TOITŪ TE WHENUA

LAND INFORMATION NEW ZEALAND

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ENGINEERS • RESOURCE MANAGERS • SURVEYORS

146 TE MAWHAI ROAD, FORMER TOKANUI PSYCHIATRIC HOSPITAL, TE AWAMUTU

FORMER TOKANUI PSYCHIATRIC HOSPITAL
DEMOLITION AND REMEDIATION
EXISTING DISPOSAL SITES – INTRUSIVE INVESTIGATION REPORT

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FORMER TOKANUI PSYCHIATRIC HOSPITAL DEMOLITION AND REMEDIATION EXISTING DISPOSAL SITES – INTRUSIVE INVESTIGATION REPORT

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EXECUTIVE SUMMARY

E1. Background Information

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

The former Tokanui Hospital is managed by LINZ on behalf of the Crown in the Treaty Settlements Landbank. 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 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. There is no requirement under the Deed to remediate the existing disposal sites, but LINZ is responsible for managing this site in perpetuity, while the ongoing maintenance and monitoring of these sites is covered by a regional resource consent with oversight from Waikato Regional Council.

This intrusive investigation report covers the existing disposal sites portion of the site. This is located off Farm Road (private road), directly east of the Wharekōrino Stream. The investigation area is approximately 7.7ha, of which the existing disposal sites make up approximately 2.1ha in area, including some additional filling areas found during this investigation. