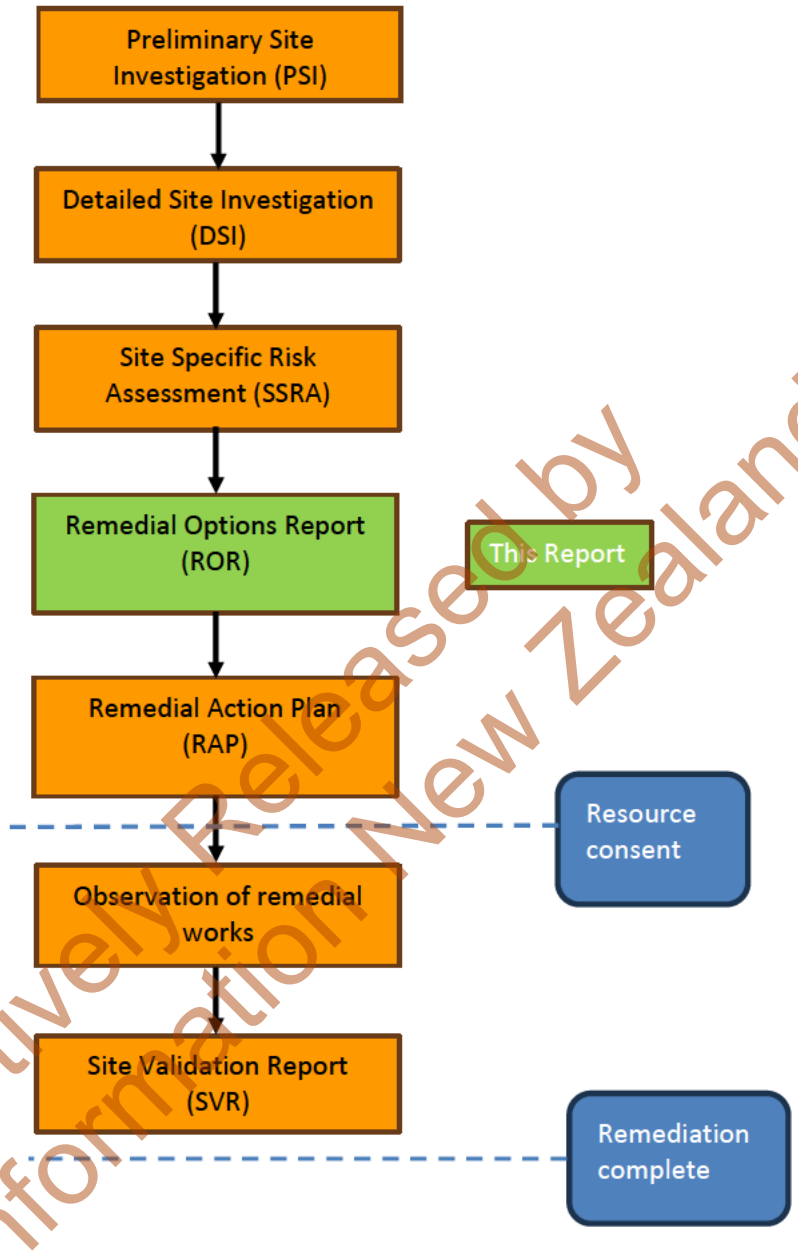


Figure 2: Sequence of Reporting and Remediation

5.2 EARLIER AND COMPLEMENTARY REPORTS

These investigations are listed below.

Table 2: Summary of Earlier and Complementary Reports

Report	Relevance
Opus Ltd (March 2015) – Tokanui Psychiatric Hospital Site Scoping, Contaminated PSI Report	Initial contamination assessment of the Site and potential effects on the proposed site use (pasture), for inclusion in the Opus Demolition Plan. The PSI included a review of the Site's history to understand likely HAIL activities at the Site, identified key Areas of Concern (AoC) and likely Contaminants of Potential Concern (CoPC) arising from the identified HAIL activities, and developed a Conceptual Site Model (CSM).
Opus Ltd (May 2015) – Tokanui Hospital Demolition Waste Management Plan	Summarises findings from March 2015 PSI and associated material quantities estimates: 42,000m^3 general demolition materials; 9,300m^3 contaminated soil and 25,000m^3 external paving and concrete, but with no supporting details on the derivation of these quantities.
Opus Ltd (2015) – Tokanui Building Inspection Reports	Building inspection reports, including assessing whether lead paint and asbestos are potentially or actually present.
AECOM (2018a) – Tokanui Hospital Environmental Compliance Observations	Outline of environmental compliance issues identified by AECOM and recommended immediate and longer term actions to address these issues, with many of these actions being addressed in subsequent AECOM work.
AECOM (2018b) – AST Removal and Mechanical Pit Dewatering	Documents AECOM's supervision of ECL Group Ltd (contractor) engaged to empty and remove two above ground storage tanks adjacent to the former Boiler House (building B68); empty and remove four waste oil drums and containers outside the former Assistant Engineer's Office (building B66) and within the former petrol station (building B16) and dewater the mechanical pit in the former petrol station. Works were undertaken in Jul 2018, with 16,000 litres of waste oil and water removed from these sources (including dewatering of the UST from The Store (building B65) covered under AECOM (2018c) below. No sampling or other analysis of soil or water were undertaken as part of this investigation. Refer GHD PSI for further details.
AECOM (2018c) – UPSS Removal Former Tokanui Hospital	Documents removal of a 5,000L underground petroleum storage system (UPSS) in an unlined pit and associated fuel lines located near the former store (building B65) by ECL Group in July 2018, associated soil sampling and a risk assessment. Approximately 20 tonnes of hydrocarbon impacted soil and bedding material was removed from the southern wall of the tank pit site and disposed of at the Hampton Downs Landfill, while soil sampling was also undertaken. Refer GHD PSI for further details.
AECOM (2018d) – PSI Gap Assessment	Review of Opus PSI (2015) to identify any data gaps and make updates, based on other 2018 investigations. Refer GHD PSI for further details.
AECOM (2018e) – UPSS Decommissioning at Tokanui Hospital	Documents decommissioning and removal of UPSS from the former petrol station (building B16), associated soil sampling and a risk assessment. Two 10,000 litre steel tanks (one petrol, one diesel) in good condition, installed circa 1979, and associated lines and dispensers were removed in July 2018 by Petroleum Services Limited. Approximately 31.4 tonnes of minor hydrocarbon impacted material was removed from the Site and disposed of at the

Report	Relevance
	Hampton Downs Landfill; validation soil sampling was also undertaken. Refer GHD PSI for further details.
AECOM Ltd (Oct 2018) – Tokanui Hospital Site Remediation: Options Description and Cost Estimation	High level analysis of three demolition options to understand the pros/cons of each option and potential range of future costs, based on do-minimum approach versus complete site remediation to an agricultural landuse scenario with demolition waste managed either offsite or onsite.
AECOM Ltd (Apr 2019) - Tokanui Hospital Site Remediation: Onsite Land Disposal Feasibility Study	Onsite land disposal feasibility study to identify if there were any areas onsite suitable for the management of demolition waste materials and any associated significant regulatory issues. The assessment was based on an estimated demolition waste volume of 156,000m^3 (loose measure), onsite disposal facility of minimum volume 80,000m^3 and assumed waste acceptance criteria (WAC), which were materials based rather than contaminant based, and included asbestos and lead contaminated soils. Five potential sites were identified. This study did not take into account cultural or archaeological sites of significance or some other constraints (e.g. wetlands), which have since been identified through further assessments undertaken by LINZ.
AECOM Ltd (Aug 2019) – Tokanui Hospital: Detailed Site Investigation (draft)	DSI of Site to assess soil and contaminant conditions and associated risks to human health and the environment, based on a agricultural land use, in line with district plan zoning. Primary focus of soil sampling was to get a preliminary understanding of the horizontal and vertical extent of soil contamination as a result of hazardous building materials – namely asbestos roofing and lead based paint; however, it did not investigate other potential HAIL activities identified in earlier reports. Refer GHD PSI for more details.
AECOM Ltd (Aug 2019) – Tokanui Hospital Site Remediation – (refined) Detailed Options Assessment	Revision of Oct 2018 Detailed Options Assessment to provide a higher level of cost certainty, incorporating the findings from AECOM's DSI for the Site, a review of the existing Site Asbestos Register and materials quantity assessment. Costings spreadsheets were developed for each option on a "measure and value" approach (i.e. quantity x rate = cost), with rates provided by a number of North Island demolition contractors.
WSP (2019b) – Tokanui Village and Hospital Wastewater Upgrade DSI Investigation	DSI of Hospital WWTP ahead of WWTP decommissioning. Desktop study identified the potential use of oils and solvents at the WWTP, biological waste from the wastewater treatment process, and asbestos. Sampling results found heavy metals above background concentrations, but below applicable human health guideline values. Volatile organic compounds and asbestos were not detected in any of the samples.
4Sight Consulting Ltd (2023) – Asbestos and Lead Paint Building Investigations	Comprehensive assessment of all buildings at the Site for ACM and lead-based paint to better quantify the location, extent and magnitude of hazardous building materials across the site. The surveys specifically identified asbestos within the structures so it can be removed safely prior to demolition commencing and identified lead-based paint within the structures to inform waste characterisation and handling requirements. Due to the extensive scale of the works, the surveys were provided across four separate reports, relating to four separate areas, with these areas being

Report	Relevance
	established for reporting purposes only. As part of the surveys, 4Sight have produced plans of individual buildings showing their findings, along with supporting spreadsheets.
Fraser Thomas Ltd (2023) – Tokanui Hospital Horizontal Infrastructure Investigation	Investigation and assessment of the condition and extent of all existing "horizontal infrastructure" on the Site, comprising all roading and associated paved areas; retaining walls (1); water, stormwater and wastewater reticulation; building heating system, comprising an underground concrete ducting system, with steam and condensate pipes that were formerly used to heat the Site buildings; and utilities – power and telecom. Investigation involved a desktop review of available information, comprehensive site investigations including site walkovers, pavement test pits and deflection measurements, CCTV and underground services detection, hydro excavation and topographical survey, followed by compiling updated horizontal infrastructure plans and assessment of materials quantities. Multi-criteria assessment and costing of a range of remedial options for each type of horizontal infrastructure, leading to selection of a preferred option for each infrastructure type.
Fraser Thomas Ltd (Jul 2023) – Former Tokanui Hospital – Existing Disposal Sites – Intrusive Investigation Report	Intrusive investigation of existing disposal sites, determining the horizontal and vertical extent of the landfilled area, the nature and estimated depth/volume of the deposited fill materials, overlying cap and topsoil details and key issues and risks.

The above list is not an exhaustive list of investigations undertaken on the Site, but only covers those investigations relevant to this Remedial Options Report.

Further complementary specialist investigations used in constraints mapping for onsite disposal site locations are reviewed separately in section 9.2 of this report.

5.3 RECENT INVESTIGATIONS

The more recent investigations used as the basis for this report are summarised in this section. In brief, these investigations build on the earlier work done by others and were targeted at closing out data gaps (such as whether or not a potentially contaminating activity was more likely than not to have occurred) and improving the delineation of soil contamination across the Site, both horizontally and vertically, to inform the remedial options assessment.

5.3.1 GHD - PSI (OCT 2023)

GHD undertook a PSI of the entire Site in order to comply with Ministry for the Environment (MfE) Contaminated Land Management Guidelines (CLMGs). This involved:

(a) reviewing available information and data from existing reports,
(b) identifying and closing out any data gaps,
(c) identifying all potential sources of contamination on the MfE Hazardous Activities and Industries List (HAIL activities) which may have occurred at the Site for the purposes of a change of land use under the NESCS from hospital back to rural land and compliance with the terms of the THDSP, and

(d) refinement of the conceptual site model developed by AECOM to reflect PSI findings and to inform design of the DSI intrusive investigation Sampling and Analysis Plan (SAP).

The PSI identified a total of 43 locations where HAIL activities potentially or actually occurred on-site.

5.3.2 GHD - SAP AND DSI – FACTUAL REPORT (JAN 2024)

GHD developed a Sampling Analysis Plan (SAP) based on their PSI findings and undertook a DSI of the entire Site over the period March to September 2023. This report provides a factual description of their findings. While these reports were prepared as two separate deliverables for LINZ, the SAP is included as an appendix in the DSI.

Sampling was undertaken in accordance with the SAP, with some minor departures. GHD undertook soil sampling at 192 locations and sediment sampling in nine locations. Overall, 329 samples were collected from the Site, the majority of which were tested.

As part of this work, HAIL undertook X-Ray Fluorescence (XRF) analysis on 95 transects and individual sampling points, and composite samples from 10 areas of the Site. A combined XRF and leachate analysis was undertaken in the halos of three buildings. HAIL samples were analysed in situ with an XRF, and composite samples were collected with a push sampler and composited on site.

The underlying geology generally comprised clays and sands in the northern part of the Site, and clay in the southwestern portion of the Site. The observed geology is broadly consistent with the published soil and geological information, although allophanic soils appear to reach further north than the published soil data. Groundwater was encountered in one location at a depth of 2.1m below ground level.

Demolition fill was observed in areas of the Site where demolition had historically occurred, and in the horticultural area. Paint flakes were observed around several buildings.

Samples were delivered to Hill Laboratories in Hamilton for analysis of the contaminants of concern identified during the PSI, namely:

(a) Heavy metals, these being common contaminants associated with human activities;
(b) TPHs (Total Petroleum Hydrocarbons), a screening analysis used to assess the presence of hydrocarbons in soil;
(c) Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), a group of contaminants associated with petrol;
(d) PAHs (Polycyclic Aromatic Hydrocarbons), a group of contaminants associated with diesel fuel and incomplete burnt material;
(e) PCB (Polychlorinated biphenyls), a group of contaminants associated with electrical transformers;
(f) VOC (Volatile organic compounds), a group of hydrocarbon contaminants associated with fuels, solvents and cleaning products;
(g) SVOC (Semi-volatile organic compounds), a group of hydrocarbon contaminants which are commonly associated with industrial processes;
(h) Pesticides, from former agrichemical use;
(i) Dioxins, as an impurity in some insecticides (e.g. 2,4,5-T) and byproduct of incineration; and,
(j) Asbestos, from building materials.

Screening for volatile compounds with a photo ionisation detector (PID) did not detect the presence of soil vapours around the laundry (building B74) (e.g. associated with dry cleaning chemicals) or the former service station (building B17) (associated with fuels). Low levels of hydrocarbons were identified with the PID near where the former Store (building B65) fuel bowser was located (with results ranging between 27 – 28 parts per million (ppm)). Of the 128 samples analysed for asbestos, 12 samples had detections of asbestos.

The soil and sediment sampling results are discussed and interpreted in the HAIL Site Specific Risk Assessment Report.

5.3.3 FTL/HAIL ENVIRONMENTAL - SUPPLEMENTARY DSI (2024)

Following review of the combined AECOM and GHD soil sampling locations and results, FTL and HAIL undertook an additional supplementary investigation covering the following:

(a) Additional XRF transects around building halos with a relatively low sampling density;
(b) Additional asbestos sampling around building halos with a relatively low sampling density;
(c) Leachability testing of selected samples to check for potential environmental effects if these soils are left onsite and potential leachability if disposed off-site to landfill.

Findings from this investigation have been reported in a combined report, which includes the earlier XRF sampling and leaching testing from 2023, undertaken by HAIL as part of the GHD DSI. These results are discussed and interpreted in the HAIL Site Specific Risk Assessment report. The findings of this investigation have been used to inform this ROR and the combined report referred to above will be provided to LINZ subsequently.

5.3.4 HAIL ENVIRONMENTAL – SITE SPECIFIC RISK ASSESSMENT (APRIL 2024)

HAIL undertook a SSRA, that establishes remedial standards in accordance with the Deed requirements, defining these standards for the "rural residential remediation standard" (85% of Site) and "managed remediation standard" (not more than 15% of Site). Specifically, the remedial standards have been derived to pose minimal risk to food production, to people who live on the land, and to soil quality. In relevant parts of the block, the standards also seek to protect water quality and wetland values including the associated mahinga kai (traditional value of food resources and their ecosystems). The resulting remedial standards are stated in section 6.4 of this report.

The SSRA also reviewed and interpreted the sampling data collected by various parties to date.

Confirmed sources of soil contamination on the Site include:

(a) Buildings that had asbestos cement roofs or cladding panels, and/or had been painted with lead-based paints, resulting in localised contamination of the building HALOs.

Table 3: Building Halo Contamination

Item	Affected Building Halos
Buildings with heavy metal and asbestos halo contamination	B11, B13, B20, B21, B29, B30, B31, B33, B35, B55, B56, B58, B66, B74, B75, S1
Buildings with asbestos halo contamination (but no heavy metal contamination)	B67, S2, S8
Buildings with heavy metal contamination (but no asbestos contamination)	B2, B3, B5, B7, B8, B10, B12, B15, B16, B17, B18, B19, B21, B22, B23, B24, B26, B27, B28, B37, B38, B41, B43, B48, B49, B50, B51, B52, B59, B60, B63, B70, B71, B73, PAV, CHP

Note: Contamination in this context means any contaminant concentration exceeding the rural residential remediation standard (lower standard).

Halo sampling identified elevated lead concentrations in shallow soils around buildings. Lead concentrations generally decreased with distance from the buildings and with depth in the soil. Zinc was also found at elevated concentrations in shallow soils around many of the buildings where lead was elevated – these generally decreased with distance from the building and with depth in the soil. Other heavy metals, particularly arsenic and cadmium, were also found in some locations.

Leachability sampling was completed on a subset of buildings, namely B2, B11, B12, B19, B21, B38, B55, B56 and B59. This comprised Toxicity Characteristics Leaching Procedure (TCLP) testing and/or Synthetic Precipitation Leaching Procedure (SPLP) analysis for lead and zinc. The TCLP test simulates leaching from soil within a typical municipal landfill in the operating phase where acidic conditions dominate, whereas the SPLP test simulates leaching from rainfall in the natural environment.

On this basis, the average TCLP-leachable lead concentration for the most impacted samples – from the halos of buildings with high-lead paints at 0.5m distance and 0.0m depth (average total concentration 455mg/kg) is predicted to be 0.59 mg/L, while the corresponding average SPLP is predicted to be 0.01 mg/L, which is significantly lower, indicating leaching from lead impacted soils on the Site is almost negligible.

(b) Farming. The GHD DSI included ten composite topsoil samples COMP1-COMP10 from ten open space areas around the Site and nine composite topsoil samples from the former gardening area in the northeast. The AECOM investigation included six test pits from open space areas, TPA-E and TPZ. The sampling results showed that open space and agricultural area samples collected during the investigations meet adopted rural residential remedial standards, and indeed meet cleanfill criteria. One location, the Gardener Building (B59), did detect some acid herbicides at low levels, with subsequent repeat sampling not detecting any acid herbicides, while organochlorine pesticides were detected in the composite sample but at trace level for total DDT (0.46mg/kg).

(c) Using and storing fuels. The three AECOM tank removal reports showed that traces of fuels and oils remained in tank pits at the former service station (building B16) and store (building B65), and under fuel lines. Those reports did not cover the workshop (building B16) or some parts of the fuel storage systems, which were picked up in the GHD DSI; again only traces of fuels and oils were seen. Benzene was only detected once, at 1.5mg/kg in one wall of the tank pit by the store, but is not expected to represent a risk to groundwater due to the presence of clay soils in this area. PAHs were not often found, and even then, were generally at trace levels. One exception was by the Store (building B65), where 7.2mg/kg of BAP (eq) was recorded in a shallow soil sample. This appears most likely to be due to cross-contamination with historic asphalt at this location and is considered low risk.

(d) Landfilling. Intrusive investigation of the closed landfills (existing disposal sites) is covered in a separate report by FTL, and is outside the scope of the Deed in terms of remediation requirements; however, one remedial option considers utilising the closed landfills to manage contaminated soil from the hospital, which is assessed in this report and further described in the Existing Disposal Site Repair and Upgrade Works Report (under preparation).

(e) Localised hotspots: A number of localised hotspots were identified:

- Within the greenhouse and shed footprints in the agricultural area in the north of the land, between buildings B34 and B35, where heavy metal concentrations are elevated.
- Where waste has been buried around substation (building S2), around building B26 (rubble and other fill material, brick and wire), and at one open space location in the south of the land (AECOM TPZ), resulting in contamination with heavy metals and/or asbestos (0.0027%).
- Surface waste and dirt on hard standing near B66 contained asbestos, lead and zinc above managed remedial criteria, as well as substantially elevated arsenic and boron.

Overall, the combined soil sampling undertaken across the Site indicates that it is generally **not contaminated**, with the principal contamination issues being limited to asbestos and lead from building materials in localised areas around building halos. Investigations to date have found nothing that is likely to compromise the Deed; rather, the contaminants that are present are limited in extent and can readily be remediated or managed. Soils around the buildings listed above will require some remediation to meet the adopted standards, while limited remediation or management is also required in the localised hotspot areas referred to above.

Importantly, the following potential HAIL activities identified in the GHD PSI were found **not** to be an issue.

Table 4: Potential HAIL Activities from GHD PSI that are NOT an Issue

Location	Potential Contaminants of Concern	Results Summary and Interpretation
Dentist (B8)	Mercury	Only the closest sample B8 HA01 below the dentist contained elevated mercury, 1.2 mg/kg at surface, below the rural residential remedial standard of 3 mg/kg. Mercury was much lower in composite sample COMP10 from below the dental

		surgery, at 0.11 mg/kg, and was not detected in the XRF transects adjacent to the dentist. Similarly, mercury levels were low in nearby AECOM samples S1-S5, at 0.07-0.12 mg/kg. On this basis, it is considered that there is insufficient evidence for this contamination source.
Laundry (B74)	trichloroethylene (TCE) and perchloroethylene (PCE), from possible dry cleaning	No chlorinated solvents reported in soil samples from around B74, nor were there any field observations of volatile compounds (which would include solvents) or solvent odours (GHD DSI)
Morgues (old (B19) and new (B25)	Heavy metals (e.g. mercury)	No evidence found of any heavy metal contamination.
Potential Sheep dip	Heavy metals, pesticides	No evidence found of any sheep dip.
Sports turfs	Arsenic, copper, lead and organochlorine pesticides	Historic bowling green and tennis court areas were sampled, with arsenic within background levels and no OCPs detected.
Substations (S1-S8)	PCBs, used in transformer oils from 1940s-70s.	No PCBs found in samples around substations
WWTP, water treatment plant, swimming pool	Heavy metals, asbestos	Soil samples from these locations overall met rural residential remedial criteria for heavy metal contaminants, and were not reported to contain asbestos.

5.4 HOW WAS THIS INFORMATION USED IN THIS REPORT

The building lead paint/asbestos survey data was analysed together with the PSI/DSI reports, leading to some supplementary soil sampling being undertaken by FTL/HAIL in 2024, primarily around building halos but also in some areas where buried fill material was found, whilst leaching tests were also undertaken at selected locations to inform site management and disposal options.

The above information was then used to determine the location, extent and severity of soil contamination on the Site, using site specific remediation standards developed by HAIL and a risk assessment approach undertaken by them, providing the base data for the remedial options assessment. This process is explained in the flow diagram in Figure 3.

The separate FTL Existing Disposal Sites Intrusive Investigation (2023) links into this process, as one of the remedial options involves utilising the existing landfill on-site for the disposal of contaminated soils, as explained further in Section 9 of this report.

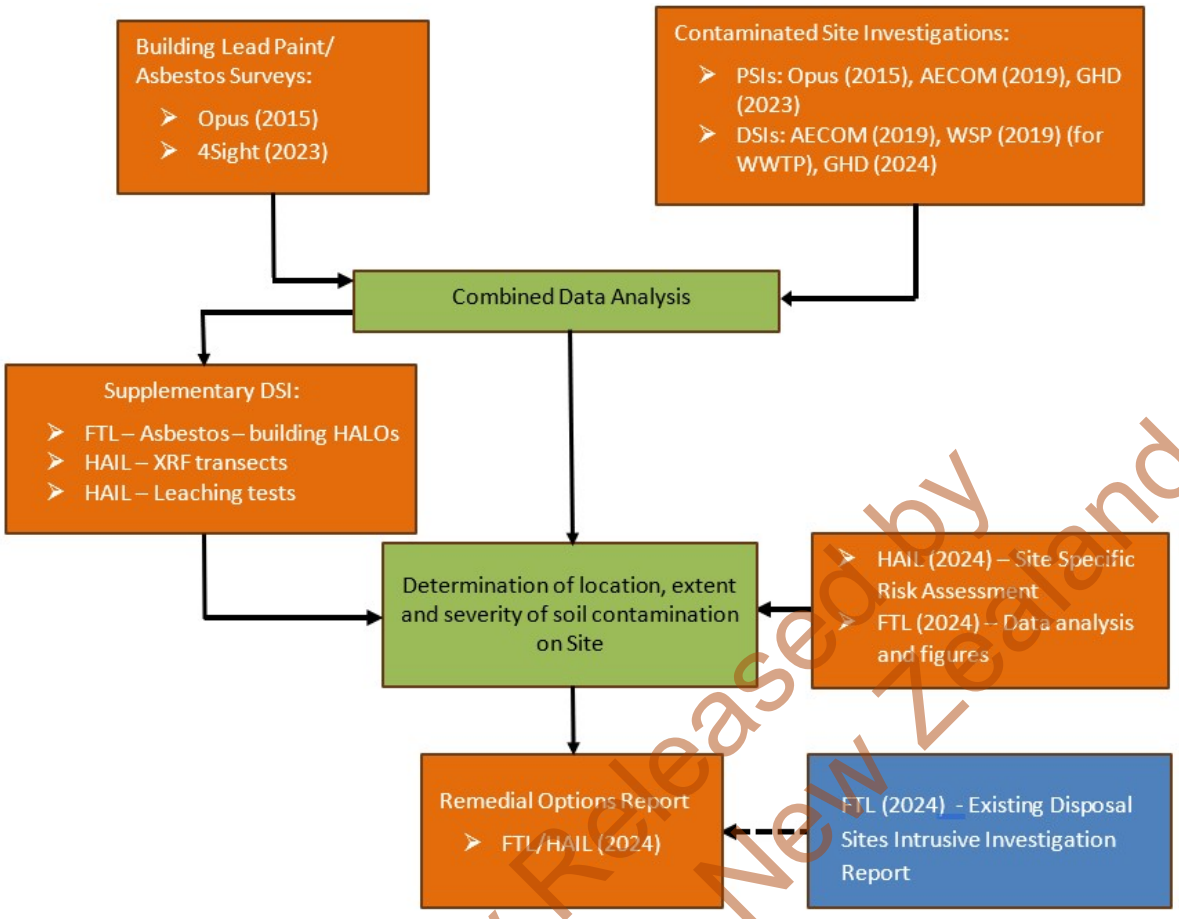


Figure 3: Schematic showing how various reports were used to inform the remedial options assessment

6.0 CONFIRMED EXTENT OF CONTAMINATION

6.1 CONCEPT OF RISK FROM CONTAMINATION

In site contamination practice, risks arising from soil contamination can be thought of using the metaphor of a chain describing the "source – pathway – receptor" model. Contaminants from a **source** have to travel via a **pathway** (e.g. direct contact, air, water) to reach a **receptor** (e.g. person, flora, fauna) and be taken up by them. This is often referred to as a conceptual site model (CSM). A CSM is used to determine if there is a risk and then make a determination if measures are needed, such as remediation, to manage the potential risk. Figure 4 below shows one example of how asbestos soil contamination can affect people as a result of soil disturbance. If any of these elements – the source, pathway, or receptor – are not present, the chain is broken and there is no risk of harm.

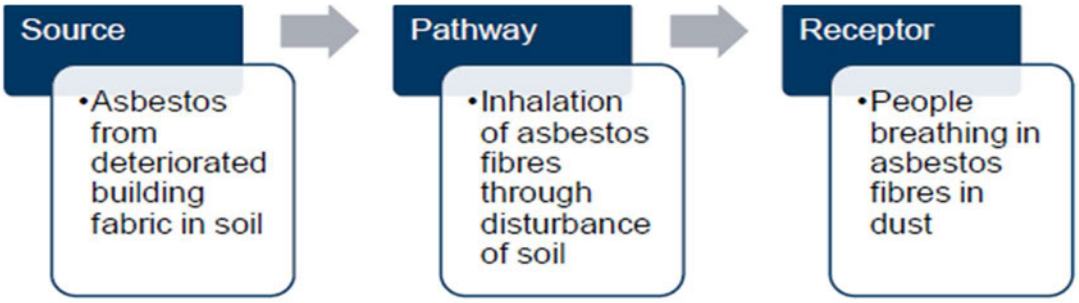


Figure 4: Example of Complete Source – Pathway – Receptor [adapted from GHD PSI]

Even then, remediation is only undertaken if there is enough contamination that there is a chance the receptor could be seriously harmed. In practice, this decision is based on there being at least a minimal risk, based on threshold concentrations set by regulations developed by the Ministry for the Environment and regulated by relevant territorial and regional authorities in New Zealand.

6.2 NATURE OF CONTAMINANTS AT TOKANUI

This section provides a brief overview of the nature of the main contaminants found on the Site, namely asbestos and the heavy metals (arsenic, cadmium, lead and zinc) and also comments on specific organic compounds found by the Gardener's building (building B59).

6.2.1 ASBESTOS

Asbestos is a silicate mineral that occurs in the form of microscopic needle-like fibres. The toxicity of asbestos is due more to the shape than the chemical composition of these fibres: Asbestos is chemically almost identical, and co-occurs with, non-toxic minerals such as serpentine, a fertiliser, and soapstone, a decorative material used in tableware. However, when inhaled by people, asbestos fibres cause or contribute to fatal lung conditions including mesothelioma (a type of cancer) and asbestosis.

The mineral yet fibrous nature of asbestos made it a 'miracle material', an electrical and thermal insulator capable of being woven into cloth or used as a strengthening additive to boards and coatings, while also being virtually impervious to heat, chemicals or biological attack.

As such, the usual approach to asbestos is not to destroy it, but to ensure it is buried somewhere that it will not be disturbed – if fibres cannot be released into breathing air, the exposure pathway is broken, so asbestos no longer presents a risk.

6.2.2 ARSENIC

Arsenic is a chemical element and as such cannot be destroyed. It is found naturally in rock, often near gold deposits. It has been used to kill insects that attack animals, timber, vegetables and fruit. In some situations, it can harm people's health. Arsenic based pesticides and herbicdes were phased out during the 1970s, and it was widely used in sheep dips until the 1950s. It doesn't break down and it doesn't leach very quickly.

Generally, soil removal to a location where it poses less risk (e.g. landfill on-site or off-site) or blending soils to bring arsenic concentrations down to a more beneficial level are the only two realistic remediation options for arsenic contamination. Phytoremediation, where plants take up

contaminants, has been trialled, but this is a long-term approach requiring ongoing management and the eventual disposal of the plants.

6.2.3 CADMIUM

Cadmium is a chemical element and as such cannot be destroyed. It is a soft, bluish white metal found in zinc ores, and to a much lesser extent, in the cadmium mineral greenockite. Cadmium found early use as a pigment and is commonly used today in batteries, alloys, coatings (electroplating), solar cells, plastic stabilisers and pigments. In New Zealand, cadmium accumulation in agricultural soils is linked to phosphate use, with cadmium being a natural impurity in superphosphate form some countries (e.g. Nauru). Cadmium and its compounds are highly toxic and exposure to this metal is known to cause cancer and targets the body's internal organs.

As for arsenic, soil removal to a location where it poses less risk (e.g. landfill on-site or off-site) or blending soils to bring cadmium concentrations down to a more beneficial level are the main realistic remediation options for cadmium, while upwards pH adjustment of the soil (e.g. by liming) will reduce its leachability.

6.2.4 LEAD

Lead is a chemical element and as such cannot be destroyed. In the environment, lead is a positively charged ion that binds quite strongly to most soils. Lead is somewhat toxic and ecotoxic due to its ability to mimic calcium in biological systems and is particularly damaging to children's brain development.

Not only is lead indestructible, it is also difficult to extract from soils. In practice, the only viable approaches to lead contamination are to put the soil somewhere that it is unlikely to cause harm; or to 'stabilise' the lead – to treat the soil with something that makes the lead harder to extract, and hence less likely to be taken up into plants, animals or people.

As for arsenic and cadmium, soil removal to a location where it poses less risk (e.g. landfill on-site or off-site) or blending soils to bring lead concentrations down to a more beneficial level are the main realistic remediation options for lead.

6.2.5 ZINC

Zinc is a chemical element and as such cannot be destroyed. Unlike lead, zinc is an essential micronutrient for all forms of life, so it is only toxic at high concentrations, and even then, poses little risk to people. Zinc is more leachable than lead and considerably more difficult to immobilise.

Zinc is rarely considered for remediation. The most promising options appear to be moving soil to where it poses less risk or blending soils to bring zinc concentrations down to a more beneficial level, at least where zinc is the sole contaminant of concern.

6.2.6 LOCALISED FILL MATERIALS

Localised non-engineered fill materials comprising discoloured clays/silts and building debris were encountered near or surrounding the following structures: Building 26, Chapel (CHP), south of

Buildings 30 & 31 (Area I), south of Building 16, underneath and surrounding S2, underneath and surrounding Buildings 01 and 02 and within the road network leading to Buildings 75 and 76. Some of these fill materials contain some heavy metal and asbestos contamination. Hence, appropriate remediation options are similar to those discussed above, but must also consider the physical nature of the fill and whether it is suitable for reuse as backfill material of excavation cavities, or should be disposed of to an appropriate landfill on-site or off-site.

6.3 CONCEPTUAL SITE MODEL

The CSM for Tokanui in the context of this ROR focuses on the main exposure scenario that has been identified – risk to future site users – as the main purpose of this ROR is to identify and assess remedial options.

Potential risks from contaminated soil to contractors during demolition and remediation works will be mitigated through all workers following the Remedial Action Plan requirements, including appropriate personal/respiratory protective equipment (PPE/RPE). Other potential risks from hazardous materials during demolition will be managed through the Demolition Management Plan and Asbestos Removal Control Plan (noting these plans are not related to contaminants in soil).

6.3.1 SOURCES OF CONTAMINATION

Sources of localised soil contamination confirmed at the Site exceeding one or both of the site specific remediation standards include:

(a) Buildings with asbestos cement roofs or cladding panels, painted with lead-based paints, and tin roofs.

(b) Minor buried fill containing various manmade materials (e.g. bricks, timber).

6.3.2 PATHWAYS FOR CONTAMINANT EXPOSURE

Te rohe Pōtae (King Country region) had a rich gardening tradition, and a recent soil science assessment indicated that the Site could be restored to Highly Productive Land (HPL) land use classes 2 and 3 (refer section 9.2.6 of this report). The main pathway for contaminant exposure to future site users and onsite ecological receptors could therefore be via crop uptake, eating contaminated crops, direct soil contact, inhalation of dust and surface water runoff from rainfall.

As the land is largely flat, and as leaching tests (synthetic precipitation leaching protocol, SPLP) have shown lead and zinc do not readily leach from the soils, this means the contaminants have largely remained where they were deposited. The main pathway for contaminant migration from the Site and exposure to offsite receptors appears to be the hospital stormwater network. Sampling from overland drainage pathways and from the Wharekōrino stream indicates that these pathways have not resulted in extensive migration of these contaminants, although some samples show above background concentrations of heavy metals, including cadmium, copper, lead and zinc and DDT. These contaminants are likely to derive from Tokanui Hospital buildings and also potentially farming activities, closed landfills, and/or from other land upstream.

Leaching to groundwater from the Site is less likely.

6.3.3 SENSITIVE RECEPTORS THAT COULD BE HARMED BY CONTAMINATION

The primary receptors that could be harmed by exposure to contamination currently identified on the Site are future people living on the land, the identified wetland areas, the Wharekōrino Stream and groundwater.

As the Site is being remediated to a rural residential standard, the main remedial concerns are protecting soil quality for possible future food production on the Site and protecting children potentially living on the site in the future.

Additionally, the historic Mokoroa wetland area in the northwest of the Site is considered potentially ecologically sensitive, but this is located upstream of most of the hospital buildings and hence unlikely to be affected by contamination from the hospital itself.

Water quality in the Wharekōrino Stream should be maintained to protect human health and freshwater ecology and this will be achieved through the demolition/remediation process by removal of contamination sources. The CSM outlining potential effects to the Wharekōrino Stream from the closed landfill is being reported on separately.

There is only one groundwater abstraction bore within 1km downstream of the site where water is used for nursery irrigation at the Mangatoatoa Marae – hence, it is considered unlikely that any potential contaminant migration via groundwater would pose an unacceptable risk to human health.

6.3.4 TABULATED CONCEPTUAL SITE MODEL

The above narrative is captured below in the CSM represented in Table 5 in tabular format and in Figure 5.

Post-demolition and remediation, contamination sources will have been removed or managed , based on the current known extent of contamination, meaning the risk to future site users is significantly reduced or eliminated, following the remediation works.

If there is a significant accidental discovery during the remediation, the CSM will be updated and options to include with the preferred remedial option will be assessed to ensure LINZ remains compliant with the remediation standards set out in the Deed. Should the managed remedial standard need to be implemented because it not feasible to remediate to the rural residential remediation standard, any ongoing management requirements will be set out in an Ongoing Site Management Plan (to be prepared at such time).

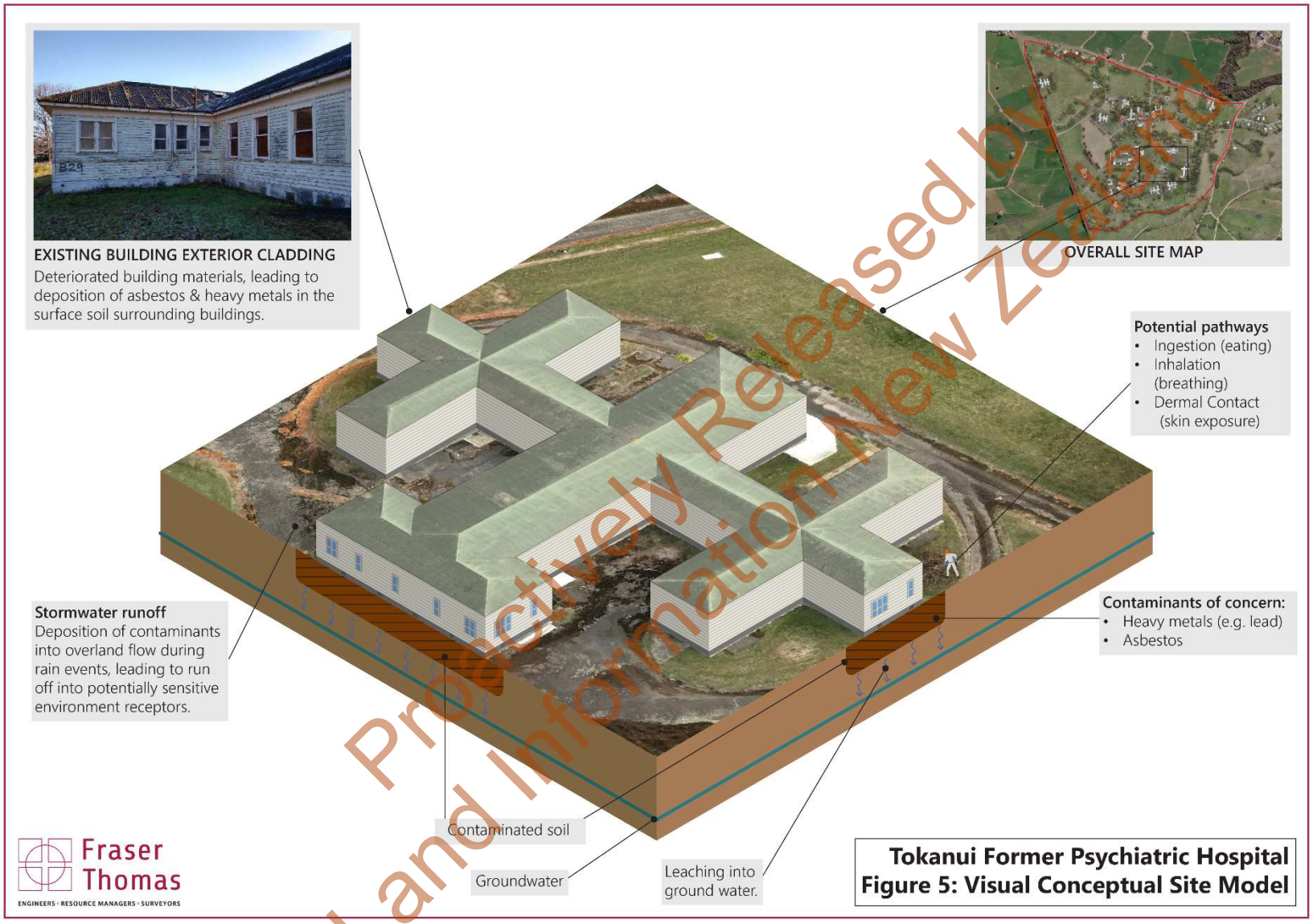


Table 5: Conceptual Site Model

Source	Contaminants of Concern	Potential Pathways	Potential Receptors	Pre-Remediation Pathway Complete?	Post-Remediation Pathway Complete?	Comments
Hospital buildings	Asbestos, heavy metals (notably lead, zinc, cadmium and arsenic)	Ingestion and dermal contact of contaminated soils; Inhalation of asbestos fibres or metals in contaminated dust	Future site users	Complete	Incomplete	Without remediation, the pathway will be complete. Post-remedial works, the pathway will be incomplete, as remedial works will eliminate contamination sources through removal of hospital buildings and infrastructure, making site fit for purpose for future users
			Off-site residents	Potentially	Incomplete	Windblown dust during site demolition and remedial works may potentially affect off-site residents. However, this will be managed with appropriate controls. Post-remediation, this pathway will be incomplete.
		Stormwater runoff	Ecological receptors (flora and fauna)	Complete	Incomplete	Site has extensive stormwater drainage system (catchpits & pipes) that collects site runoff and discharges it to a small stream that flows into the Wharekōrino Stream near the former wastewater treatment plant, just upstream of Te Mawhai Road. Stream sediment sampling found slightly elevated levels of heavy metals, including cadmium, copper, lead and zinc, but well within ANZECC ISQG-low trigger values, other than two marginally elevated zinc concentrations (250 and 260mg/kg vs trigger of 200mg/kg) without allowing for any dilution. Removal of site buildings and soil remediation will eliminate this source. Sediment found in the stormwater system during demolition works should be tested for contamination and disposed of accordingly.
			Future site users	Potentially	Incomplete	Remedial works will address soil contamination issues and eliminate contamination sources through removal of hospital buildings and infrastructure, making site fit for purpose for future users
			Off-site residents	Potentially	Incomplete	Remedial works will address soil contamination issues and eliminate contamination sources through removal of hospital buildings and infrastructure, making site fit for purpose for future users
		Leaching of contaminants to groundwater	Downgradient water users	Incomplete	Incomplete	Testing has shown both lead and zinc are not readily leached from site soils under natural conditions. As there is only one groundwater abstraction bore within 1km downstream of the site where water is consented for use for nursery irrigation at the Mangatoatoa Marae, it is considered unlikely that any potential contaminant migration via groundwater would pose an unacceptable risk to human health. Remedial works will eliminate contamination sources through removal of hospital buildings and infrastructure.
			Ecological receptors (flora and fauna)	Incomplete	Incomplete	Shallow groundwater from the site is likely to flow into the Wharekōrino Stream, with potential ecological effects covered above under stormwater.
Localised Hotspots	Demolition waste/ fill	Ingestion and dermal contact of contaminated soils; Inhalation of asbestos fibres or metals in contaminated dust	Future site users	Complete	Incomplete	Contamination relates to localised, well defined areas. Without remediation, the pathway will be complete, but localised to small parts of the site. Post-remedial works, the pathway will be incomplete, as remedial works will address soil contamination issues, isolating or eliminating the source from the receptor, making site fit for purpose for future users.
			Off-site residents	Potentially	Incomplete	Windblown dust during site demolition and remedial works may potentially affect off-site residents. However, this will be managed with appropriate controls. Post-remediation, this pathway will be incomplete.
		Stormwater runoff	Ecological receptors (flora and fauna)	Unlikely	Incomplete	Small pockets of demolition waste/fill found were all buried below ground level and unlikely to cause contamination of stormwater runoff. Post-remedial works, the pathway will be incomplete, as remedial works will address soil contamination issues isolating or eliminating the source from the receptor, making site fit for purpose for future users.
			Future site users	Potentially	Incomplete	Remedial works will address soil contamination issues, while these contamination sources relate to historical activities that ceased many years ago, making site fit for purpose for future users.
			Off-site residents	Potentially	Incomplete	Remedial works will address soil contamination issues, while these contamination sources relate to historical activities that ceased many years ago, making site fit for purpose for future users.
		Leaching of contaminants to groundwater	Downgradient water users;	Incomplete	Incomplete	Contaminants in these sources are present at low concentrations and are unlikely to leach to groundwater. As above, there is only one groundwater abstraction bore within 1km downstream of the site where water is consented for use for nursery irrigation at the Mangatoatoa Marae, it is considered unlikely that any potential contaminant migration via groundwater would pose an unacceptable risk to human health. Remedial works will address soil contamination issues isolating or eliminating the source from the receptor.
			Ecological receptors	Incomplete	Incomplete	Shallow groundwater from the site is likely to flow into the Wharekōrino Stream, with potential ecological effects covered above under stormwater.

6.4 REMEDIAL STANDARDS

HAIL's SSRA established remedial standards that define what concentrations of contaminants must the Crown achieve to meet the requirements of the Deed in regards to soil contamination identified at the Site. Specifically, the remedial standards have been derived to pose minimal risk to food production, to people who live on the land, and to soil quality. In relevant parts of the block, the standards also seek to protect water quality and wetland values including the associated mahinga kai.

As described in the SSRA, two remedial standards were agreed in the Deed, while a third remedial standard has since been adopted for the protection of wetland areas identified in the Site. The resulting values are shown in Table 6.

Table 6: Site-specific Remedial Standards

Scenario	*Wetland*[1]	*Rural residential*[1]	*Managed*[1]
Arsenic	9	9	70
Cadmium	0.3	0.9	10
Chromium	100	150	150
Copper	50	280	280
Lead	70	120	460
Mercury	3	3	3
Zinc	150	350	450
DDT[2]	1	2	2
ACM[2]	0.01 %	0.01 %	0.01 %
AF/FA[2]	0.001 %	0.001 %	0.001 %
Fuels and Oils	No odour or staining	No LNAPL[2]	No LNAPL[2]
Benzene	0.11	0.11	0.11*
BaP_{eq}[2]	6	6	35
Hazardous Wastes	Absent	Absent	-

Notes:

1. All concentrations milligrams per kilogram dry weight, except asbestos % weight for weight, and fuels and oil and hazardous wastes.
2. DDT, dichlorodiphenyltrichloroethane, is an insecticide banned in the 1970s. ACM refers to fragments of asbestos-containing materials, up to 7 mm in size. AF/FA is asbestos fines and fibrous asbestos. BaP_{eq} is a way of expressing the toxicity-weighted concentration of a group of chemicals called polycyclic aromatic hydrocarbons (PAHs) that are formed by incomplete burning of organic materials. LNAPL (light non-aqueous phase liquid) is a groundwater contaminant such as petrol, diesel or oil that is less dense than water and not very soluble in water.

*Only within 100 m of surface water.

6.5 CONTAMINATED SOIL VOLUMES AND DESCRIPTION

Contaminated soil volumes are broken down into the categories shown in Table 7 below. In this report, soils exceeding the site specific rural residential soil remedial standard but not the managed remedial standard are referred to as "low level" contaminated soils, while soils exceeding the managed

remedial standard are referred to as "moderate level" contaminated soils. No "high level" contaminated soils have been found on the Site.

Table 7: Tokanui Hospital Site Remediation: Estimated Contaminated Soil Volumes (solid measure)

Contamination Level Classification	Contaminated Soils Description	Contains asbestos	Estimated Volumes (m^3)
Low Level	Exceeds site specific rural residential soil remedial standard but not the managed remedial standard.	Yes	593
		No	384
Moderate Level	Exceeds site specific managed remedial standard.	Yes	824
		No	602
		TOTAL	**2,403**
PROVISIONAL ALLOWANCES			
Estimated halo scrape post-building demolition[2]		Some	869
Estimated building subfloor space scrape, post-building demolition[3]		Some	1,930
Inferred asbestos contaminated soil around asbestos watermains[1]		Likely	328
		TOTAL INCLUDING PROVISIONAL ALLOWANCES	**5,530**

Notes:

1. Assumed that on average a 100mm wide ring of soil around the asbestos watermains that are to be removed is contaminated with asbestos. Testing will be undertaken at the time of watermain removal of this soil to confirm the volume of soil requiring remediation. This is addressed further in the separate Demolition Management Plan for the Site.
2. Provisional allowance made for soil scrape around all buildings, post-demolition and post-contaminated soils removal, comprising 1m wide strip x 150mm deep, excluding areas already remediated
3. Provisional allowance made for soil scrape across the subfloor space of all buildings excluding those with concrete floor slabs, post-demolition and post-contaminated soils removal comprising building footprint areas x 150mm depth.

6.6 ADDITIONAL REQUIREMENTS FOR HANDLING ASBESTOS CONTAMINATED SOILS

Asbestos-contaminated soils would pose additional handling risks while being placed, or if disturbed subsequently. Works involving low level asbestos contaminated soils can be undertaken as unlicensed asbestos works, for which the additional controls are relatively minor. Works involving moderate level asbestos contaminated soils will need to be undertaken either as asbestos related works or Class B works in limited areas of the site. Class B asbestos works require a specialist contractor, an asbestos management control plan, dust controls, engineering controls and PPE/RPE, air monitoring, decontamination, and clearance from an independent asbestos assessor. As such they would entail additional cost, time and difficulty but are a requirement of the demolition and remediation project and as such could be efficiently managed between the two areas of the Site.

7.0 REMEDIAL OBJECTIVES

7.1 INTRODUCTION

7.1.1 OBJECTIVES

As described in Section 2, objectives relating to the remediation of the Site have been to assess a range of options for the management of contaminated soil identified on the Site, using a holistic approach taking into account environmental, social, cultural and economic factors that meet Deed requirements and stakeholder expectations, comply with industry best practice and government sustainability and broader outcome goals, protecting human health and the environment, and incorporating te ao Māori.

7.1.2 GUIDING PRINCIPLES

In recent times, management of historically contaminated land has largely been based on prevention of unacceptable risks to human health and the environment, to ensure a site is "fit for use." More recently, interest has been shown in including sustainability as a decision-making criterion, giving rise to what is known as **sustainable remediation**, as described further below.

In brief, the principles being applied to this project comprise:

(a) Treaty of Waitangi.
(b) Protection of human health and the wider environment.
(c) Safe working practices.
(d) Consistent, clear and reproducible evidence-based decision making.
(e) Record keeping and transparent reporting.
(f) Good governance and stakeholder involvement.
(g) Sound science.

7.1.3 TE AO MĀORI

LINZ are committed to incorporating mātauranga Māori into the delivery of this project. Mātauranga Māori has been described in the Wai262 claim as "the unique Māori way of viewing the world" and includes traditional knowledge and culture. In keeping with the Treaty Settlement context, LINZ asked that cultural considerations to be assessed as a dimension in their own right as part of the remediation of the site.

Te Ao Māori means Māori language, it means respect and acknowledgement of Māori customs and protocols, it means embracing the Māori story and identity and, embracing what that means, not just for Māori, but for all Kiwis both in New Zealand and around the world.

To assist LINZ with incorporating te ao Māori into the delivery of the project, they previously commissioned a Cultural Impact Assessment (CIA) to help inform assessment of effects from the onset of project delivery. Additional information pertaining to potential impacts on the whenua and wider cultural landscape were described at the Cultural Induction held between 8 – 9 February 2023 and summarised in the Waahi Tapu Investigation and Cultural Induction Summary (TAR 2023). The Maniapoto Environmental Management Plan has also been used as part of the

remedial options assessment as well as any feedback received from mana whenua at several public hui that were held over the course of the project. This is discussed further, below.

LINZ continue to engage with mana whenua and TNN throughout the delivery of the project to ensure scoping of each phase can take feedback into account. Further consultation LINZ has undertaken as part of this ROR is reported on separately.

7.2 SUSTAINABLE REMEDIATION

7.2.1 ISO 18504:2017: SOIL QUALITY - SUSTAINABLE REMEDIATION

The international standard ISO 18504:2017 *Soil Quality – Sustainable Remediation* recognises that remediation has economic, social and environmental dimensions that need to be balanced. It does not list cultural factors as a separate dimension. For each factor, it identifies a number of criteria to be considered, which are listed in Table 8.

Table 8: ISO 18504:2017 Economic, Social and Environmental Factors for Consideration

Factors	Criteria
Economic	• Direct cost of remediation projects (from preparation through operation to decommissioning) • Creating jobs • Creating or removing land use restrictions • Increasing land value • Indirect costs such as borrowing, deferring reuse, temporary business interruption, temporary relocation • Demonstration value of successfully executing a novel remediation • Risk of damaging existing buildings and infrastructure • Avoiding regulatory penalties such as fines • Losing reputation or brand value
Social	• Community safety during remediation projects • Nuisances such as odour, noise, dust, traffic • Ground compaction and settlement • Loss of amenity • Aesthetic impact • Community health and well-being after remediation • Community social equity, vision and quality of life expectations
Environmental	• Energy use and climate change implications • Water resource use and water resource quality • Ecosystem services and land use • Raw material / resource use and pollution prevention.

7.2.2 UK SUSTAINABLE REMEDIATION FORUM (SURF-UK)

The process of identifying **sustainable remediation** is defined by The UK Sustainable Remediation Forum as "*the practice of demonstrating, in terms of environmental, economic and social indicators, that the benefit of undertaking remediation is greater than its impact, and that the optimum remediation solution is selected through the use of a balanced decision-making process.*"

Sustainable remediation is the practice of considering the effects of implementing an environmental cleanup and incorporating options to minimize the footprint of the cleanup actions. Opportunities for green and sustainable practices exist throughout the site remediation process of remedial investigation, design, construction, operation, and monitoring. Five core elements are evaluated as part of the environmental footprint analysis including energy, air and atmosphere, materials and waste, land and ecosystem, and water. The cleanup remedy is evaluated for each core element to:

(a) minimize total energy use and maximize renewable energy use;

(b) minimize air pollutants and greenhouse gas emissions;

(c) minimize water use and impacts to water resources;

(d) reduce, reuse, and recycle materials and waste; and,

(e) minimize land use and protect ecosystems.

The latest SuRF-UK SR2 indicators are illustrated below.

Environmental	Economic	Social
ENV1: Emissions to air	ECON1: Direct economic costs and benefits	SOC1: Human health and safety
ENV2: Soil and ground conditions	ECON2: Indirect economic costs and benefits	SOC2: Ethics and equity
ENV3: Groundwater and surface water	ECON3: Employment and employment capital	SOC3: Neighbourhoods and locality
ENV4: Ecology	ECON4: Induced economic costs and benefits	SOC4: Communities and community involvement
ENV5: Natural resources and waste	ECON5: Project lifespan and flexibility	SOC5: Uncertainty and evidence

Figure 6: SuRF-UK SR2 Indicators (refer https://claire.co.uk/projects-and-initiatives/surf-uk)

7.2.3 APPLICATION TO THIS SITE

New Zealand does not currently have its own sustainable remediation standards or guidelines. The environmental, economic and social considerations of ISO18504:2017 and the SuRF-UK system do not adequately account for incorporation of a cultural lens into sustainable remediation assessments, arising from the principles of the Treaty of Waitangi and other relevant legislation in New Zealand. As such, this cultural lens should sit at the same assessment level as the environmental, economic and social considerations of ISO18504:2017 and the SuRF-UK system. Furthermore, some of the factors identified for consideration under the ISO18504:2017 and SuRF-UK system are not relevant or readily applicable to the Site.

This cultural lens is particularly important in the context of the Tokanui site.

For these reasons, a hybrid approach has been taken with the remedial options assessment, based on sustainable remediation principles but adapting these to the particular context of the Site and the New Zealand legislative framework, as explained further in Section 8 of this report.

8.0 REMEDIAL OPTIONS SELECTION AND ASSESSMENT APPROACH

8.1 OPTIONS SELECTION PROCESS

The main purpose of the remedial options assessment undertaken for this report is to:

(a) investigate potential remedial options;
(b) assess the viability, benefits and limitations of each remedial option;
(c) select a suitable remedial option, or combination of options.

The options assessment process has considered the following factors that could affect the suitability of each methodology assessed such as:

(a) long-term objectives;
(b) legal requirements including environmental, and health and safety;
(c) Treaty partner's views including te ao Māori;
(d) risks that need to be controlled during remediation;
(e) reduction in site users' exposure to contaminants to be achieved;
(f) site specific constraints;
(g) short, medium and long term adverse effects including noise, disruption, traffic, etc.;
(h) practicability and ongoing maintenance of selected methodology;
(i) estimates of financial costs for each remedial option, including monitoring;
(j) Sustainable remediation objectives (e.g. ISO 18504:2017, SuRF-UK);
(k) timeframes and duration including establishment, operation and decommissioning;
(l) additional benefits beyond simply reducing the risk and presence of contaminants on site.

8.2 ASSESSMENT APPROACH OVERVIEW

As described above, the evaluation assessment approach was developed as a hybrid approach tailored to the Site. This hybrid approach was adopted to align with assessment criteria provided to the Te Nehenehenui and Ministers to determine the full extent of horizontal infrastructure removal and management of demolition material as part of the demolition workstream of the project. Ministerial support of this criteria was provided in January 2023 *Tokanui Hospital: Decision-making process and criteria* (BRF 23-169 refers). Although not required, LINZ have elected to adopt the same assessment approach for consistency.

The hybrid assessment approach is based on the following tools:

(a) Multi-criteria analysis (MCA): This can be used to assess multiple criteria, both quantitative and qualitative relating to a proposed project. MCA can be used to compare different alternatives and options and assist with conversations between the project proponent and stakeholders to help inform decision making.
(b) ISO18504:2017 Soil Quality – Sustainable Remediation.
(c) Framework for Assessing the Sustainability of Soil and Groundwater Remediation (CL:AIRE, 2010): This is a framework by the Sustainable Remediation Forum – United Kingdom (SuRF-UK) for sustainable remediation involving consideration of a range of environmental, economic and social indicators, as described in section 7.2.1 of this report.

(d) Mauri model: The Mauri Model Decision Making Framework was developed in New Zealand and is unique in its approach to the management of water resources as the framework offers a transparent and inclusive approach to considering the environmental, economic, social and cultural aspects of the decisions being contemplated. It is consistent with the RMA sustainability framework and incorporates both western scientific and indigenous world views. It has been adapted to waste management by D Hikuroa (2011).

(e) Landcare Research has developed a range of Māori environmental assessment and performance indicator tools, primarily in relation to freshwater resources.

8.3 ASSESSMENT CRITERIA AND INDICATORS

The hybrid approach to the remedial options assessment for contaminated soil established environmental, social, cultural, economic criteria consistent with the Mauri model. It also took the criteria agreed to by the Crown to assess and inform the disposal options assessment and the horizontal infrastructure options assessment into account.

The choice of criteria is important as it will ensure LINZ considers the right information as part of this options analysis. Within each criteria, a number of indicators[4] were developed for evaluation, along with a number of sub-factors to help explain what each indicator covered.

Table 9: Assessment Criteria, Indicators and Sub-headings

Criteria	Indicator	Sub-factors
Environ-mental	Effects on land use/ productivity	Contamination of the land Associated effects on land use/productivity
	Effects on surface water	Quantity – peak flows/volumes Quality Silt/sediment Scour/erosion
	Groundwater effects	Groundwater table effects (groundwater levels) Quality Use
	Ecological effects	Plants/trees/birds and other fauna Aquatic species
	Air emissions	Dust/odour Particulate/volatile gases Greenhouse gases (carbon dioxide, methane)
	Sustainability	Reuse/recycling Resilience (e.g. ability to cope with climate change effects) Legacy (future generation) issues

[4] An indicator is a single characteristic that represents a potential or actual effect which can be compared across options to evaluate their relative performance. Indicators need to be measurable in some way that is sufficient to allow evaluation (adapted from SuRF-UK, 2011).

Social	Public health and safety	Physical injury Contaminant effects on human health Traffic impacts
	Worker health and safety	Physical injury Contaminant effects on human health Traffic impacts
	Neighbourhood effects	Dust, noise, odour, vibration, traffic Changes to surface runoff flow patterns
	Amenity/land use	Nuisance Visual effects Land use limitations
	Employment opportunities	Short term during works Long term – ongoing maintenance
	"Wellbeing" perceptions	Dislike of having landfill in local area Personal associations with site history
Cultural	Loss of mauri	Loss of a "health and spirit" which permeates through all living and non-living things - plants, animals, water and soil
	Destruction of wāhi tapu (cultural/spiritual) sites	Ancestral burial sites Loss of cultural heritage Disruption of cultural connectivity Damage Iwi relationships Impact on land and resources
	Kiatiakitanga (guardianship) and Whenua (land)	Extent of Māori active involvement in control, management and protection of land Restrictions on land use (physical, contamination, etc.) causing loss of resources/ opportunities for economic development
	Healing the land (Papatūānuku)	Soil health
	Restoration of water services (Wai Ora)	Water quality Ecology
	Mahinga kai (garden, cultivation, food gathering places)	Garden, cultivation, food gathering places Collecting plants for various (e.g. medicine, weaving) purposes (e.g. toetoe, raupo, harakeke, paopao)
Economic	Demolition/remedial works initial costs	Cost scores were made on a qualitative, judgement basis
	Ongoing maintenance costs (opex)	Opex cost scores were made on a qualitative, judgement basis
	Effects on land value	Impact of demolition/remedial works on land value
	Effects on potential earnings from land	Extent and productivity/health of land area available for use

	Minimisation of future liabilities	Legacy effects of residual infrastructure/contamination left in place or deposited in landfill onsite

An additional "deliverability" assessment was also included, which involved a Yes/No/Likely/Unlikely assessment of the ability to deliver on the Crown's commitments under the THDSP, taking into account the prescribed timeframes and delivery risks in terms of significant constraints and consentability. These are described in detail in Section 9.4.

9.0 REMEDIAL OPTIONS

The following sections outline the remedial options that were selected, including, as summary of each option (Section 9.1) and subsequent constraints (Section 9.2), options refinement (Section 9.3) and consentability analysis (Section 9.4).

9.1 OPTIONS CONSIDERED

Selected options are listed below and described further in this section.

- Option 1: Use as backfill material within designated areas on the Site, for cavities created by the demolition process (Section 9.1.1);
- Option 2: Blending with cleaner material to acceptable concentrations (Section 9.1.2);
- Option 3: Stabilisation within a designated management area (Section 9.1.3);
- Option 4: Bioremediation and/or destruction (Section 9.1.4);
- Option 5: Containment within a designated management area (Section 9.1.5);
- Option 6: Containment within the existing Disposal Site (Section 9.1.6);
- Option 7: Off-site Disposal to Landfill (Section 9.1.7); and,
- Option 8: Combination of Options (Section 9.1.8).

9.1.1 OPTION 1: REUSE AS BACKFILL

The Deed allows the Crown to remediate a contiguous area not exceeding 15% of the total land area of the Site to the managed remediation standard. "Contiguous" in this context is taken to mean touching or connected throughout in an unbroken sequence and hence would ideally be a single continuous area or a number of separate areas directly next to each other. This option is based on selecting a management area where there is a large, contiguous void space below existing ground level left by the demolition (e.g. removal of a deep foundation or basement), where low level contaminated soil that exceeds the rural residential remediation standard but is within the managed remediation standard and does not contain any asbestos can be used as backfill material. Soil in this category amounts to an estimated 384m^3 of contaminated soil.

The buildings on-site are generally reasonably spread out and do not form a contiguous area, while many building foundations are made from a concrete perimeter footing with concrete piles, and a concrete slab under toilets and kitchens. Using low level contaminated soil as backfill for trenches resulting from concrete duct/pit and watermain/stormwater/wastewater pipe removals is not considered appropriate, as these services span the site and are not considered contiguous in this context. Taking this into account, the most suitable locations for this option are considered to be:

(a) Under roading/paving that is to be removed and restored to farmland. This comprises the blue shaded areas shown below, with an estimated backfill requirement of 10,500m^3. Collectively, the blue areas are not contiguous, but there are three main sub-areas circled below that are more contiguous. Estimating these areas to comprise 60-70% of the total blue area, gives a backfill requirement of 6,300-7,350m^3.

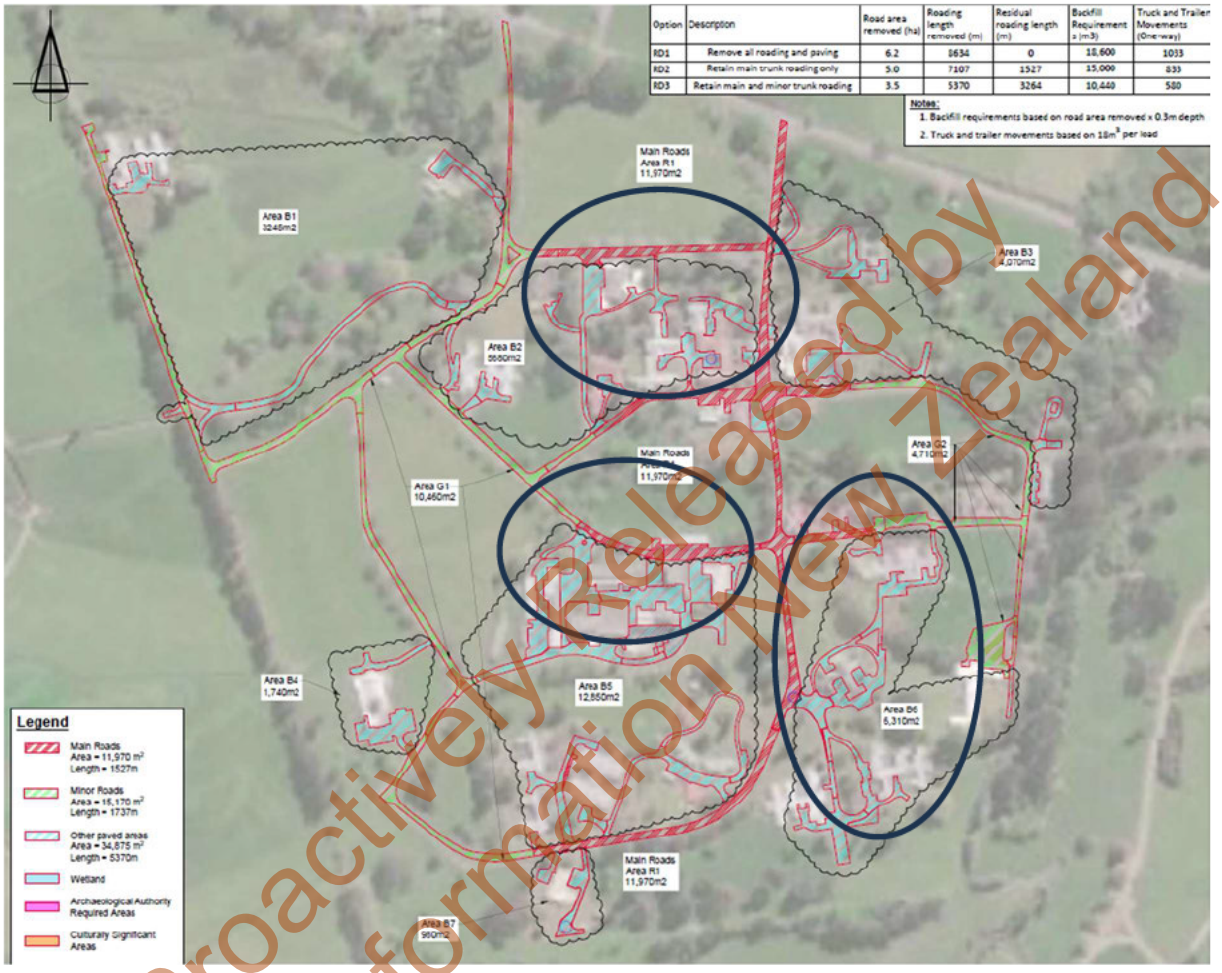


Figure 7: Roading/paving to be removed and potential backfilling opportunities

(b) Buildings B10-B14: These buildings are large and reasonably close together. They occupy an approximate area of 7,200m^2 of which the building footprints make up around 3,830m^2.

(c) Buildings B62, 63, 65, 68, 69 and 74 (industrial area): These buildings occupy an approximate area of 12,800m^2 of which the building footprints make up around 4,360m^2. The majority of the area between the buildings is paved and is already proposed to be removed as part of hospital demolition. WSP pavement pits in this area (TP18, 19, 20, 22 and 23A) found total pavement thicknesses of 200-350mm, with an average thickness of 246mm, (rounded off to 250mm).

- Assuming building footings make up 10% of the building footprints and extend to 1m depth based on the nature of these buildings, then the required backfill volume is 436m^3, which is relatively low.

- If the building footings were removed as assumed above, and paving was removed to a uniform depth (250mm) along with building footprints, and the pervious areas in between the paving were also removed to 250mm depth, then the required backfill volume would be 3,530m^3. The corresponding backfill volume for Buildings B10-B14 is 2090m^3.This also assumes that the low-level contaminated soil can be placed in this area without any impermeable liner and clean cover material over it (e.g. 150mm clean topsoil).

In summary, this assessment shows that the low-level contaminated soil can be placed within a localised area, using one of the options listed above. The backfilling could be concentrated into a very localised area, if the entire building footprints are excavated out for this purpose along with adjacent paved areas and potentially associated pervious areas. The most suitable area is considered to be the former industrial area, due to the building and paving/roading density in this area being the highest across the entire Site.

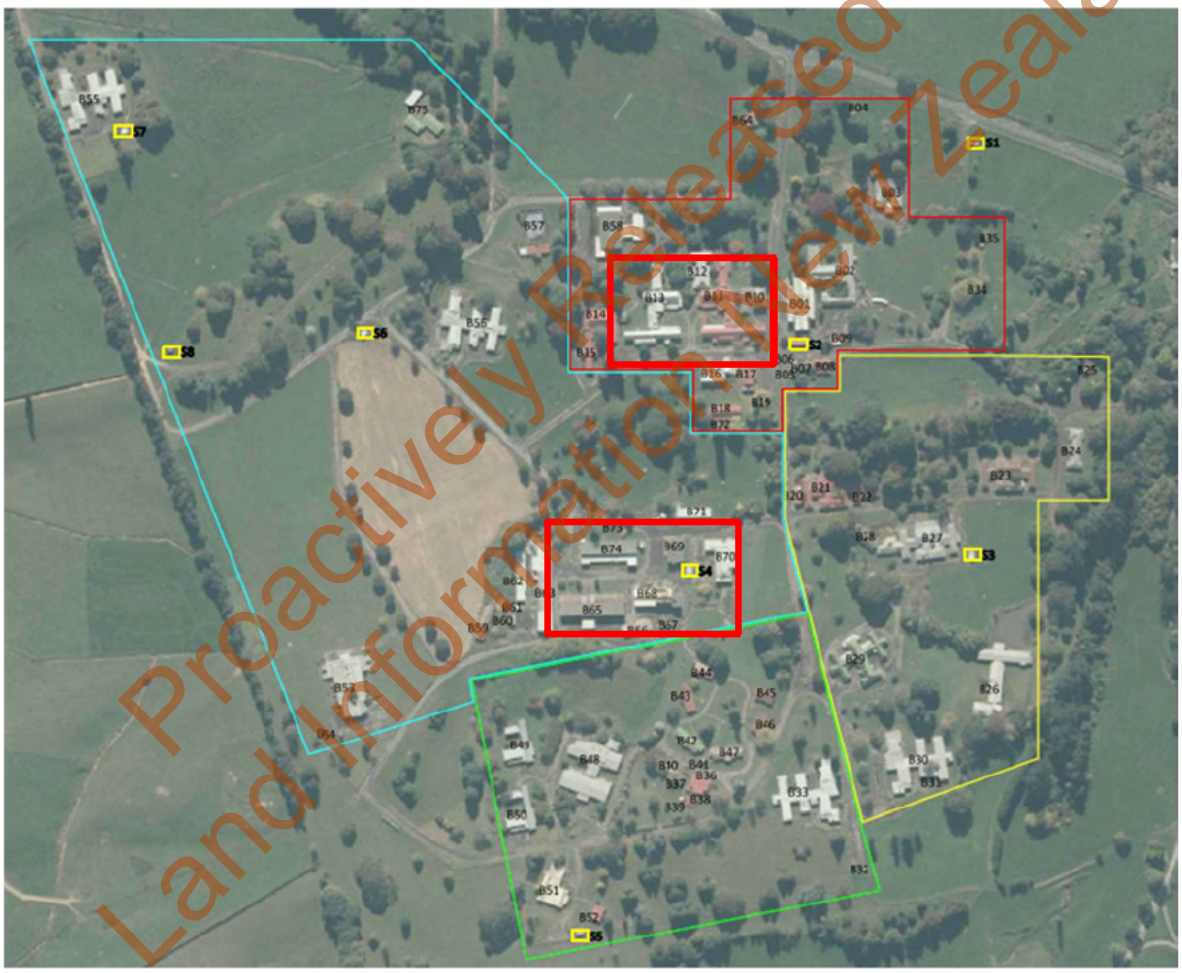


Figure 8: Main Building Areas (red rectangles) considered for Backfill of Low-Level Contaminated Soils

Reusing soils in this way will avoid importing clean backfill material and exporting low level contaminated soils, and therefore is likely to be low-cost, whilst reducing transportation requirements and associated vehicle emissions. It will concentrate low level contaminated soil into a smaller area,

but this has both positive and negative effects, since it makes the contamination easier to manage, even though it does not actually reduce the amount on site.

9.1.2 OPTION 2: BLEND TO ACCEPTABLE CONCENTRATIONS

Blending contaminated soils with clean materials, or differently contaminated soils, can reduce concentrations to acceptable levels. Some authorities consider blending inherently inappropriate, as there is always a risk that blending doesn't quite achieve the necessary dilution, resulting in an increased volume of less contaminated soil to manage. Moreover, for contaminants such as asbestos that pose health and safety risks when disturbed, blending is not straightforward and may even create more risk than it averts (e.g. dust generation during the blending process).

For zinc-contaminated soils, however, given there is some safe or even beneficial level of zinc and given its very low toxicity to workers, blending may well be appropriate.

Preliminary calculations indicate blending ratios could be in the range of 1.5:1 to 2.6:1, meaning that for every 100m^3 of contaminated soil to be blended, 150-260m^3 of un-impacted soil would need to be mixed with it.

Blending does mean that more soil will be disturbed than required for other methods, involving more materials handling, and close monitoring of the blending process is required to increase its chances of success.

9.1.3 OPTION 3: STABILISATION

Stabilisation involves mixing contaminated soils with other substances to reduce or eliminate contaminant bioavailabilty and leachability.

Cement

Blending contaminated soils with several percent of cement is an established approach to breaking exposure pathways, or at least reducing contaminant bioavailability and leachability, while improving geotechnical properties. Conversely, cement stabilisation will render a soil impossible to cultivate, and hence unsuitable for rural residential purposes. This approach would only be helpful for Options 1, 5 and 6.

While cement stabilisation would make those other approaches more effective, it would also make them considerably more difficult and more expensive. Part of the cost of cement stabilisation is simply the additional handling, part of it is the cost of the cement, which obviously is dependent on the amount of cement required to achieve the desired change in properties. There would also be increased transportation requirements and vehicle emissions associated with bringing the cement to site, while cement production is typically associated with high carbon dioxide emissions (making 1kg of cement sends approximately 0.5-0.9kg of carbon dioxide into the atmosphere).

Phosphate

Considering lead contamination in particular, there is a considerable body of evidence that soil amendment with phosphate generally results in lead forming insoluble minerals such as pyromorphite, reducing its bioavailability and leachability [Ref: Scheckel et al]. A potentially significant

difficulty with phosphate amendment is that phosphate is an essential nutrient, and as such is continually removed from soil by plants, so it would likely require topping up over time. Moreover, allophanic soils, such as those present on-site, are well known to bind phosphate strongly, which may interfere with pyromorphite formation, likely reducing the effectiveness of the approach.

pH adjustment

Generally, heavy metals leach more with decreasing pH, with cadmium being a good example. Liming of soils to increase their pH will decrease heavy metal leaching, but may also alter pasture productivity. Ongoing lime addition will likely be required.

Overall, given that the leaching testing undertaken onsite has not shown leaching to be an issue, this option has been rejected for further consideration, as it is likely to be excessively expensive compared with other options.

9.1.4 OPTION 4: BIOREMEDIATION AND DESTRUCTION

Bioremediation is a natural process, which relies on bacteria, fungi and/or plants to remove, reduce, degrade or immobilise environmental pollutants from soil, thus reducing contaminant levels in the soil, and ideally restoring contaminated sites to a relatively clean non-toxic environment. Bioremediation is more commonly applied to hydrocarbon and pesticide contaminated soils, rather than heavy metal contaminated soils. At the Tokanui Site, very little (or no) hydrocarbon or pesticide contaminated soils were found. Hence, this option is not considered further in this investigation.

World-leading research into detoxifying asbestos is underway in New Zealand. Auckland company EDL is exploring ball milling to physically break up asbestos fibres, while Unitec Institute of Technology in Auckland is investigating the capabilities of certain fungi to reduce the carcinogenicity of asbestos. However, neither of these technologies has regulatory acceptance yet, nor are they commercially available, and when or if they are available in the future, they are likely to be more applicable to asbestos-containing materials than to trace asbestos in soils. Therefore, they are not considered further here.

For these reasons, this option has been rejected for further consideration.

9.1.5 OPTION 5: CONTAINMENT IN MANAGED AREA

The contaminated soils could be retained within a designated management area, buried in a cell and covered with a capping system, commonly referred to as a containment cell. This would break the exposure pathway to future users, and hence any soil that did not pose unacceptable environmental risk could be placed in containment, potentially including soils that do not meet the managed remedial standards.

A general concern with containment cell approaches is whether the contaminants will leach to groundwater. In this case, asbestos is not believed to pose a leaching risk, and lead and zinc leachability (by SPLP) is within managed fill (Class 4 landfill) waste acceptance criteria. The potential for leaching could be further reduced by providing an impervious cap and/or walls.

Asbestos-contaminated soils would pose additional handling risks while being placed, or if disturbed subsequently. These would be additional Class B asbestos works, requiring a specialist contractor, an

asbestos management control plan, dust controls, engineering controls and PPE/RPE, air monitoring, decontamination, and clearance from an independent asbestos assessor. Hence, the encapsulation of asbestos contaminated soils will entail additional cost, time and difficulty.

FTL (2023) has previously undertaken an assessment of potential locations for a new on-site disposal site for non-recyclable demolition waste, revising the work undertaken by AECOM, taking into account site specific constraints. This led to three locations being considered suitable, as shown in Figure 9 below, comprising:

(a) Area 6 (3.3ha, 160,000m^3 capacity) is underlain by alluvial materials and would require geotechnical investigation to check the extent and depth of alluvial materials and hence the amount of undercutting that might be required, as well as checking the groundwater table in this area. Undercut alluvial materials from this area are unlikely to be suitable for capping and may require offsite disposal.

(b) Area 9 (3.8ha, 160,000m^3 capacity) is typical of a large stockpile being placed on the site, which would create a mound feature. It is subject to limited constraints, the main one being that part of it overlies a likely historic swamp. This can be managed through appropriate geotechnical investigation of this area and engineering design. It is also located on the former industrial area of the Site, which has potential benefits in minimising the impact on highly productive land, while some excavation is already required in this area to remove building foundations, roading/paving and localised areas of contaminated soils.

(c) Area 10 (3.3ha, 160,000m^3 capacity) has been shifted further southeast from its original location to avoid the Archaeological Authority hill feature. Its location and extent is still limited by an overland flowpath (OLFP) to the east and stormwater reticulation to the south, where an OLFP is a conveyance pathway for surface runoff. It is 280m away from the nearest residential dwelling.

(d) All three sites involve mound rather than gully fills so may be visually obtrusive. Figure 10 provides typical landfill cross-sections for each disposal site at specific locations.

(e) All three sites would require suitable clay and topsoil material to be sourced for capping and final cover. Sufficient topsoil may likely be obtained by stripping topsoil from the fill area, temporary stockpiling and then respreading on the completion of filling and capping. The desktop geotechnical assessment indicates that clayey soils, which may be suitable for landfill capping material, are generally encountered from a depth of 2m below the ground surface, but further investigation and testing is required to verify this. There is potential to excavate out Areas 9 and 10 first, creating a cavity with any suitable clay capping material being stockpiled, followed by filling the disposal area and then replacing the stockpiled clay to cap the fill, following be retopsoiling. This would reduce the finished height of the landfill mound and hence the visual effects of both these sites.

In summary, there is no ideal location for a containment cell for contaminated soil onsite. The three shortlisted sites have ample capacity to take all estimated contaminated soil volumes, while Area 9 is subject to the least constraints. Capping material may either need to be imported or may potentially be sourced on-site, or alternative synthetic capping solution considered.

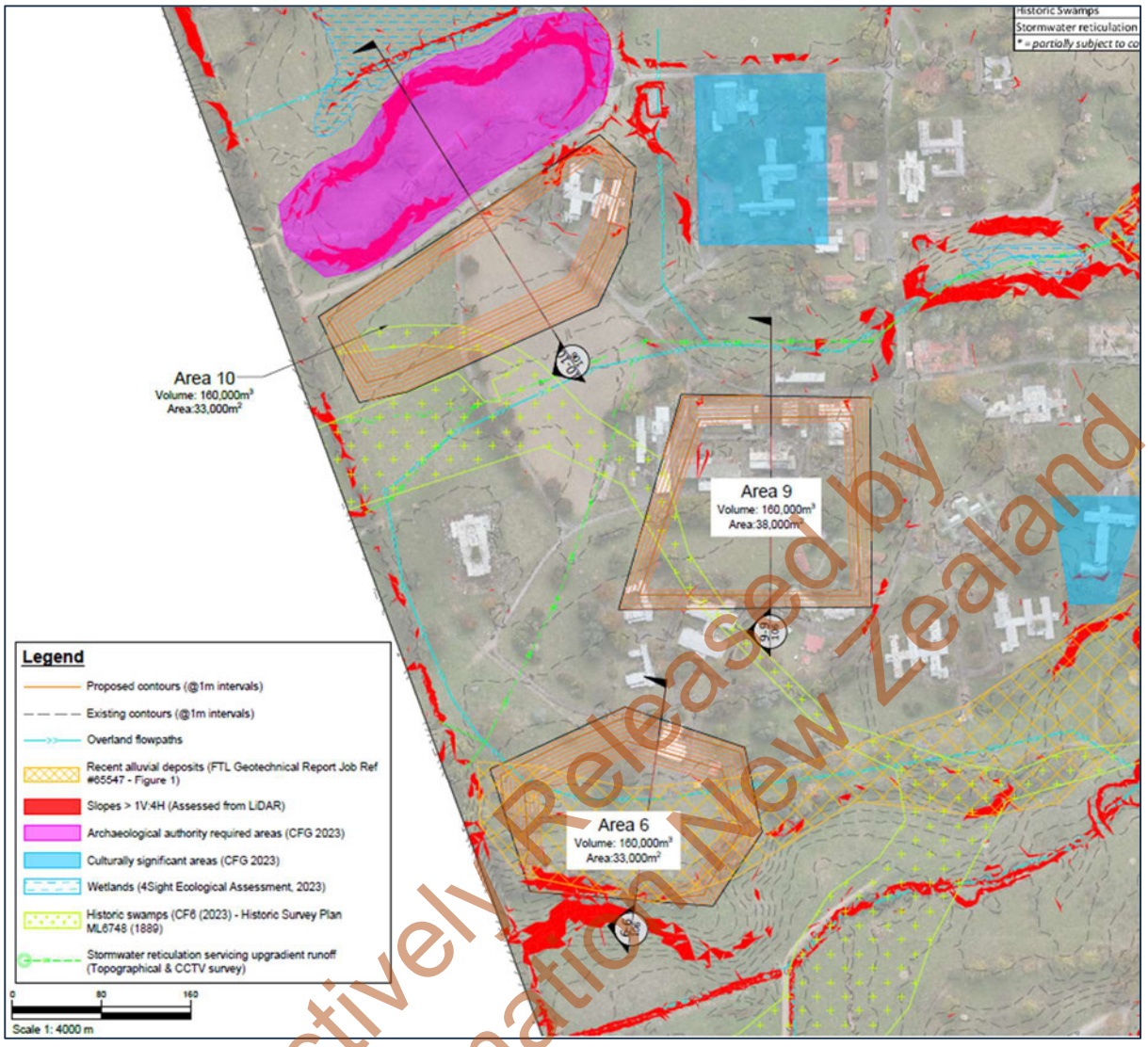


Figure 9: Potential new onsite Containment Cell Areas (from FTL (2023))

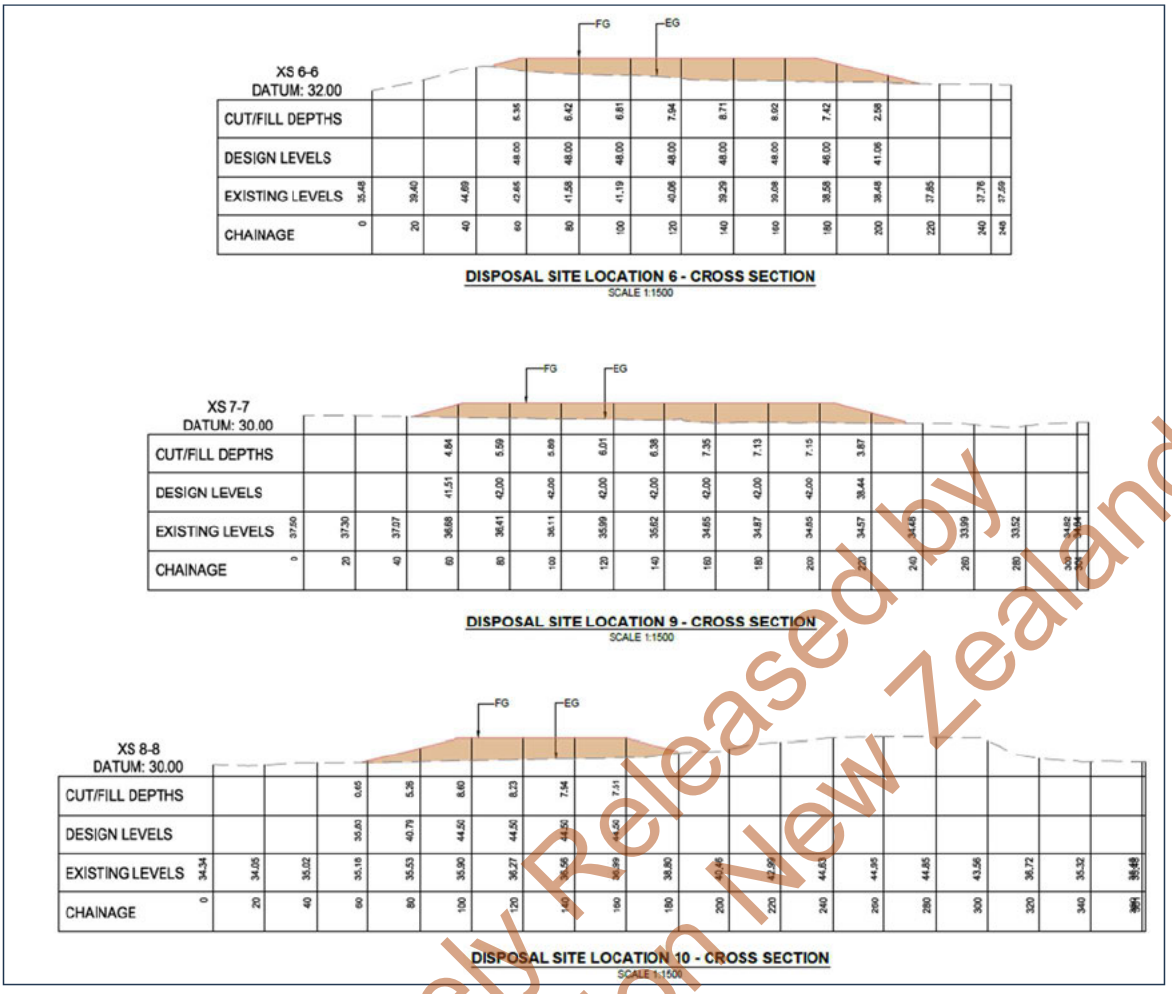


Figure 10: Potential new onsite Containment Cell Areas – Typical Cross-sections (from FTL (2023))

Table 10: Potential Shortlisted Onsite Disposal Locations

Site	6	9	10
Area (m^2)	33,000	38,000	33,000
Fill volume (m^3)	160,000	160,000	160,000
Visual amenity	Will create elevated feature but partly tied into existing hillside	Will create new elevated "mound"	Will create new hill feature
Constraints	OLFP diversion required; alluvial soils; possible groundwater issues; abuts land steeper than 1V:4H	Partly overlies estimated alignment of historic swamp	Areal extent limited by multiple nearby constraints. 280m to nearest houses.

Notes:

1. All potential new disposal site areas and heights allow for provision of 600mm landfill cap and 150mm topsoil.
2. Geotechnical investigation required to investigate possible onsite clay capping sources. If site specific investigations show site won material is not suitable, a synthetic cap or imported clay cap would be required.

The estimated combined volumes of low and moderate level contaminated soil are 2,400m^3, while the worst case estimate, allowing for potential additional HALO scrapes, subfloor space scrapes and from soil around the asbestos watermains, is 5,530m^3.

Based on these volumes, if contaminated soil was placed as a 2m thick layer with 600mm cap and 150mm topsoil, the footprint of the containment would be on the order of 10,300m^2, which could for example be an approximately 92x112m cell. If only the confirmed contaminated soils were placed in containment, that would make for a considerably smaller cell, of the order of 4,624m^2 (68x68m).

Because the contaminated soils are largely topsoils, they could not be compacted to a high bearing strength, and might settle somewhat after placement. There would likely be geotechnical constraints on the use of the containment cell footprint, which might be best left as open space.

This option would also reduce traffic movements to/from the Site and associated vehicle emissions.

9.1.6 OPTION 6: PLACE IN EXISTING ONSITE LANDFILL

There is no requirement under the Deed to remediate the existing disposal sites (landfill), but LINZ is responsible for managing these sites in perpetuity (forever), while the ongoing maintenance and monitoring of these sites is covered by a regional resource consent with oversight from Waikato Regional Council.

Investigation work by Fraser Thomas (2022-24) has identified that the main issues with the existing disposal sites are:

- The landfill clay cap is deficient in terms of thickness and/or impermeability, thus allowing a higher amount of rainfall infiltration into the landfill than for “best practice”, which will increase leachate generation.
- The landfill has no base or side impermeable liner, so that any rainfall that enters the landfill can collect contaminants as it passes through the refuse and percolate down through the ground under the landfill. Some of these contaminants are taken up by the underlying soils, but some will enter shallow groundwater under the landfill.
- There is no leachate collection system, this being consistent with landfilling practice at the time the landfilling areas were constructed.
- Shallow groundwater has been found to come into direct contact with buried refuse in some landfilled areas.
- Elevated boron concentrations are present in shallow groundwater travelling under the landfill and in surface water in the Wharekōrino stream but below the Australian and New Zealand guidelines for the protection of 95% of aquatic species in freshwater.
- The proximity to the Wharekōrino Stream means the site is potentially subject to inundation by flood waters, while an aging culvert runs through the southernmost landfill area.

LINZ is committed as part of its ongoing management role to remain compliant with existing resource consent conditions. Option 6 integrates a significant long-term management strategy and enhancement to the closed landfill and addresses these issues through undertaking closed landfill repair/upgrade works in conjunction with the remediation of the low-moderate level contaminated soil from the hospital, including:

- Adding the contaminated soils in an appropriate location and with appropriate controls in place (e.g. liner) to minimise potential environmental effects.
- Upgrading the landfill cap across the entire landfill to make it more impervious and shaping it to shed surface runoff, to reduce rainfall infiltration into the landfill, followed by retopsoiling and grassing.
- Potentially installing a groundwater diversion drain upgradient of the landfill to divert clean groundwater around the landfill.

These measures will reduce leachate generation and contaminant concentrations in any groundwater and will stop contaminants from entering the stream.

The obsolete road crossing and associated culvert and embankment into the hospital from off Farm Road is also to be removed, which will lower flood levels in the stream adjacent to the landfill and reduce the flood risk, while the old southern culvert going through the landfill is to be replaced or removed, with refuse material relocated into other parts of the existing landfill, which will significantly reduce the risk of this culvert possibly failing in the future and refuse being washed down the stream.

Taking LINZ's proactive approach to addressing the identified issues with the existing disposal sites into account, Option 6 goes significantly further than the Crown is required to do under the Deed. The addition of identified contaminated soils into the existing disposal sites can be done in such a way that the net volume change is approximately neutral, by for example taking good clean soil from some of the landfill areas (e.g. Area E) to use as backfill material in the hospital demolition works and shifting the low and moderate level contaminated soil into an appropriately lined and capped landfill cell created in Area E. Leaching testing for lead and zinc from these soils shows that leaching of these contaminants is very low, while asbestos does not leach. These tests, combined with the contaminated soils being put into a containment cell (sometimes called a "dry tomb"), means there will be little or no leachate produced from this practice.

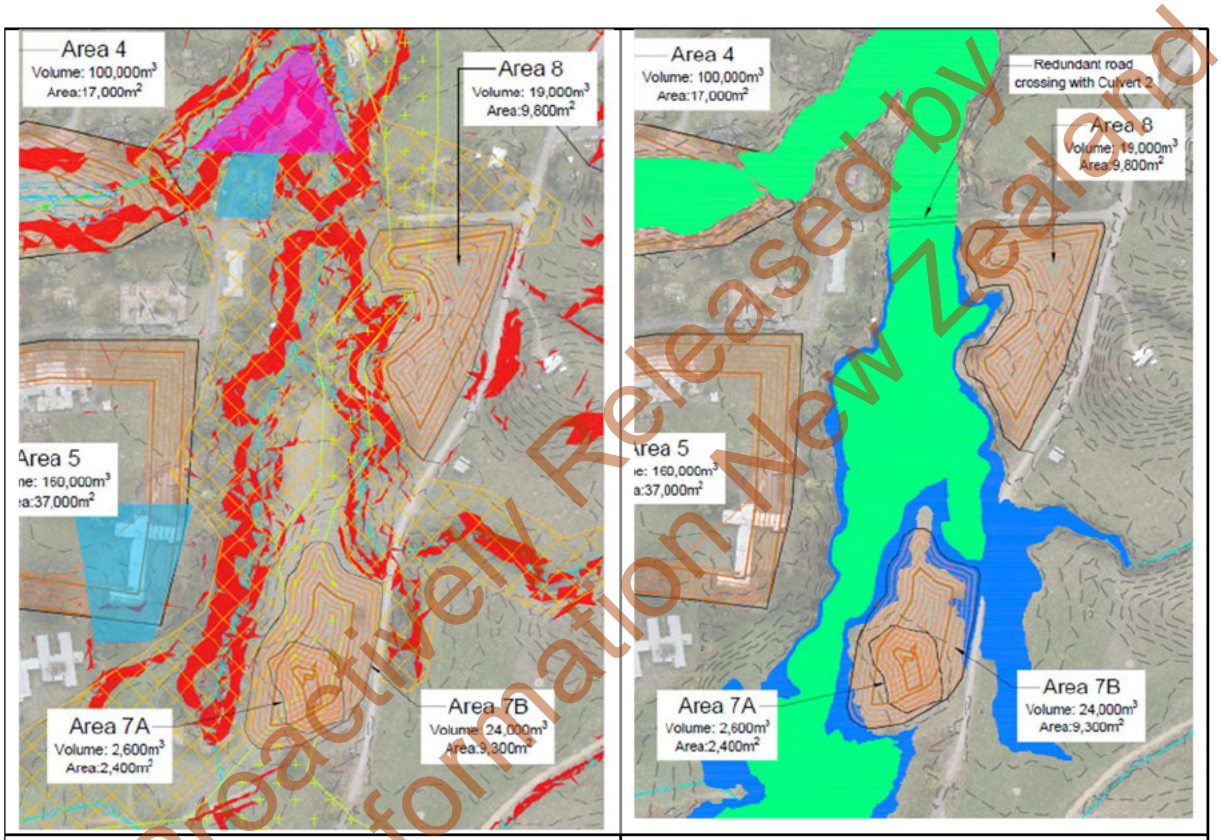
Collectively this approach will result in a significant upgrade of the existing disposal sites, reducing the environmental effects, even with adding low and moderate level contaminated soil into the disposal sites, whilst avoiding the transport related impacts of Option 7 (offsite disposal) and potentially having to import soil for backfilling from off-site. Incorporating a long-term management approach to enhance the closed landfill is likely to cost more to the Crown than simply taking soil offsite but results in better environmental and social outcomes; further, the Crown is required to manage the landfill including contaminated soil added from the hospital in perpetuity - therefore, the liability associated to both the contaminated soil from the hospital and the existing closed landfills will not be passed onto any future owner. LINZ will continue to be responsible for long term management and monitoring.

For the existing disposal sites, two potential areas were identified that could be utilised to take the low-moderate level contaminated soil from the hospital remediation works:

(a) The southern site (existing landfill areas A and B) is based on two potential footprints – a minimum available footprint (Area 7A), keeping the landfill outside the estimated floodplain extent of the Wharekōrino Stream for the 100 year storm with allowance for climate change (allowing for partial culvert blockage) in accordance with Waikato regional requirements and

existing stream/culvert conditions; and a maximum footprint (Area 7B) assuming the redundant road crossing of the stream into the site is removed, which would significantly reduce the floodplain extent. For Area 7A, the available fill area is 0.24ha and potential additional maximum fill volume is 2,600m^3. Corresponding values for Area 7B are 0.93ha and maximum fill volume of 24,000m^3 respectively.

(b) The northern site is based on utilising the northern disposal site (existing landfill areas D, E and F) outside of the floodplain extent. For this area, the area available is limited by the Wharekōrino stream floodplain to the west and south, a gully feature to the north and Farm Road and an existing residential dwelling cluster to the east and north-east respectively. The available area and potential volume are 0.98ha and maximum fill volume of 19,000m^3.



Areas steeper than 1V:4H (red shading)

Area subject to stream floodplain, post removal of Culvert 2 (green shading)

Figure 11: Possible Landfill Extension Areas, including principal hazards

Hence, either of these areas alone is easily sufficient to cater for the estimated 2,400m^3 volume of low and moderate level contaminated soil, and even the worst case contaminated soil estimate of 5,530m^3, all from the hospital site.

Issues to consider further for these potential locations include:

- The landfill extension may increase the landfill areal extent slightly, covering some additional areas of natural ground. Consideration will need to be given to appropriate lining of these areas. The need for a base impermeable synthetic liner (e.g. HDPE) will largely be controlled by the nature of the additional fill material, particularly its leachability, which testing has shown to be low; the impermeability of the landfill cap; and depth to groundwater.

- Potentially significant volumes of clay capping and topsoil being required. Incorporating a geomembrane into the new landfill cap will reduce clay capping requirements and also reduce rainfall infiltration into the landfill, which is important for reducing ongoing leachate disposal costs.
- Both options are potentially subject to minor geotechnical stability issues and overland flowpaths, but their extent has been deliberately designed to minimise this risk.
- The landfill areas are relatively close to the Wharekōrino stream floodplain, representing an ongoing risk, particularly if climate change is worse than currently predicted or the culvert under Te Mawhai Road was to be blocked. The extension extent has been deliberately located to minimise this risk.
- The northern site is located within 65m of a cluster of existing residential dwellings outside the site and approximately 45-50m from a farmhouse on the adjacent property.

9.1.7 OPTION 7: SEND TO OFFSITE LANDFILL

This option would involve the off-site disposal of low-moderate level contaminated soil to landfill (2,403m^3). Assuming this is done by truck and trailers (18m^3, 28-38T), this would involve an estimated 153 truck and trailer movements (one-way), while an estimated 153 truck and trailer movements may be required to bring clean "backfill" material to the site, assuming a 1.15 solid to loose factor, unless suitable backfill material can be sourced from within the site. If all other potential contaminated soil (building halo scrape, subfloor scrape and asbestos watermain HALO) was removed off-site, this would add another 200 truck and trailer movements each way, plus possible additional backfilling.

Asbestos-contaminated soils would have to go to Class 1 or 2 landfill where suitable handling regimes are in place. Lead and zinc-contaminated soils appear to meet leachability criteria for Class 1 and 2 landfills and indeed for Class 3 and 4 landfills that accept soils based on leachability.

In this report, disposal facility options have been assessed within an approximately 100km radius of the site, as shown in Figure 12. This assessment has been made through liaison with Waikato Regional Council to obtain current fill/landfill facility details within the region and through contacting various fill facility operators.

Possible disposal facilities are listed below, followed by waste acceptance criteria (WAC) for cleanfills (Waikato region) and selected managed fills. It should be noted that the cleanfills and managed fills have different WAC from the adopted site specific remedial standards and hence some further results analysis would be required for the low level contaminated soil, likely on a building by building basis, to determine whether it can go to any of the listed managed fills or must be taken to a Class 1 or 2 landfill, if this options is adopted. All moderate level contaminated soils will have to be taken to Hampton Downs based on lead concentrations exceeding 460mg/kg.

The GRP Ltd facility at Rotawaro (former Puke Coal site) has consents to discharge up to 208,000 tonnes per year of cleanfill and construction and demolition sector waste onto land (AUTH138113.04.03) and to discharge up to 8,000,000m^3 of municipal solid waste to land (AUTH125466.01.02). However, WRC advice is that the municipal solid waste consent was transferred to them from the previous owner/operator but the indication is that they are not going to exercise it at this stage.

Table 11: Potential Offsite Disposal Facilities

Available Sites	Operator	Landfill/Fill Class	Distance from Tokanui – one way (km)	Comments
North Waikato Regional Landfill, Hampton Downs	Envirowaste Services Ltd (ESL)	Class 1	99	Most modern, engineered landfill facility in region with capacity for 30,000,00m³ over its lifetime.
1161 Rotowaro Rd, Glen Afton	GRP Ltd (Green Gorilla)	Class 2 & 4	85	Active. Limited to 208,000T/yr; WAC exclude asbestos and contaminated soils
205 Bedford Rd, Te Kowhai	IH Wedding & Sons (Waikato) Ltd	Class 2 & 4	50	Active, but can only accept 300m³/d. While consent allows for accepting C&D waste, site is only accepting cleanfill now.
Riverview Rd, Huntly	Gleeson Quarries	Class 3 & 4	40	WRC (15/4/24) have advised that final appeals have now been settled; earthworks are to start soon and estimated first cell open October 2024
225 Ridge Rd, Bombay	Ridge Road Quarry Limited	Class 3 & 4	114	Active
Ridge Rd, Bombay (Envirofill South)	ESL	Class 3 & 4	114	Active

Removing the contaminated soils from the land would avoid the Crown from having to manage them in the future, but it does not align with the Government's broader outcomes framework and sustainability objectives. Further, this approach would remove the soils from Te Rohe Pōtae shifting a problem to another region and taking up valuable landfill space. Since it does not appear that there are any suitable class landfill sites nearby, this option would entail additional transport costs, emissions and safety risks. Additional truck movements on Te Mawhai Road to relocate soil to another region may also be a nuisance for neighbours.

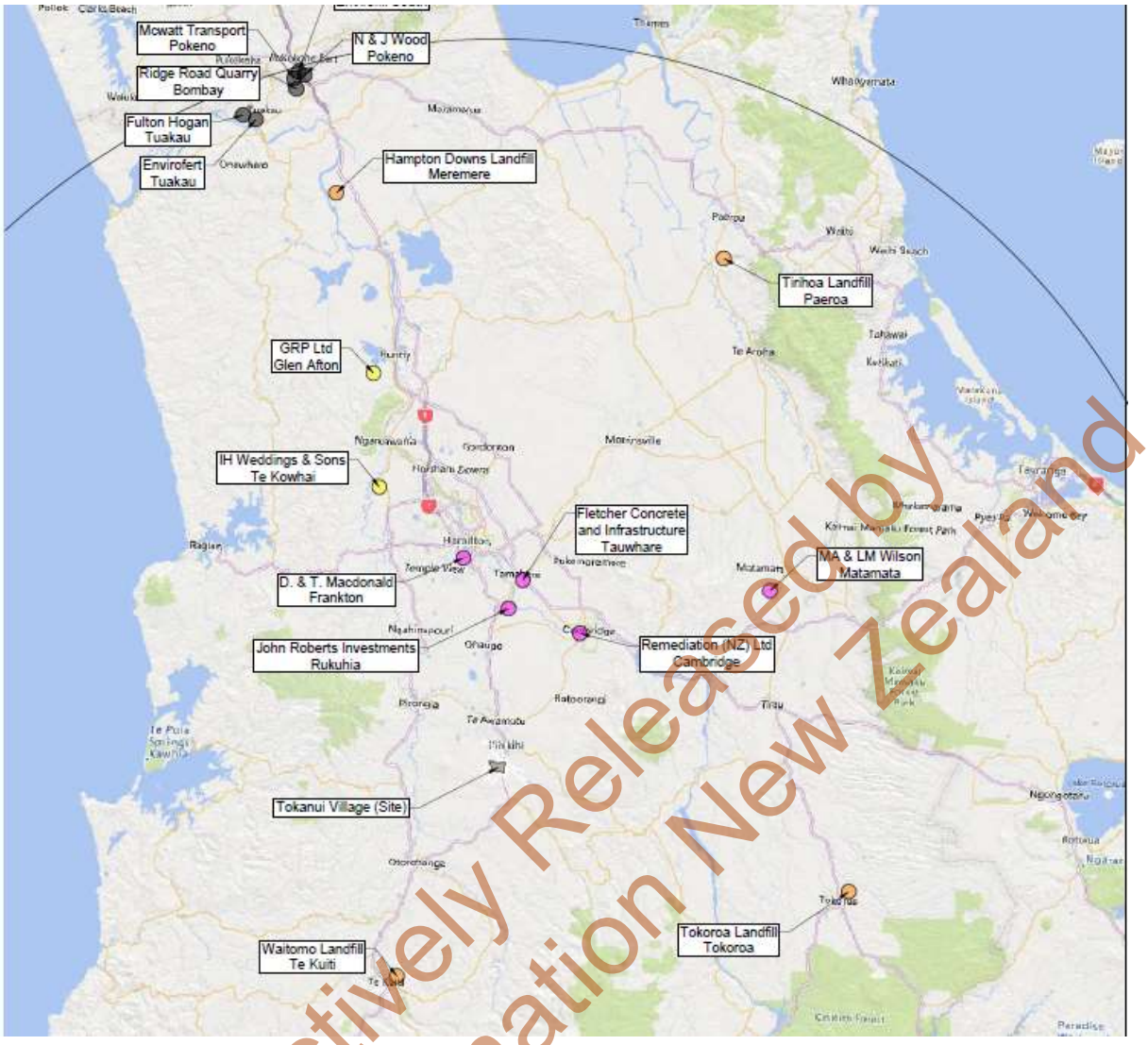


Figure 12: Disposal site locations relative to site within 100km radius (circle outline)

Table 12: Waikato Region Cleanfill and Managed Fill WAC (mg/kg)

Item	Contaminant	Cleanfill (Waikato region)	Gleeson Managed Fill	Bombay Quarry Managed Fill	Ridge Rd Managed Fill	GRP Ltd, Rotawaro - Cleanfill	Hampton Downs Landfill	Hampton Downs Landfill – TCLP (g/m^3)
Trace elements	Arsenic	17 to 20	100	52.5 (70)	70-140	20	100	5
	Boron	15	45 (260)	130 (260)	260	15	500	25
	Cadmium	0.8 to 1	7.5	0.9 (1.2)	7.5-10	1	20 (500)	1
	Chromium	56	400	270 (362)	400	95	Cr(III): 600 Cr(VI): 100	Cr(III): 30 Cr(VI): 5
	Copper	120	280 (325)	80 (107)	280	120	200	10
	Lead	78	250 (1000)	157 (210)	250-460	90	200	10
	Mercury	1	1.5	0.75 (1.0)	0.75-3	2	4 (500)	0.2
	Nickel	33 to 50	65 (320)	220 (320)	320	60	200	10
	Zinc	175	400 (2000)	655 (1160)	400-1200	175	500	25
Organic compounds	TPH (C7-C9)	110*	120	(2700)	200	2700	--	--
	TPH (C10-C14)	58*	300 (1400)	(2000)	300-600	560	--	--
	TPH (C15-C36)	--	20000	>20000	5600-20000	4000	--	--
	Benzene	0.11 to 1.1	0.2	0.5 (0.66)	0.11	1.1	--	--
	Ethylbenzene	10 to 53	1.1	0.85 (1.1)	10	53	--	--
	Toluene	19 to 68	1.0	0.75 (1.0)	19	67	--	--
	Total Xylene	25 to 48	0.61	0.45 (0.61)	25	48	--	--
	Benzo[a]pyrene (equivalent)	0.2 to 2.8	20	26.25 (35)	20-125	0.27	--	--
	Dieldrin	0.02 to 0.1	0.7	0.015 (0.020)	0.2-0.7	0.02	(1.3)	
	Total DDT	0.5 to 2	8.4	0.7 (12)	12	0.70	2.7*	

Notes: *Some variation for older consents

1. For Gleeson's Managed Fill, for concentrations above the lower limits stated up to the upper limit in brackets, SPLP leaching testing is required to confirm fill acceptance. SPLP limits for lead and zinc are 0.34mg/L and 0.8mg/L respectively.
2. For Bombay Quarry, lower value is weighted 12 month rolling mean; upper value is maximum allowable concentration
3. For Ridge Rd, lower values are for quarry and upper for quarry type 2 fill.
4. For GRP Ltd, stated WAC re for cleanfill; C&D WAC are listed in schedule 2 of their consent
5. For Hampton Downs landfill, first number is maximum concentration without TCLP, number in brackets is maximum concentration with TCLP, where stated; acceptable TCLP limits stated in separate column; DDT is calculated sum of 3 different DDT species

9.1.8 OPTION 8: HYBRID COMBINATION SOLUTIONS

For the asbestos-contaminated soils, reuse as managed backfill and blending to acceptable concentrations are not feasible: only containment or landfilling could work.

For those lead-contaminated soils that exceed managed remedial standards, blending may still be viable.

For the remainder of the contaminated soils, all five short-listed options are feasible. Blending could make them meet the rural residential remedial standards, which would be a technically preferable outcome, avoiding the need for further management or remediation in the future.

Thus, a combination of solutions is possible, as summarised in the following table.

Table 13: Combination Options Matrix

Option	Soil contaminant	Zinc	Lead within managed standard	Lead exceeding managed standard	Asbestos
1	Backfill	Feasible	Feasible	Possibly feasible together	**Not an option**
2	Blending	**Effective**	**Effective**		**Not an option**
5	Containment	Feasible	Feasible	Feasible	Feasible
6	Onsite disposal	Feasible	Feasible	Feasible	Feasible
7	Offsite disposal	Feasible	Feasible	Feasible	Feasible

9.2 CONSTRAINTS ANALYSIS

Constraints mapping was undertaken for options that involve any "new works" on the Site that will create new features (e.g. new containment cell, extension of existing disposal site(s)) for the following matters:

- Proximity to existing residential dwellings that are to remain;
- Geotechnical – geology and slope stability;
- Cultural significance;
- Archaeological;
- Heritage;
- Productive land classification;
- Ecology;
- Surface water conveyance; and,
- Groundwater.

These constraints are further described in sections 9.2.1-9.2.6, associated figures and are identified on the attached Features Plan (drawing 33205/G01).

9.2.1 PROXIMITY TO RESIDENTIAL DWELLINGS

Residential dwellings that are in relatively close proximity of the site include those located along Te Mawhai Road to the north of the site, a cluster of houses at the Cruickshank/Te Mawhai Rd intersection to the north west of the Site, and another cluster of houses along Croasdale and Symonds

Rd to the east of the Site. The Mangatoatoa Marae is also located approximately 400m from the north-eastern corner of the Site. These residential dwellings are shown on Figure 13.

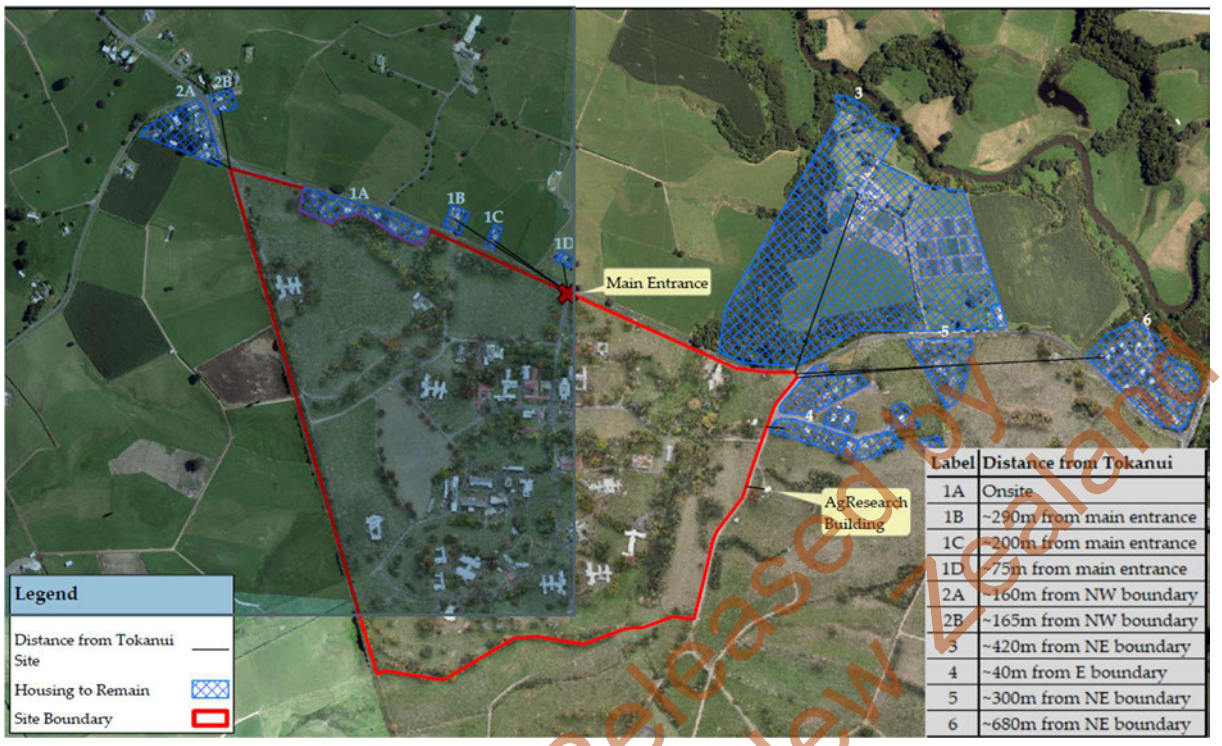


Figure 13: Residential dwellings that are to remain within close proximity of the Site and the Marae land (feature 3)

9.2.2 ALLUVIAL SOILS

Alluvial soils identified from the FTL geotechnical review are shown in Figure 14. Alluvial areas should be avoided if possible for any proposed containment cells and extension of existing disposal site(s). Otherwise undercutting and off-site disposal of the alluvial materials will be required.

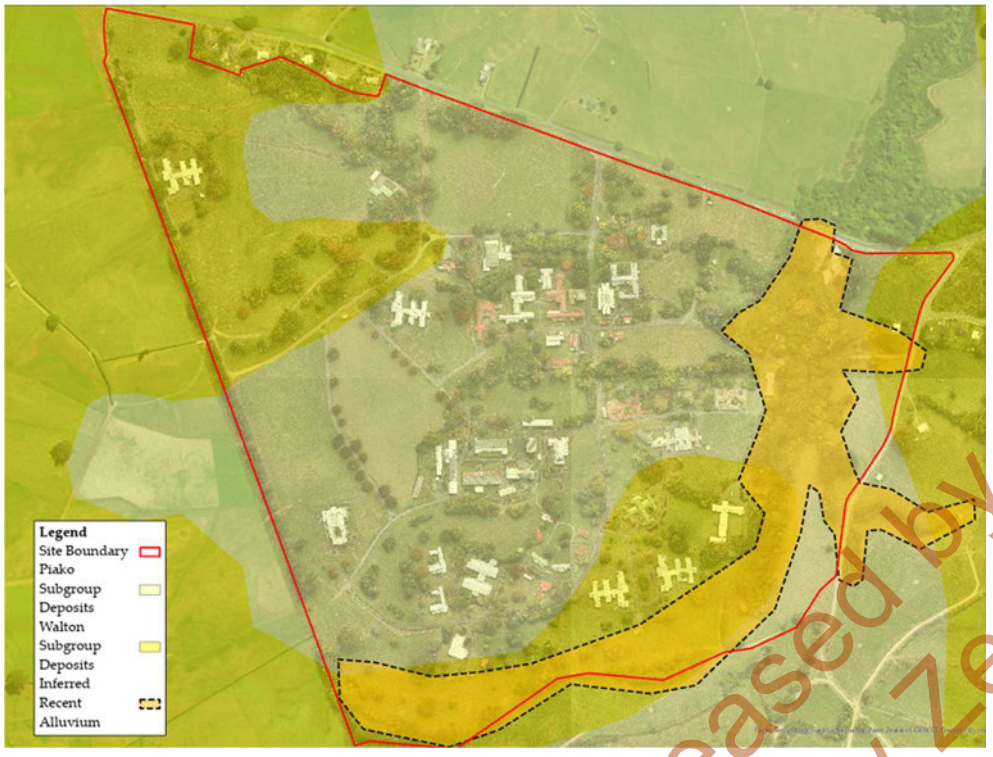


Figure 14: Annotated geological map of Tokanui Hospital site showing alluvial soils

9.2.3 CULTURAL SIGNIFICANCE

As noted above, LINZ previously commissioned a CIA to help inform assessment of effects from the onset of project delivery. While the CIA was focused on the options pertaining to handling of demolition waste, there are strong parallels or themes that relate to the contaminated soil remediation.

The CIA for the Site relates that:

Mokoroa was the only name used from ancient times when referring to what is now known as Tokanui Hospital campus…

Mokoroa was one of two swamps that were drained and filled to build the hospital; the name of the other swamp was Tarutuhi. Both of these swamps were located on the land where the hospital was built. The swamps were drained and filled to build the hospital.

Mokoroa is also another name for taniwha. A kaitiaki in this case. It was and still is a very significant and special place for Ngāti Paia, a place of healing, learning, reflection, maara kai. Kai from the swamps (tuna) and surrounding plants, shrubs and trees, rongoā… [Ref: Te Muraahi and Maniapoto].

This history and description of the Site prior to development by the Crown aligns with the wetland areas identified in the northwest of the Site that have been considered potentially ecologically sensitive.

Additional information pertaining to potential impacts on the whenua and wider cultural landscape were described at the Cultural Induction held between 8 – 9 February 2023 and summarised in the Waahi Tapu Investigation and Cultural Induction Summary (TAR 2023). This

work resulted in the identification of several waahi tapu area, which are therefore culturally significant. These are shown in blue on Figure 15.

Figure 15: Tokanui Hospital Site – Culturally Significant Areas of Interest

9.2.4 ARCHAEOLOGICAL SIGNIFICANCE

All archaeological sites, based on evidence of pre-1900 human occupation, whether recorded or not, are protected by the provisions of the Heritage New Zealand Pouhere Taonga (NZHPT) Act 2014 and may not be destroyed, damaged or modified without an authority issued by Heritage New Zealand Pouhere Taonga.

CFG Heritage undertook an archaeological assessment of the site and identified the following areas of potential archaeological interest:

- A low hill extends from outside the property into the northwest corner of the site, on which Building 55 is currently located (trapezoidal area around Building 55 in Figure 16).
- This comprises a hill (Mokoroa Hill) that extends through the centre of the former Tokanui Hospital in the form of a headland, bordered by a stream (large blue area, western side in Figure 16). Although there is evidence of ground modification for roading and structures across the hill, there is potential for previously unrecorded archaeological sites being present here based on its position as a high point surrounded by historic wetlands, in an area which historic sources and oral traditions indicate was used by Māori pre-1900.
- This is a small hill on which the former Tokanui Hospital morgue stands and comprises a headland resting at the intersection of, and overlooking, two small streams (small blue triangular area,

eastern side in Figure 15). The hill is covered in exotic trees, with native undergrowth and has a stepped eastern slope. Awakeri Pā may have been located on or near the hill in this area. The landfill itself is not an archaeological site as it does not predate 1900, but the ground which it sits on could have potential sites which can be managed by the process outlined below.

The CFG Heritage 2024 recommends that an Archaeological Authority be obtained from HNZPT to modify or destroy previously unrecorded sites for works in the three areas indicated on Figure 15. This is a legal requirement.

It further recommends that an Archaeological Management Plan be prepared to accompany the Authority application. This will set out appropriate methods for managing any effects on these three sites during soil disturbance works and will need to be followed by all contractors working in these areas.

Figure 16: Tokanui Hospital Site – Areas of Potential Archaeological Interest (blue shading)

9.2.5 HERITAGE

There are no buildings with heritage status on the site.

9.2.6 HIGHLY PRODUCTIVE LAND USE CLASSIFICATION

The National Policy Statement for Highly Productive Land came into force in October 2022 and places restrictions on rezoning, subdivision and land use proposals on land that meets the transitional definition of Highly Productive Land (HPL) – Land Use Capability (LUC) Classes 1-3, with some

exceptions. This transitional definition applies until each relevant territorial authority provides a regional policy statement containing HPL maps for their region and this policy statement is operative.

The site is zoned 'Rural Zone' (Waipā District Plan, 2019 – Map 12), while LUC maps indicate that most of the site (refer Figure 17) falls under LUC Class 2 which is defined as "*very good multiple-use land, slight limitations, suitable for cropping, viticulture, berry fruit, pastoralism, tree crops and forestry*". Hence, the Site would be classified as HPL Class 2 under the NPS-HPL.

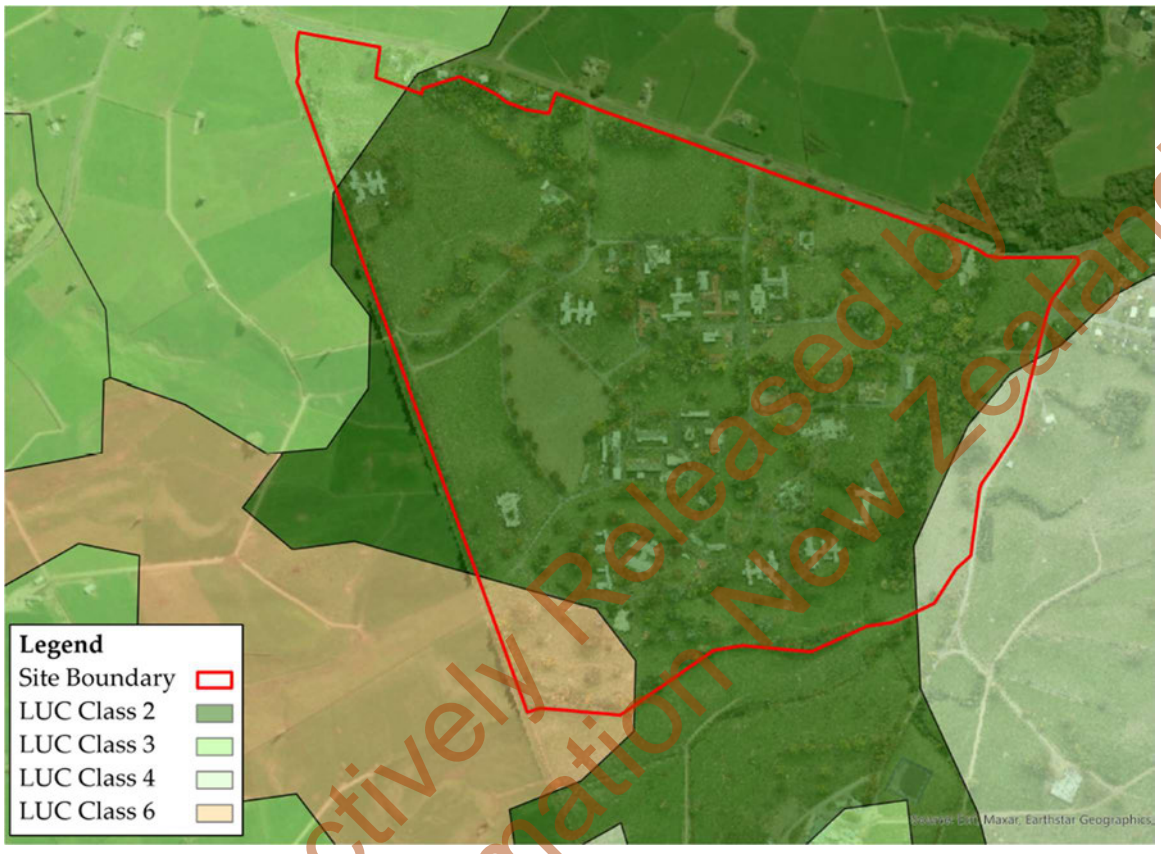


Figure 17: Tokanui Hospital Site – HPL Class 1 and 2 Overlay

As part of the options analysis on the construction of a new disposal site to manage non-recyclable demolition material, advice was prepared by Soil and LUC Consultant, Dr Scott Fraser. As the requirements are similar, this advice has been applied to the option of constructing a new containment cell for contaminated soil. Dr Fraser advised that the LUC maps do not accurately reflect what was on the Tokanui village land in the 1980s, which needs to be considered when planning site restoration works. He further advises that a new disposal site could potentially be developed onsite without impacting existing HPL if it was constructed on land occupied by existing infrastructure which would not be currently considered HPL (e.g. industrial area). When any potential new disposal site construction was completed if a cap of no less than 60cm of good quality soil was reinstated this land could also be restored as HPL. However, subsoil drainage and compaction would need to be carefully managed.

Taking Dr Fraser's comments into account, the HPL classification of the Site is likely to make it more difficult to obtain consent for construction of a containment cell for contaminated soil onsite, if constructed on land not currently occupied by existing infrastructure. It may still be difficult to construct on other HPL land where there is existing infrastructure, as the HPL National Policy

Statement is relatively new and hence largely untested, so local and regional councils would need to be consulted with to check if they agree with Dr Fraser's opinion set out above, that areas of the Site occupied by existing infrastructure would not currently be considered HPL.

A new containment cell can be designed and constructed so as to ensure the productive land use of the containment cell location is maintained post-containment, through the provision of an appropriate "agricultural cap" over the containment cell cap. Dr Fraser sets out minimum requirements above, based on 60cm of good quality soil and careful management of subsoil drainage and compaction.

9.2.7 WETLANDS

Wetlands identified on the site from the ecological investigation, taking into account the latest definition of what is a natural inland wetland from the National Policy Statement - Freshwater Management (January 2024) are shown in Figure 18.

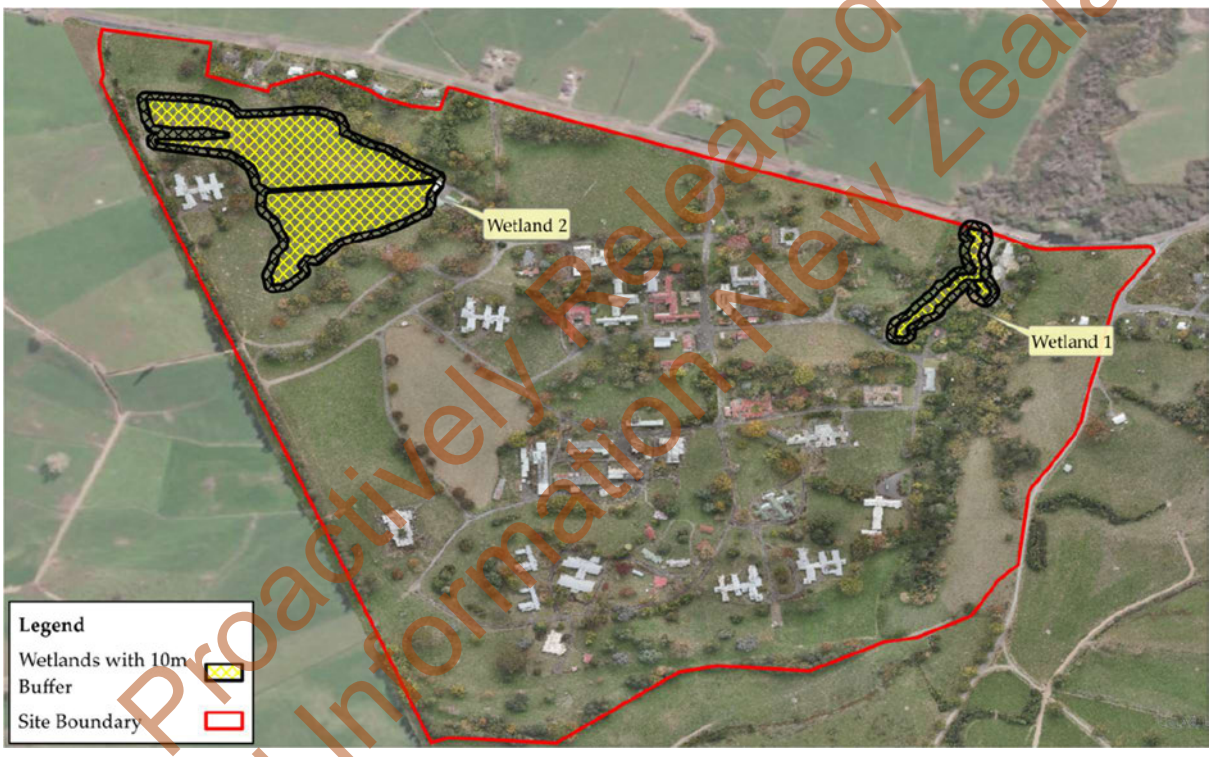


Figure 18: Tokanui Hospital Site – Natural Wetland Extents from SLR (previously 4Sight) Ecological Assessment

9.2.8 SURFACE WATER CONVEYANCE

Investigation of the Site's stormwater system has found that runoff from upgradient farmland to the west of the site has been piped through the site as shown in Figure 19 below, meaning these historical watercourses have been infilled and also realigned as the stormwater pipe system alignment differs from the historical swamp/watercourse alignment.

CCTV investigation has shown that these stormwater pipes are in relatively poor condition. Under common law, a downgradient property cannot restrict the passage of upgradient surface runoff through it. This means that the existing stormwater pipe "trunk main" drainage system will either

need to be repaired, replaced or removed and a stream reinstated along its current alignment or the historic alignment (this practice is known as "stream daylighting").

It is preferable that any backfill area or blended low level contaminated soil area or new containment cell is not located over the trunk main stormwater drainage system or in close proximity to any reinstated watercourse.

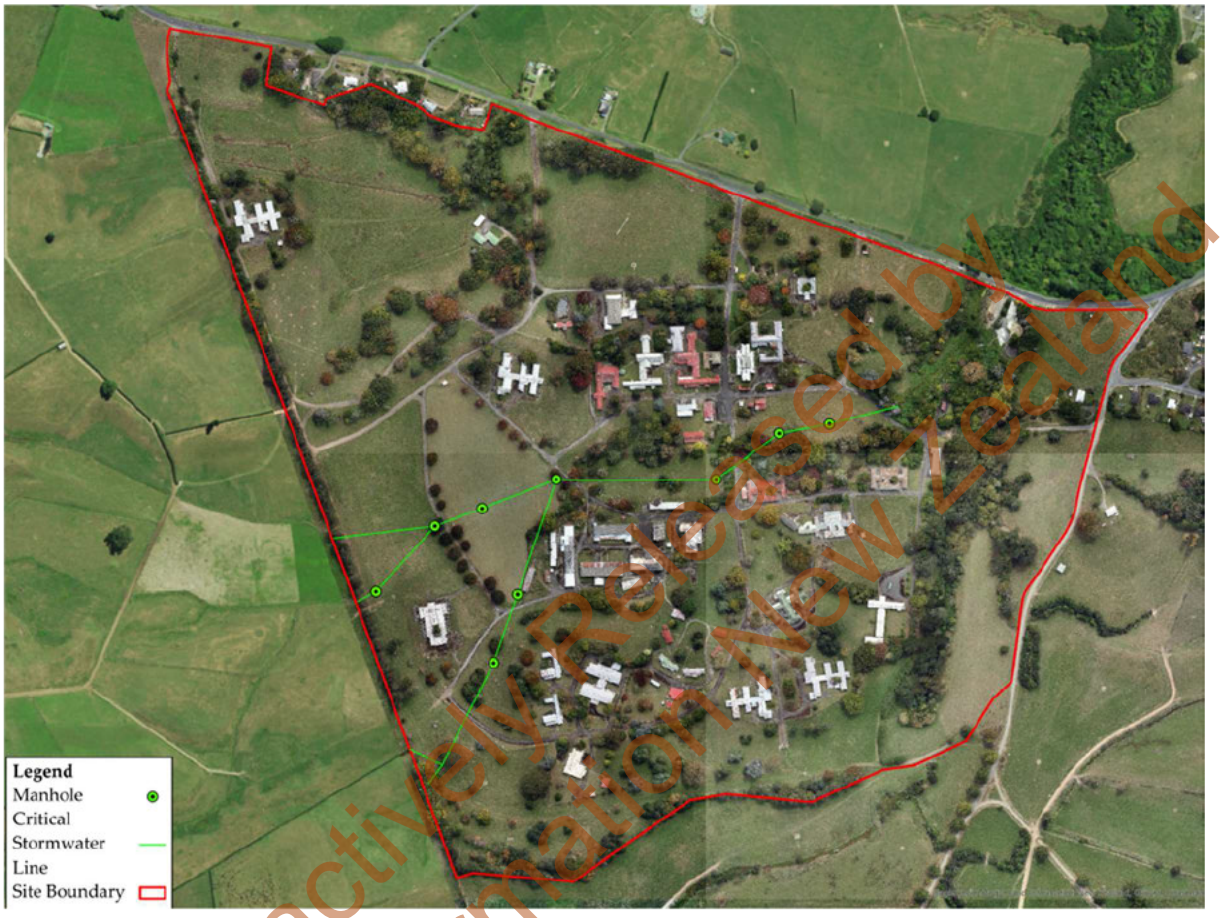


Figure 19: Tokanui Hospital Site – Current Trunk Stormwater Reticulation conveying upgradient runoff through Site

9.2.9 SUMMARY

Table 14 provides a summary of site constraints and how they may be managed or mitigated for the proposed works in general terms.

Table 14: Site Constraints and Proposed Management/Mitigation Measures

Item	Description	Management/Mitigation Measure
Proximity to nearby residential houses	Remedial works locations need to take into account distances to the nearest residential dwellings. Refer Figure 13.	Some remedial options include relocation areas for contaminated soils. If any of these options are selected, the locations will be chosen to achieve appropriate separation distances to nearby houses as much as practicable.
Geotechnical issues	FTL geotechnical investigation found that recent alluvial	Alluvial areas should be avoided if possible for any proposed containment cells and extension of

	deposits generally comprising compressible clays, silts and organic material may be present within isolated low-lying areas adjacent to streams and gully features in the eastern and southern parts of the site. Refer Figure 14. Potential slope stability issues in any areas steeper than 1V:4H.	existing disposal site(s). Otherwise undercutting and off-site disposal of the alluvial materials will be required. For any new works located on or within close proximity to slopes at or steeper than 14° to the horizontal (1V:4H), additional geotechnical investigation and slope stability appraisals should be undertaken to assess potential impacts.
Culturally Significant Areas	Five areas identified to date: Large area SW of Buildings B75/76 (location of 3 former buildings); wetland adjacent to former WWTP; Areas around Morgue (B25), Ward 21 (B26), and Old Morgue (B19); refer 33097 series drawings and Figure 15.	Works in these areas need to follow specific requirements, including pre-approval from LINZ and observation by cultural monitors. "New works" should be avoided in these areas where possible.
Archaeological significant areas	Three potentially significant areas identified. Refer Figure 16.	Works within these areas will be subject to an Archaeological Authority and associated Archaeological Management Plan, setting out appropriate methods for managing any effects on these three sites during soil disturbance works and will need to be followed by all contractors working in these areas.
Heritage	No heritage buildings identified on the site.	Not applicable.
Highly productive land use classification	Soils across site classified as LUC Class 2 or 3. Refer Figure 17.	Proposed contaminated soil remedial works will reduce the extent and severity of soil contamination on the Site, helping to restore soil productivity.
Ecology	Trees	Recommended that all large trees (native & exotic) are retained to avoid adverse effects on fauna, and to retain amenity values, where possible. Hence, large trees (≥15+ meters) or any protected trees should be managed to mitigate any detrimental impacts on these trees. All remedial options should avoid working within tree driplines, as much as practicable.
	Bats / Avifauna	Contractor must comply with the Bat Management Plan (BMP) provided separately.
	Wetlands	Three natural wetlands identified on-site as shown in the 33097 series drawings and on Figure 18. Works within 10m of any of these wetlands will be covered under specific resource consent conditions.

Surface water	Upgradient farm land drains via stormwater pipes through the site via several routes, as shown in Figure 16. These pipes need protecting from damage.	Preferable that any new containment cell is not located over the trunk main stormwater drainage system or in close proximity to any reinstated watercourse.
Groundwater	Potentially elevated groundwater table, especially during winter months.	Majority of site encompassing the hospital infrastructure is classified as "poorly" or "imperfectly" drained areas on Landcare S-Maps. GHD advised that AECOM (DSI) found groundwater levels of 1.3-2.4m bgl over period May-Sep, inferred to represent winter conditions, while GHD only found groundwater in one location (B74, TP2) at 2.1m bgl. Contractor is responsible for any groundwater dewatering that may be required during soil remediation works. Available information and generally shallow nature of soil contamination works indicates this is low risk.

9.3 OPTIONS REFINEMENT

Table 15 provides an additional specific assessment of how soil with different levels of contaminants is handled in each option, site specific constraints relevant to each option, and which options have been rejected from further consideration, based on the preceding assessment.

Table 15: Options Summary, including Site Specific Constraints

Option	Name	Low Level Contaminated Soil		Moderate Level Contaminated Soil	Specific Site Constraints for each option
		No Asbestos	With Asbestos		
1	Reuse as Backfill	Suitable	Not Suitable	Not Suitable	Industrial area preferred site, to minimise potential HPL issues
2	Blending	Suitable	Not Suitable	Potentially Suitable (if asbestos free)	If blending moderate level soils to low level status, will result in larger volume of low level contaminated soils, with possible HPL issues
3	Stabilisation	Not applicable – rejected for further consideration			
4	Bioremediation/ destruction	Not applicable – rejected for further consideration			
5	New containment cell on-site	Suitable	Suitable	Suitable	Industrial area is preferred location – avoids alluvial soils, HPL and stormwater issues
6	Utilise existing disposal site(s)	Suitable	Suitable	Suitable	Northern site within 65m of cluster of residential houses

					and ~40m from farm house on adjacent property
7	Off-site disposal	Suitable	Suitable	Suitable	None
8	Combination	Varies - see Table 13			

9.4 CONSENTABILITY

9.4.1 PRELIMINARY CONSENTING REQUIREMENTS

This section provides an assessment of the likelihood of successfully gaining consent for the five short-listed options being considered, based on SLR's (previously 4Sight) Legislative/Planning Assessment (2022), AECOM (2019) and FTL / HAIL professional experience.

All remedial options involve moving contaminated soils within the site and potentially outside of it and hence could face a range of consenting requirements. These requirements were evaluated for demolition waste earlier in the project and have been updated in this report for contaminated soil remediation. This assessment is summarised below.

Table 16: Preliminary Consenting Requirements for Soil Remediation

Plan/Standard	Preliminary Assessment of Consenting Requirements
NESCS	Consent will likely be required for disturbance of soil and possibly changing land use, irrespective of which remediation option is chosen. Consent status to be determined.
NES - Freshwater	Consent may be required for any earthworks located within a 100m setback from a natural wetland and will be required for earthworks within 10m of a natural wetland. Consent status to be determined.
Waikato Regional Plan	Rule 5.2.7.1 – Discharges into or onto land and any subsequent discharge of contaminants into water or air as part of the operation of a landfill is a **Discretionary Activity.** Rule 5.3.4.8 – Any discharges arising from the remediation of contaminated land that does not comply with the permitted or controlled activity rules is a **Discretionary Activity.** Rules 5.1.4.11-15 – Soil Disturbance in high risk erosion areas (generally within 10m of wetlands and streams). Consent status to be determined based on volume and length of works in the high risk erosion area.
Waipā District Plan	Rule 4.4.2.75 – Earthworks in the Rural Zone exceeding 1000m^3 – **Discretionary Activity** Rule 26.4.2.1 – Earthworks within 23m Setback from lakes and water bodies – **Restricted Discretionary Activity** Rule 4.4.1.5(b) – Landfills in the Rural zone are not listed within the activity status tables and therefore default to a **Non-Complying Activity** Rule 16.4.2.22 – Activities generating over 250 vehicles per day (with heavy vehicles taken as 10 car equivalents) – **Restricted Discretionary Activity**
HNZPT	**Archaeological Authority** required for three locations on the Site (refer section 9.2.4).

Additionally, disturbing asbestos-contaminated soil is controlled by the Asbestos Regulations (under the Health and Safety at Work Act 2015). These regulations seek to ensure that asbestos fibres in air never exceed an acceptable level. When triggered, they require a wide range of health and safety controls to be implemented. All confirmed low/moderate level contaminated soil has no or low levels of asbestos for which the associated management controls are relatively straightforward. More significantly contaminated areas may be found during the demolition process, particularly from building sub-floor scrapes and removal of asbestos pipes. For extensive works on significantly contaminated soil, these controls include specific expert skills, equipment and experience, and there are significant legal obligations on all parties involved.

Importantly the above table shows that if any option is considered a new landfill, then this will be a non-complying activity under the Waipā District Plan. This is likely to apply to Option 5 (new containment cell), while its applicability to Option 6 (utilisation of existing landfill) will be discussed with Council. The project planner, SLR, has advised that replacement and/or additional regional consents would be required for utilisation of the existing landfill, as that activity would be beyond the scope of the existing consents. LINZ is already considering the long-term management of the existing landfill, and as such will be taking these requirements into account as part of the assessment of remedial options.

9.4.2 POTENTIAL ACTIVITIES TRIGGERED

Potential activities triggered by different remedial options are summarised below.

Table 17: Potential Activities Triggered

Option	1 Backfill / Reuse	2 Blending	5 New Containment Cell	6 Utilise existing landfill	7 Off-site Disposal
NESCS – soil disturbance and possible change in land use	Yes	Yes	Yes	Yes	Yes
Earthworks	Yes	Yes	Yes	Yes	Yes
NES-FW	No*	No*	No*	No (124m minimum separation)	No
Discharge to ground / water	Unlikely	Unlikely	Potentially	Yes	No
Landfill	Potentially	No	Likely	Potentially	No
Groundwater dewatering	Unlikely	No	Potentially	No	No
Traffic Movements	Unlikely	Unlikely	Unlikely	Unlikely	Yes

*Assuming site suitably chosen to maintain sufficient separation to wetlands.

10.0 COSTS

10.1 BASIS

Costs for the options considered involving at least some off-site disposal (Options 1, 2 and 7) were estimated using the following:

- Soil volumes based on the combined soil sampling results undertaken to date and typical densities.
- Allowance for backfilling, retopsoiling and grassing costs of the areas where the contaminated soils come from, based on cleanfill (topsoil) being imported to site.
- For the backfilling option (Option 1), allowed for contaminated materials excavation only, as transporting soil and placing as backfill in another area would have been done in any case as part of the demolition works.
- Average rates from LINZ for excavation, transportation, plant and personnel and disposal facility rates, updated by LINZ to May 2023, with landfill disposal costs increased to allow for a $30/T increase in the landfill disposal levy since then.
- Estimation of loading, haulage and disposal costs for different waste materials. Factors were applied to some material categories on the base loading and haulage rates to reflect these materials have stricter handling and transport requirements (e.g. asbestos).
- Haulage for off-site disposal was based on a worst-case scenario of all materials being disposed to Hampton Downs Landfill, being the furthest from the Site (99km).
- Loading and haulage times were estimated from consideration of travel distance and time, other similar projects and experience.
- Allowance for contractor Preliminary and General (P&G) costs of 10%.
- Allowance for consultants and other professional fees of 7.5%.
- Allowance for escalation costs of 6%, based on the works being started in mid to late 2025.

Costs for on-site disposal (Options 5 and 6) were estimated using the following:

- The same approach as for Options 1, 2 and 7 except for the following.
- Haulage costs allowed for an average return trip of 1km within the site.
- Estimation of costs for a new containment cell or extension of the existing disposal facility covering construction, filling, capping and closure/aftercare, based on a geocomposite base liner (options 5B, 6 only), groundwater underdrainage, clay and HDPE/LLDPE liner capping, retopsoiling and regrassing to enable productive land use. Access roading and a turning circle area, erosion/sediment controls and stormwater drainage were also allowed for. Leachate collection was not allowed for, based on the low/moderate level of the soil contamination and the low leachability test results.
- Allowance for consultants and other professional fees of 10.5%, to incorporate landfill design costs.

In both cases, no allowance was made for:

- Cavities already having been partially created as a result of demolition works, which would reduce landfill cell construction costs, or

- Offsetting of landfill cell construction costs, due to funds being available from other sources to address some identified issues at the existing disposal sites, which would be tackled at the time of cell construction.

Ongoing operation and maintenance costs were estimated based on the following:

- Consent compliance checks – visual inspections on assumed six monthly basis.
- Any surface water, groundwater monitoring required under the consent – assumed sampling required at 6 month intervals.
- Routine maintenance – e.g. reinstating cap/topsoil cover, fixing any scour/erosion, etc.
- Estimation of total operational and management (O&M) costs over a 10yr period based on an average inflation rate of 2.1%, compounded over the 10 year period.
- For option 6, the O&M costs have been expressed as net increased O&M costs, determining the total estimated O&M costs and then deducting estimated existing O&M costs for the existing closed disposal site, as LINZ currently incurs O&M costs for maintenance of the existing disposal site already and the ongoing O&M tasks associated with this option are substantially unchanged.

10.2 COSTS – CONFIRMED CONTAMINATED SOIL ONLY

This section summarises the remedial and ongoing (Operation & maintenance) costs excluding additional contaminated soil that may be generated from building subfloor area scrapes, building halo scrapes, and from asbestos pipe removals.

These costs are illustrated in Figures 19 and 20 and summarised in Table 18. The remedial costs clearly show that "off-site disposal" (Option 7) is the most expensive option, with transport and disposal charges making up most of these costs, so it is important to reduce the volume of material that requires disposal to a Class 1 or 2 landfill offsite, as much as possible, or to explore alternative, closer disposal facilities than Hampton Downs (e.g. Gleesons managed fill in Huntly which may be open from October 2024). Options 1 and 2 achieve reduced volumes to off-site disposal and this is reflected in their reduced one-off costs. Options 5 and 6 costs are controlled by the costs of constructing, filling and capping a new containment cell or utilising the existing disposal facilities on-site. Costs are strongly affected by fill depth and decrease significantly with increasing depth over the range allowed for (typically 1.5-3m depth).

It has been assumed that any new onsite disposal site would be a non-commercial operation and not subject to the national landfill levy, a view that has been informally discussed with Ministry for the Environment staff and considered reasonable, based on the nature of the facility and that it is not receiving any waste from outside the site and not generating any income.

Table 18: Disposal Options Cost Comparison – confirmed contaminated soil (2,400m^3)

Option	Description	Remedial costs	Ongoing O&M costs (10yr total)	Combined Total	Rank (highest to lowest)
1	Backfilling low level, asbestos free contaminated soil – all other soils to off-site landfill	[redacted]	[redacted]	[redacted]	3
2	Blending low and moderate level, asbestos free soil – all other soils to off-site disposal	[redacted]	[redacted]	[redacted]	4
5	New onsite containment cell	[redacted]	[redacted]	[redacted]	2
6A	Utilise existing disposal site (increase height)	[redacted]	[redacted]	[redacted]	6
6B	Utilise existing disposal site (increase area)	[redacted]	[redacted]	[redacted]	5
7	Off-site disposal of all contaminated soil	[redacted]	[redacted]	[redacted]	1

Note: Ongoing cumulative 10yr O&M costs for the existing closed landfill are estimated to be [redacted]
There are also additional repair and upgrade works required on the landfill which are reported on separately.

Figure 19: Tokanui Contaminated Soil Disposal Options Cost Comparison – Remedial costs

Figure 20: Tokanui Contaminated Soil Disposal Options Cost Comparison – Cumulative O&M Costs over 10 Year Period

10.3 COSTS – ALL ACTUAL AND POTENTIAL CONTAMINATED SOIL

This section summarises the remedial and O&M costs including additional contaminated soil that may be generated from building subfloor area scrapes, building halo scrapes, and from asbestos pipe removals. The most likely contaminant from this material is asbestos, but as asbestos does not leach, no additional provision has been made for leachate collection and disposal.

These costs are summarised below in Table 19 and illustrated in Figures 21, 22 and 23. The remedial costs clearly show that as the amount of contaminated soil that needs to be disposed of off-site increases, "off-site disposal" (Option 7) becomes relatively more expensive compared with other options and Options 1 and 2 offer proportionately less cost reduction. Conversely, Options 5 and 6 costs become relatively less expensive in terms of remedial costs.

Table 19: Disposal Options Cost Comparison – all potential and actual contaminated soil (5,530m^3)

Option	Description	Initial Materials removal / disposal costs	Ongoing O&M costs (10yr total)	Combined Total	Rank (highest to lowest)
1	Backfilling low level, asbestos free contaminated soil – all other soils to off-site landfill	[redacted]	[redacted]	[redacted]	2

2	Blending low and moderate level, asbestos free soil – all other soils to off-site disposal	[redacted]	[redacted]	[redacted]	4
5	New onsite containment cell	[redacted]	[redacted]	[redacted]	3
6A	Utilise existing disposal site (increase height)	[redacted]	[redacted]	[redacted]	5
6B	Utilise existing disposal site (increase area)	[redacted]	[redacted]	[redacted]	6
7	Off-site disposal of all contaminated soil	[redacted]	[redacted]	[redacted]	1

Figure 21: Tokanui Contaminated Soil Disposal Options Cost Comparison – Remedial costs

Figure 22: Tokanui Contaminated Soil Disposal Options Cost Comparison – Cumulative O&M Costs over 10 Year Period

Figure 23: Tokanui Contaminated Soil Remedial Costs Comparison – Likely Initial Cost range from minimum (blue) to maximum (blue + red)

11.0 ASSESSMENT SCORES

11.1 SCORING PROCESS

FTL, HAIL and LINZ representatives reviewed the contents of this report, particularly the sections outlining the remedial options, constraints analysis, consentablity and costs. The options were then scored by following the process described below.

A scoring spreadsheet was developed based on the criteria, indicators and sub-factors outlined in Section 8, above, the full spreadsheet is provided in Appendix B.

11.1.1 SCORING CONSIDERATIONS

Under each criteria indicator, notes were added to the evaluation spreadsheet, summarising considerations that may influence scoring as described below. One example for each criteria are given below, while the complete notes can be viewed in the spreadsheet in Appendix B. For the cultural scoring consideration, wording from the Deed, Cultural Impact Assessment, the cultural induction provided by mana whenua and ongoing engagement with mana whenua and Te Nehenehenui were used to inform this assessment.

Table 20: Example of Scoring Considerations for Specific Indicators for each Criteria

Criteria, Indicator and Sub-headings	Scoring Considerations
ENVIRONMENTAL **Sustainability:** ***Reuse/recycling*** ***Resilience*** ***Legacy (future generation issues)***	**Reuse as backfill:** Low level contaminated soils still present on-site but contained in contiguous area – long term legacy issue **Blending:** Low level contaminated soils eliminated, but ongoing management/legacy issue if moderate contaminated soils blended to low levels; asbestos soils still need to be disposed of off-site. **New containment cell:** Contaminants still present on-site but contained in engineered cell which has finite life (long term legacy issue). **Utilise existing disposal site(s):** Contaminants still present onsite but with improved capping; long term legacy issue (similar to existing but involving increased waste quantities) **Offsite disposal:** Removes contaminants from site, avoiding long term legacy issue, but not in sustainable manner (road traffic, vehicle emissions from transport, problem shifted elsewhere)
SOCIAL **Neighbourhood effects:** ***Dust, noise, odour, vibration, traffic*** ***Changes to surface runoff flowpaths***	**Reuse as backfill:** Dust, noise and increased onsite traffic during works **Blending:** Dust, noise and increased onsite traffic during works (greater volume) **New containment cell:** Dust, noise and increased onsite traffic during works (greater volume if below ground cell) **Utilise existing disposal site(s):** Dust, noise and increased onsite traffic during works (greater volume associated with removal of existing cap and recapping after soil placement) **Offsite disposal:** Significant increase in traffic on public roads + dust/noise/increased onsite traffic
CULTURAL **Healing papatūānuku (Healing the land):** ***Soil health***	**Reuse as backfill:** Low level contaminated soil buried on-site in localised area; rest of site remediated **Blending:** Contaminants reduced to acceptable levels (or managed level if moderate level soils blended to low level soils) **New containment cell:** Contaminants contained in localised engineered cell, rest of site remediated

	Utilise existing disposal site(s): Uses existing disposal area, but with improved capping and topsoiling, improving existing situation **Offsite disposal:** All contaminated soil completely removed from site, providing maximum benefit to land (but shifts problem to another rohe (home area of a particular Iwi).
ECONOMIC **Minimisation of future liabilities:** ***Legacy effects of residual infrastructure/contamination left in place or deposited in landfill onsite***	**Reuse as backfill:** New future liability associated with backfill area (but existing liability associated with scattered low level contamination removed) **Blending:** Reduced liability **New containment cell:** Creates long term liability **Utilise existing disposal site(s):** Increased liability associated with existing disposal site, as contains more waste, but removes liability from rest of site - net neutral **Offsite disposal:** Maximum benefit in terms of minimising future site liability (but does shift liability elsewhere, albeit to engineered landfill)

11.1.2 WEIGHTINGS

Evaluation spreadsheet weightings for environmental, social, cultural and economic criteria were adopted from typical weightings used in the Mauri model. The adopted weightings were applied to support the priority order detailed in BRF 23-169 and has been updated following several hui with mana whenua in relation to the options presented in this report.

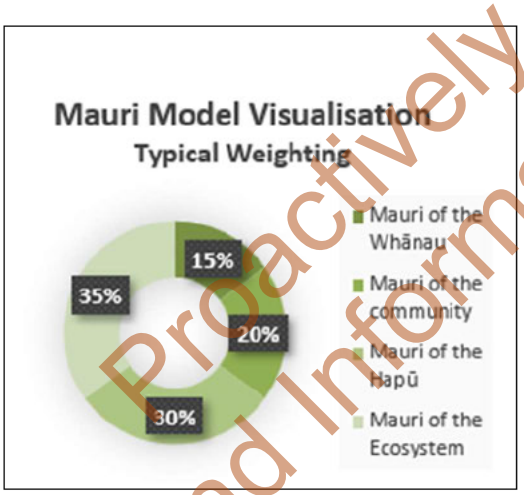


Figure 24: Mauri Model Typical Weighting (source: adapted from Morgan TKKB and Fa'aui TN (Sept 2014))

These weightings can be adjusted by the participants involved in the evaluation or alternatively sensitivity testing can be done with different weightings to check the effect this has on the ranking of different options.

Table 21: Criteria Weightings

Criteria	No of Indicators	Selected Weighting
Environmental	6	35%
Social	6	20%
Cultural	6	30%
Economic	6*	15%
Total	23	100%

***Note: With the economic criteria, the physical remedial works costs indicator was given double scoring, as it was considered this indicator should be given more weighting than the other economic factors. This also meant that each criteria had the same effective number of factors, so that all scores are directly comparable.**

11.1.3 SCORING

The adopted scoring system was again based on the Mauri model, with five scoring options, ranging from -2 (full negative) through 0 (no impact) to +2 (fully positive).

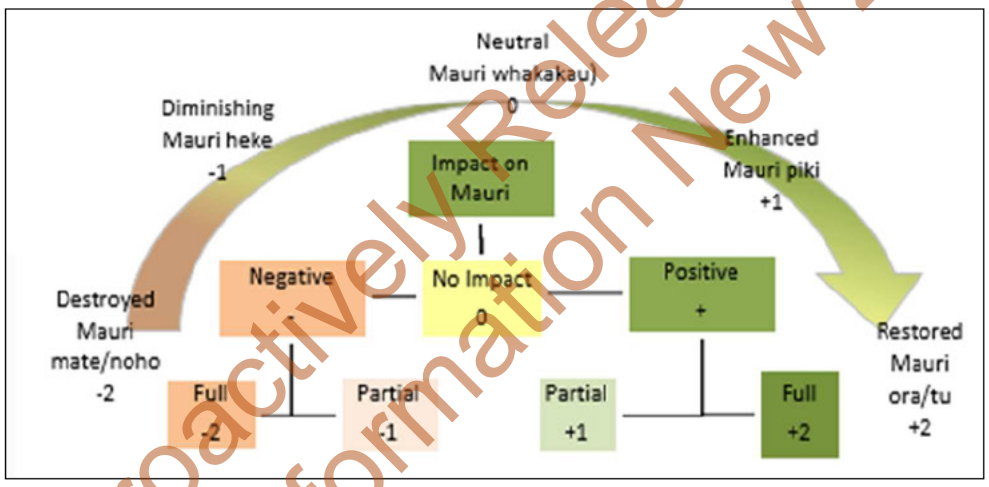


Figure 25: Mauri Model Visualisation (source: adapted from Morgan TKKB and Fa'aui TN (Sept 2014))

The five scores are listed below.

Table 22: Evaluation Scoring System

Score				
-2	-1	0	1	2
Fully negative	Partly negative	No impact	Partly positive	Fully positive

Scores for each criteria are obtained by summing up the scores of individual indicators and then multiplying those scores by the criteria weighting. The overall score for each option is then obtained by summing up the weighted criteria scores, with the options then ranked.

11.1.4 INTERPRETING RESULTS

With evaluation processes of this nature, it is important not to use the evaluation spreadsheet as a black box, ***it is a process to aid the decision making process NOT to replace it***. Therefore, one of the most important steps after completing the scoring/ranking process is to look at the results and see if they 'make sense'. If it cannot be explained why one option ranks higher or lower than another, then the individual scores for each criteria should be checked. Often it may simply be an error (putting the wrong number in the wrong box) or a realisation that the score given the first time was not quite right; or by reviewing the individual criteria scores, it becomes clearer why the option ranked the way it did.

The way the results are reported is also important. The rankings are generated automatically by the excel formula. When reporting these rankings it is important to approximate the rankings by giving options that score within 10 to 25 points of each other as an equal ranking. The MCA process is not an 'exact science' and so the reporting of the results should also reflect the approximate nature of the process. For example, if the option had the following 'Total Score', the ranking would be reported as follows:

Total Score	655	633	775	789	702
Ranking	4th=	4th=	1st=	1st =	3rd

11.2 PRELIMINARY ASSESSMENT RESULTS

Preliminary assessment results of the contaminated soil remedial options, based on LINZ, FTL and HAIL inputs, are summarised in Table 23, with details in Appendix B. These show:

1. The preferred option is Option 6 – utilising the existing disposal site with a total score of 1.4. This option presents an opportunity to add the low and moderate level soils to the existing landfill, while undertaking separate remedial works planned by LINZ at the same time (improved capping, groundwater diversion and flood risk reduction) that will result in decreased environmental, social and cultural effects of the existing disposal sites compared with the existing situation, even with the addition of the low and moderate level contaminated soil to them, and do so in a cost-effective way.
2. The second preferred option is Option 7 – off-site disposal with a total score of 1.0. This option gets rid of the low and moderate level contaminated soil off the site, but shifts the problem to another rohe, whilst incurring associated transport environmental effects, including importing suitable soil to backfill the cavities the contaminated soil was taken from which may be considered a wasteful use of a valuable resource. It is also worth noting that Option 7 does not include the significant upgrades to the closed landfill and would only see minimal repairs undertaken for the Crown to remain compliant with existing consents conditions.
3. The third preferred option is Option 5 – new on-site containment cell, with a score of 0.7.
4. The fourth preferred option is Option 2 – blending, with a score of 0.6.
5. The fifth and least preferred option is Option 1 – backfilling, with a score of -0.3.

A combination option of blending (Option 2) and utilising the existing disposal site (Option 6) may be worth considering, although this may end up being overall more expensive, as the main costs relate to landfill extension construction works.

Table 23: Preliminary Evaluation Scores

Option	1	2	5	6	7
Name	Backfill Reuse	Blending	New Onsite Contaminant Cell	Utilise Existing Disposal Site	Off-site Disposal
	Weighted Scores				
Environmental	0.0	0.0	0.6	0.7	0.2
Social	-0.2	0.1	-0.1	0.2	0.1
Cultural	-0.2	0.2	0.2	0.5	0.6
Economic	0.1	0.2	-0.1	0.0	0.1
Total	**-0.3**	**0.6**	**0.7**	**1.4**	**1.0**
Ranking	5th	4th	3rd	1st	2nd
	Deliverability Assessment				
Significant Site Constraints	None	Minor (possible HPL issues but limited to <15% site)	Minor (choose location to avoid alluvial soils, HPL issues, trunk stormwater system and high groundwater table)	Minor (choose location to avoid floodplain, proximity to nearby residential dwellings)	None
Consentability	Somewhat complex	Somewhat complex	Somewhat complex	Somewhat complex	Less complex

12.0 SUMMARY AND CONCLUSIONS

The assessment undertaken shows that Option 6 - disposing the confirmed and potential contaminated soil present on-site to the existing disposal site is the preferred option, followed by off-site disposal (Option 7). There may be some merits in blending some of the contaminated soil, but this would likely result in increased overall costs.

This report is based on the best information, currently available at the date of issuing this report. This report is considered sufficient for LINZ to determine how contaminated soil as a result of the Site's past use as a hospital will be remediated and managed and to proceed to developing a Remedial Action Plan (RAP) on that basis. The RAP will be used to support the resource consent application for the remediation works.

13.0 LIMITATIONS

The professional opinion expressed herein has been prepared solely for, and is furnished to our client, Toitū Te Whenua – Land Information New Zealand, on the express condition that it will only be used for the purpose for which it is intended.

No liability is accepted by this firm or by any Principal, or Director, or any servant or agent of this firm, in respect of its use by any other person, and any other person who relies upon any matter contained in this report does so entirely at its own risk. This disclaimer shall apply notwithstanding that this report may be made available to any person by any person in connection with any application for permission or approval, or pursuant to any requirement of law.

We do not assume any liability for misrepresentation or items not visible, accessible or present at the subject site during the time of the site inspection; or for the validity or accuracy of any information provided by our client or third parties that have been utilised in the preparation of this report.

14.0 REFERENCES

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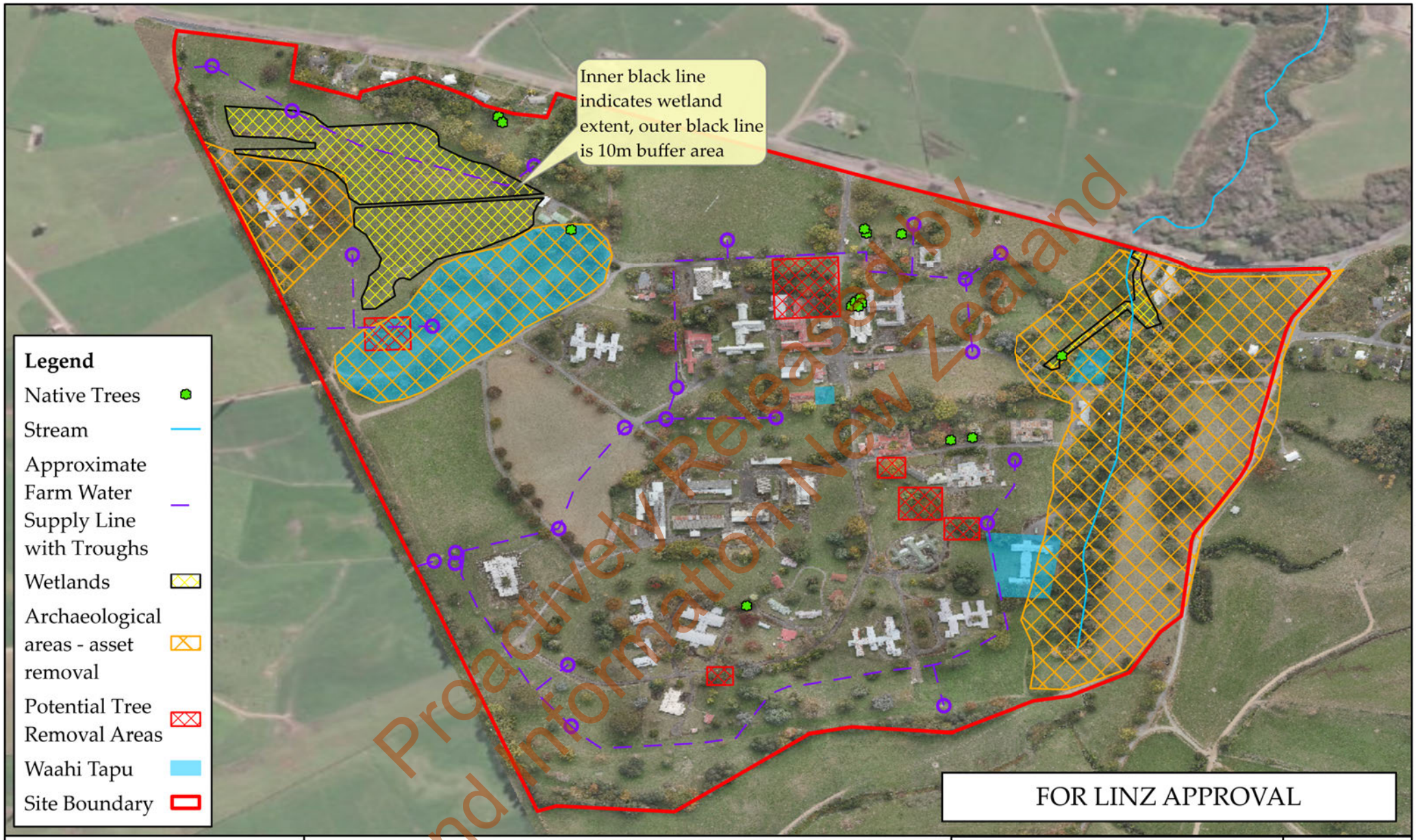
Drawings



Fraser Thomas
ENGINEERS · RESOURCE MANAGERS · SURVEYORS

G01: Site Features Plan

Toitū Te Whenua Land Information New Zealand
Remedial Options Report
Former Tokanui Hospital Demolition and Remediation Project
Tokanui
Te Awamutu

Date:	21/08/2024
Figure Reference:	33097/ROR/G01
Drawn by:	EB
Reviewed by:	SF
Job Number:	33097

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Appendix A

Options Costings

Appendix B

Options Evaluation

SCORING	
-2	Fully negative
-1	Partly negative
0	No impact
1	Partly positive
2	Fully positive

INDICATORS	SUB-HEADING	OPTION 1: Backfill					OPTION 2					OPTION 5				
		Scoring Considerations:					Blending					New Containment Cell				
		LINZ1	LINZ2	HAIL	FTL	Comb-ined	LINZ1	LINZ2	HAIL	FTL	Comb-ined	LINZ1	LINZ2	HAIL	FTL	Comb-ined
Environmental																
Effects on land use/productivity:	> Managing contamination of the land > Associated effects on land use / productivity	-1 Soil encapsulated in one place. Managed area will be to recreational like standard, so may limit use in this area of the site for future development if wanting to change to a more sensitive use	0	0 Confines contaminated soil within manageable area, little overall benefit	0 Shifts low level contaminated soil to new localised area on-site, representing an improvement compared with the present situation, due to elimination of scatttered low level contaminated soil across site but now all in one location = 0 (on balance)	-0.25	1 Site will meet rural residential standard and improve productivity and land use from current	-1	0 Soils become fit for purpose, but mass of contaminant not reduced	-1 Larger area involved in soil disturbance than other options	-0.25	1 contamination moved to one spot, so majority of site overall improved; but, that spot will have restrictions on land use. Overall positive impact.	-1	1 Manages waste within small area of site	1 Contaminated soils all moved to one place, with rest of site remediated, including soils > managed remedial standard	1
Surface water effects:	> Quantity - peak flows/volumes > Quality > Silt/sediment > Scour/erosion	0 will be encapsulated so unlikely to have an impact on surface water?	0	0	0 Neutral	0.00	0	-1	0	-1 Greater disturbed area --> potentially greater effects on surface runoff	-0.50	0	0	0	1 Improves existing situation, as contaminants all in one place and capped, so less potential to be entrained in surface runoff	0.25
Groundwater effects:	> Groundwater table effects (groundwater levels) > Quality > Use	-1 Potential for leaching? Does it need to be encapsulated?	-1	0	0 Likely low risk of encountering groundwater, as backfill will be relatively shallow	-0.50	0	0	0	0 No change in gw effects	0.00	0 presumibly would be lined as required?	-1	0	1 Slight improvement as all contaminants contained in lined cell, thus reducing potential leaching to groundwater	0
Ecological effects:	> Plants/Trees/Birds & Fauna > Aquatic species	0 encapsulated so unlikely to have impact	0	0	0 unlikely to affect local ecology as preferred backfill area is in existing industrial portion of site	0.00	1 Agree with HAIL	-1	1 Soils become fit for purpose	1 Slight benefit	0.50	1 contamination would be contained and managed.	-1	1 Breaks the pathway	1 Contaminants encapsulated	1
Air emissions:	> Dust/odour > Particulates/volatile gases > Greenhouse gases (carbon dioxide, methane)	0 less vehicle movments offsite, but still need to move soil around site.	0	0	1 Benefit of reduced traffic movements	0.25	0 emmissons during work to blend soils but only for a discrete period of time, impact likely negligent.	0	0	-1 Increased vehicle/plant movements due to mixing greater soil volumes	-0.25	1 Less truck movements to offsite landfills longer distances away from site. Still need to move around site during construction.	1	0	1 Reduced off-site traffic, as cell can contain all contaminated soil	1
Sustainability:	> Reuse/recycling > Resilience (e.g. ability to cope with climate change effects) > Legacy (future generation) issues	1 Don't need to bring fill onsite, wasting a resource	1	0	-1 Low level contaminated soils still on-site = long term legacy issue	0.25	2 keeps everything onsite but enables site to be remediated to acceptable standard, no need to move soils to and from site.	1	2 Eliminates waste altogether	1 Low level contam soils eliminated (except if moderate contam soils blended to low levels) but asbestos soils still need offsite disposal	1.50	1 manages contamination onsite rather than taking contaminated soil to municipal landfill	1	1 Manages waste within small area of site	1 Contaminants still present onsite but contained in engineered cell, which has finite life (50yrs)	1
Sub-total: Environmental		0	0	0	0	-0.04	1	0	1	-1	-0.04	1	0	1	6	2
Social																
Public health and safety:	> Physical injury > Contaminant effects on human health > Traffic impacts	0 Public would not have access to the area during construction. Area would be encapsulated and grassed following construction.	-1	0	-1 residual contamination will be present on land that is not under LINZ control and hence potentially more of a risk to public	-0.50	0 public not able to access site until remedial works are complete and site has been restored to appropriate levels.	0	0 Very low risk except if high levels of asbestos present	1 Residual low risk (assuming asbestos soils taken off-site)	0.25	0 Public not allowed to access site during work. Barriers will be in place after construction to limit exposure.	-1	0	1 Reduced risk as all soil contamination contained in engineered cell - reduced potential for public to contact	0
Worker health and safety:	> Physical injury > Contaminant effects on human health > Traffic impacts	0 would be managed during construction with LINZ H&S policy	0	0	-1 More soil handling as 2 steps - excavation + placement	-0.25	-1 Agree with HAIL	0	-1 Lots more soil handling, though not unusual	-1 More soil vol disturbed + 2 steps; possible dust issue	-0.75	0 will be managed during work	0	0	-1 3 steps - excavation + placement + cell construction	-0.25
Neighbourhood effects:	> Dust, noise, odour, vibration, traffic > Changes to surface runoff flowpaths	0 noise, dust, traffic onsite during construction. No effect afterwards so have scored 0 for long term impact	0	0	-1 Dust, noise and increased onsite traffic during works	-0.25	0 all works contained within site, any effects to neighbours would be managed through consent conditions	-1	0	-1 Dust, noise and increased onsite traffic during works (greater volume)	-0.50	1 works contained onsite away from neighbours, less truck movements on main road.	-1	0	-1 Dust, noise and increased onsite traffic during works	-0.25
Amenity/land use:	> Nuisance > Visual effects > Land use limitations	-2 The managed area would need to remain 'recreational' and have more restrictions than rest of site that is rural residential	-1	-1 Reduce use of that part of site	-1 Ngative impact on local part of site where backfill is located and reduced amenity/land use	-1.25	2 Agree with HAIL. Impact only temporary then site becomes fit for new purpose	-1	2 Soils become fit for purpose, temporary visual effect no different from farming	1 Increased land amenity	1.00	1 site becomes available for use, only a small area may have restrictions.	-1	1 Manages waste within small area of site	0 Improved site amenity; possible visual effect if mound created - overall, neutral	0
Employment opportunities:	> Short term during works > Long term - ongoing maintenance	1 Short term employment during construction for more people. Possible long term depending on ongoing monitoring requirements	0	0	1 Similar employment opportunities in short term; ongoing minor O&M	0.50	0 0 because only temporary employment opportunity, not long term positive impact	0	0	1 Similar employment opportunities in short term; no ongoing O&M	0.25	0 only short term opportunities during works.	0	0	1 Similar employment opportunities in short term; minor ongoing O&M	0.25
"Wellbeing" perceptions/fears:	> Dislike of having "landfill" in local areas > Personal associations of workers with site history	1 If creating a recreational land use space it coule improve wellbeing for future site users as a natural area with planting and create a space for people to relax in the environment. Or could be sports area where people could improve their health because they're getting exercise. Perception could be managed with good comms and visual amenity improved from current.	-1		-1 contaminants remain onsite	-0.33	-1 Perception that the site is still contamiantd becase the contaminatation wasn't 'removed' or destroyed. Contaminants will still be in soil just at acceptable concentrations	-1		2 No residual contamination	0.00	-1 Perception that the site is still contaminated becase the contaminatation wasn't 'removed' or destroyed.	-1		-1 Contaminants contained onsite in dedicated cell	-1
Sub-total: Social		0	-1	0	-4	-1.18	0	-1	0	3	0.68	0	-1	0	-1	0

Cultural																	
Loss of mauri:	> Loss of a "health and spirit" which permeates through all living and non-living things - plants, animals, water and soil	0	-1	0	-1	-0.50	-2	-1	-2	1	-1.00	0	-1	-1	0	-1
		Is moving the soil into one spot rather than across the whole site giving the rest of the site a chance to 'heal'? One small spot containing the contamination better than disperse contamination and status quo?			Mauri loss as everything buried in new landfill on Deed settlement land, but disposal materials restricted to low level contaminated soil		similar to comment in Wellbeing, above		Increases volume / area of contaminated material	Improvement, through dilution of contaminants to acceptable levels		neutral impact - healing most of site but leaving on area that can't be used for as many things.		Soil passes out of use	Soil encapsulated in engineered cell, but lost to useful purpose (overall neutral)	
Destruction of wāhi tapu (cultural/spiritual sites):	> ancestral burial sites > loss of cultural heritage > disruption of cultural connectivity > damage Iwi relationships > impact on land and resources	0	0	0	0	0.00	0	0	0	0	0.00	0	0	0	0	0
		industrial area not identified as waahi tapu			All considered neutral		will likely be able to avoid waahi tapu areas?			All considered neutral		would not put containment cell in waahi tapu location			Neutral, provided sited outside of any sacred areas	
Kiatiakitanga (guardianship) and Whenua (land):	> Extent of Maori active involvement in control, management and protection of land > Restrictions on land use (physical, contamination, etc.) causing loss of resources/opportunities for economic development	-1	-1	-1	-1	-1.00	-2	-1	-1	1	-0.75	-1	-1	-1	1	-0.5
		Agree with HAIL		Restrictions on land use	Only affects localised part of site in Deed settlement area		similar to comment in Wellbeing, above. May feel the Crown isn't doing what we said we would but keeping contamination onsite, even if it is within acceptable levels after blending. May feel they don't have control on what is happening and unable to protect the land.		Irreversible	Contam eliminated		May feel the Crown isn't doing what we said we would but keeping contam. onsite, even if it is within acceptable levels after blending. May feel they don't have control on what is happening and unable to protect the land.		Manages waste passively within small area of site	localised restriction on land use, but improved use across majority of site	
Healing papatūānuku (Healing the land):	> Soil health	-1	-1	-1	-1	-1.00	-1	-1	0	1	-0.25	0	-1	0	1	0
				Confines contaminated soil within manageable area, no overall benefit	Low level (LL) contaminated soil buried onsite but concentrated in localised part of site		Risk of perception that land has not been healed as contamination still present.... Or could be the opposite where the healthy soil is helping heal the contaminated soil??		Reduces concentrations but not mass	Contaminants reduced to acceptable levels (or to managed level, if moderate soils blended to low level soils)		Healing most of the site but not all?			Contaminants contained in engineered cell; rest of site remediated	
Wai Ora: Restoration of water services:	> Water quality > Ecology	1	0	0	1	0.50	0	0	0	1	0.25	0	0	0	1	0.25
		Agree with FTL			LL contaminated soil encapsulation in 1 area will reduce risk of contaminant entrainment in surface runoff & risk to water services considered low during works, due to location of proposed backfill area					Contaminants reduced to acceptable levels					Contaminants contained in engineered cell, reudicng potential for surface/groundwater contamination	
Mahinga kai restoration:	> Garden, cultivation, food gathering places; collecting plants for various (e.g. medicine, weaving) purposes (e.g. toetoe, raupo, harakeke, paopao)	-1	0	0	1	0.00	0	0	0	1	0.25	1	0	0	1	1
		Portion of site won't be at an acceptable level to grow food like the rural res area will be.		Status quo remains: No contaminated soil in mahinga kai areas, runoff to water minimal	Shifts low level contaminated soil scattered across site to one location on-site or offsite.					Contaminants reduced to acceptable levels		overall creating a lot more areas that could grow food for a small area that can't. Vast improvement from current.			Majority of site restored; some limits on land use at location of engineered cell	
Sub-total: cultural		0	-1	0	-1	-0.54	-1	-1	-1	5	0.79	0	-1	0	4	1
Economic																
Remedial work waste disposal costs (capex)	Double weighting, as done for Horizontal Infrastructure report	4	0	0	0	1.00	0	0	-2	-2	-1.00		-2	-2	-2	-2
		no waste disposal costs as keeping within the site boundary			Likely to be lowest cost option, as less travel within site and reuses site soils		No waste disposal costs, but should compare the cost for labour and kit to do the mixing, and where it will be done on site and how that impacts the rest of the programme.		Lots more soil handling	Higher cost as more soil handling		No waste disposal costs, but should compare the cost for labour and materials for construction and how that impacts the rest of the programme.		Significant construction cost	Significant construction cost	
Ongoing maintenance costs (opex)		-1	-1	0	0	-0.50	0	0	0	1	0.25	0	-1	0	-1	-1
		Requirement for ongoing maintenance possibly not known at present. Scoring -1 as potential risk.		Not expected to need maintenance or monitoring	No real O&M required		no ongoing costs			No maintenance		Will there be ongoing monitoring costs?			Ongoing O&M costs (minor)	
Effects on land value:	> impact of demolition/remedial works on land value	1	0	1	1	0.75	2	-1	2	2	1.25	1	0	1	1	1
		the rest of the contamination across the site is getting cleaned up, so will only be confined to a small area. Landvalue should improve overall event though small containment cell		Expect overall improvement	Net overall improvement		Site will be remediated to rural residential so significant improvement to land value as no liability remainng onsite		Expect significant improvement	Significant improvement		overall improvement apart from small area		Expect overall improvement	Overall improvement	
Effects on potential earnings from land:	> Extent and productivity/health of land area available for use	2	0	1	1	1.00	2	0	2	2	1.50	1	0	2	1	1
		Majority of the site is being remediated to high land use value. Only small portion of land restricted use but may still have amenity value if it could be planted or something nice done to it once work complete		Expect overall improvement	Overall improvement		as above.		Expect significant improvement	Significant improvement		overall improvement apart from small area		Expect significant improvement	Overall improvement	
Minimisation of future liabilities:	> Legacy effects of residual infrastructure/contamination left in place or deposited in landfill onsite	0	0	0	0	0.00	2	0	0	1	0.75	-1	-1	-1	-1	-1
		overall liability reduced significantly but small area with potential liability may remain.			New future liability associated with backfill area (but existing liability associated with scattered low level contamination removed)		future liability of contamination completely removed.			Reduced liability		creates a potential liability		This does create a liability	Containment cell creates long term liability	
Sub-total: economic		1	0	0	2	0.85	1	0	0	4	1.35	0	-1	0	-2	-1

Weighted Scores																
Criteria	**Weighting**					Weighted										
Environmental	35%	-0.2	0.0	0.0	0.0	0.0	0.7	-0.3	0.5	-1.0	0.0	0.7	-0.2	0.5	6.0	0.6
Social	20%	0.0	-0.5	-0.2	-4.0	-0.2	0.0	-0.5	0.2	3.0	0.1	0.2	-0.7	0.2	-1.0	-0.1
Cultural	30%	-0.3	-0.5	-0.3	-1.0	-0.2	-0.8	-0.5	-0.5	5.0	0.2	0.0	-0.5	-0.3	4.0	0.2
Economic	15%	1.2	-0.2	0.4	2.0	0.1	1.2	-0.2	0.4	4.0	0.2	0.3	-0.8	0.0	-2.0	-0.1
Total Score		**0.7**	**-1.2**	**-0.1**	**-3.0**	**-0.3**	**1.0**	**-1.5**	**0.6**	**11.0**	**0.6**	**1.1**	**-2.1**	**0.4**	**7.0**	**0.7**
					RANK					**RANK**					**RANK**	

Deliverability assessment																
Significant Constraints					main constraints= finding suitable location and avoiding areas subject to geotechnical, hydrogeology, archaeological, cultural, wetlands, trees and existing pipes.					Main constraint = finding suitable location and still having to deal with asbestos soil					main constraints= finding suitable location and avoiding areas subject to geotechnical and hydrogeology issues.	
Consentability					Somewhat complex: possibility that consents would not be granted due to entire site being located on HPL Class 2 land; if consent granted, possible appeal by opponents					Somewhat complex: Involves much larger soil disturbance, but should be consentable (again subject to HPL issues)					Somewhat complex: Tight timeframe to undertake required investigation (mainly geotech & groundwater); possibility that consents won't granted due to entire site being on HPL Class 2 land; if consent granted, possible appeal to Env Court by opponents; non-complying activity under Waipa DP	

SCORING	
-2	Fully negative
-1	Partly negative
0	No impact
1	Partly positive
2	Fully positive

INDICATORS	SUB-HEADING	OPTION 6 Existing Landfill					OPTION 7 Offsite disposal				
		LINZ1	LINZ2	HAIL	FTL	Comb-ined	LINZ1	LINZ2	HAIL	FTL	Comb-ined
Environmental											
Effects on land use/productivity:	> Managing contamination of the land > Associated effects on land use / productivity	2 Land is already contamianted with existing landfill. Removes contamiantion from main hospital complex and manages in a contained place that will be capped and managed under consent conditions.	1	2 Manages waste within small area of site already with reduced productivity	2 Transfers all contaminated soil to existing onsite landfill, restoring bulk of site + improvement in productive land use of disposal site area, due to improved capping	1.75	2	1	2 Completely removes soil from environment	2 removes all low level contaminated soil off-site to appropriate landfill	1.75
Surface water effects:	> Quantity - peak flows/volumes > Quality > Silt/sediment > Scour/erosion	2 with this option repairs will be made to help stop run off issues and protect surfacewater bodies. Landfill will be capped so no impact to run off	1	-1 Moves soils close to surface water	1 All contaminated soils in one place with improved capping - likely less effects on surface runoff	0.75	0	0	0	-1 More dedicated truck movements off-site and associated import of clean backfill material	-0.25
Groundwater effects:	> Groundwater table effects (groundwater levels) > Quality > Use	2 Landfill is already leaching into the stream, as above repairs will help protect gw	0	0	0 No change	0.50	0	0	0	0 No change	0.00
Ecological effects:	> Plants/Trees/Birds & Fauna > Aquatic species	1 improvement to main hospital complex and to exisiting condition of the landfil cap where ponding and other issues are occuring that are affecting healt of plants near stream	1	1 Breaks the pathway	1 Slight positive benefit, through improved capping rducing rainfall infiltratio into landfill and hence likely reduced leaching from landfill to stream	1.00	2	0	2 Completely removes soil from environment	1 Removes contaminants from site but increased traffic movements	1.25
Air emissions:	> Dust/odour > Particulates/volatile gases > Greenhouse gases (carbon dioxide, methane)	0 need to understand balance of truck movements/machinery vs other options.		0	1 Reduced off-site traffic, as all contaminated soil can be taken to existing landfill	0.33	-2		-1 Traffic	-1 Greatest off-site traffic movements, both for removing contam soils but also importing cleanfill	-1.33
Sustainability:	> Reuse/recycling > Resilience (e.g. ability to cope with climate change effects) > Legacy (future generation) issues	0 agree with HAIL & FTL	1	1 Manages waste within small area of site	1 Contaminants still present onsite but with improved capping; long term legacy issue (similar to existing but involving increased waste quantities)	0.75	-2	0	-2 'Dig and dump' - entails road use, fuel use, takes up engineered landfill space resource, soil removed from use	0 Removes long term legacy issue from site, but not in sustainable manner - overall, neutral	-1.00
Sub-total: Environmental		1	1	1	6	2.12	0	1	1	1	0.60
Social											
Public health and safety:	> Physical injury > Contaminant effects on human health > Traffic impacts	1 Agree with FTL, plus the site won't be accessible by the public while the work is underway.		0	1 considered slightly positive, as material is to be placed in existing disposal site with enhanced capping, reducing potential for public contact	0.67	-1 more truck on road		-1 Increase in heavy road traffic	-1 main public H&S risk associated wih temporary increased traffic on roads from T&T movements	-1.00
Worker health and safety:	> Physical injury > Contaminant effects on human health > Traffic impacts	0 managed through H&S protocols.	0	-1 Lots more soil handling, though not unusual	-1 4 steps - excavation, stripping existing landfill cap (potential contact with existing refuse), soil placement, recapping	-0.50	0 managed through H&S protocols.	-1	0 Heavy road crashes don't kill the truck driver…	0 1 step + increased traffic risk due to greater movements - overall neutral	-0.25
Neighbourhood effects:	> Dust, noise, odour, vibration, traffic > Changes to surface runoff flowpaths	0 Small increase to noise and dust as Sean notes but only for short term during the works. Long term improvement as area will retun close to how it looks at present.	0	0	-1 Dust, noise and increased onsite traffic during construction (greater volume)	-0.25	-1 more truck on road	0	-1 Local road traffic, noise	-2 Significant increase in traffic on public roads + dust/ noise/increased onsite traffic	-1.00
Amenity/land use:	> Nuisance > Visual effects > Land use limitations	2 Agree with FTL & HAIL.	1	2 Manages waste within small area of site already with reduced productivity	1 Already an existing landfill + improved capping should improve amenity	1.50	1	1	2 Completely removes soil from environment	2 Significantly improve site amenity/land use	1.50
Employment opportunities:	> Short term during works > Long term - ongoing maintenance	0 only short term opportunities during works.	0	0	1 Similar employment opportunities in short term; minor ongoing O&M (but similar to existing)	0.25	0	1	0	1 Similar employment opportunities in short term; no ongoing O&M	0.50
"Wellbeing" perceptions/fears:	> Dislike of having "landfill" in local areas > Personal associations of workers with site history	2 Improvement to current condition of landfill and crown will continue to manage in perpuitiy. Possibly lack of trust in the Crown that we will manage, but it is written into legislation.	1		1 Area already contains contaminated soils and they will be better encapsulated through improved cap + under LINZ control	1.33	1	0		2 Contaminated soil removed from site permanently	1.00
Sub-total: Social		1	0	0	2	0.86	0	0	0	2	0.55

Cultural												
Loss of mauri:	> Loss of a "health and spirit" which permeates through all living and non-living things - plants, animals, water and soil	1 already has an exisitng landfill and improvments will help stream health and surface runoff etc.	1	-1 Soil passes out of use	1 Already used for landfilling + improved capping should offset any potential/actual increased environmental risks	0.50	-2	1	-2 Soil passes out of use and out of rohe	1 Mauri of site fully restored, although some soil lost from rohe	-0.50
Destruction of wāhi tapu (cultural/spiritual sites):	> ancestral burial sites > loss of cultural heritage > disruption of cultural connectivity > damage Iwi relationships > impact on land and resources	0 not near sites of significance, area already impacted.	0	0	0 All considered neutral	0.00	0	0	0	0 All considered neutral	0.00
Kiatiakitanga (guardianship) and Whenua (land):	> Extent of Maori active involvement in control, management and protection of land > Restrictions on land use (physical, contamination, etc.) causing loss of resources/opportunities for economic development	1 Keeps responsibility for mgmt with the Crown with us working directly with iwi on design and long term mgmt. Upgrades to stream?	1	-1 Becomes Crown problem	1 Removes low level contaminated soil from Deed settlement area to existing landfill site, which is under LINZ control	0.50	-2 agree with HAIL	1	-2 Becomes 3rd party problem	2 Maximum benefit in terms of Māori involvement in land management and restoring site economic development potential	-0.25
Healing papatūānuku (Healing the land):	> Soil health	2 work will include remediation of full hospital complex and containment in the exitisting landfill will have improvement to current condition once cap is replaced	0	0	1 Uses existing disposal area, but with improved capping and topsoiling, improving existing situation	0.75	0	1	0	2 maximum benefit in relation to healing land (but does shift problem to another Iwi's Rohe)	0.75
Wai Ora: Restoration of water services:	> Water quality > Ecology	1 work on landfill will improve current impacts to the stream	1	0	1 Slightly greater risk during works due to proximity to stream (but risk adequately mitigated through contractor following best practice = +1 (on balance)	0.75	0	1	0	2 Removing all contaminated soil from site	0.75
Mahinga kai restoration:	> Garden, cultivation, food gathering places; collecting plants for various (e.g. medicine, weaving) purposes (e.g. toetoe, raupo, harakeke, paopao)	2 Improvement to the site to be able to support rural res & food production on site.	1	0	1 Doesn't limit any options as disposal area already used for landfilling; rest of site restored	1.00	1	1		1 Assists indirectly with mahinga kai restoration through removing all materials from site	1.00
Sub-total: cultural		1	1	0	5	1.63	-1	1	-1	8	1.88
Economic												
Remedial work waste disposal costs (capex)	Double weighting, as done for Horizontal Infrastructure report	-2 higher costs but landfill mgmt has to happen regardless	2	-2 Lots more soil handling	-4 Higher cost than option 5 due to having to strip cap/topsoil from existing landfill, prior to placing additional soil in landfill	-1.50	-4	-2	-4 Expensive	-4 Likely to be most expensive option	-3.50
Ongoing maintenance costs (opex)		0	0	0	1 No change to existing situation, as onsite landfill has to be maintained/ monitored by LINZ	0.25	1	2	0	2 No ongoing O&M costs	1.25
Effects on land value:	> impact of demolition/remedial works on land value	1	1	2 Expect significant improvement	2 Overall significant improvement - both Site and landfill area	1.50	2	1	2 Completely removes contamination	2 maximum benefit in relation to increased land value	1.75
Effects on potential earnings from land:	> Extent and productivity/health of land area available for use	1	1	2 Expect significant improvement	1 Overall improvement, but no change in potential for existing landifll area	1.25	1 closed landfill still there…	1	2 Completely removes contamination	2 Maximum increased potential as everything removed from site	1.50
Minimisation of future liabilities:	> Legacy effects of residual infrastructure/contamination left in place or deposited in landfill onsite	0 liability stays with the Crown. Positive for iwi though.	0	0 Does not really change existing liability	0 Increased liability associated with existing disposal site, as contains more waste, but removes liability from rest of site - net neutral	0.00	0 Agree with HAIL	1	0 Moves liability, albeit to safe location	1 Maximum benefit in terms of minimising future site liability (but does shift problem elsewhere, albeit to engineered landfill)	0.50
Sub-total: economic		0	1	0	0	0.30	0	1	0	3	0.90
Weighted Scores												
Criteria	**Weighting**											
Environmental	35%	1.2	0.8	0.5	6.0	0.7	0.0	1.0	1.0	1.0	0.2
Social	20%	0.8	0.4	0.2	2.0	0.2	0.0	0.2	0.0	2.0	0.1
Cultural	30%	1.2	0.7	-0.3	5.0	0.5	-0.5	0.8	-0.8	8.0	0.6
Economic	15%	0.0	0.8	0.4	0.0	0.0	0.0	0.6	0.0	3.0	0.1
Total Score		3.2	2.7	0.8	13.0	1.4	-0.5	2.6	0.2	14.0	1.0
					RANK					RANK	
Deliverability assessment												
Significant Constraints					no new constraints compared with existing situation; more temporary impacts during construction works assocaited with proximity to residential houses					largely limited to receiving landfill capacity limits and compliance with their waste acceptance criteria, both of which are achievable.	
Consentability					Somewhat complex: Investigations required to support RC application largely completed; Planner has identified replacement consents needed as adding to existing landfill would be beyond scope of existing consents, but landfill improvement works could possibly be done as e/works; Planner has identified engineering, hydrological/stormwater, contamination, ESCP and construction management plan being required to support new consent application; if consent was granted, possible appeal by opponents to Env Court.					Less complex: Disposal would be to existing consented facility	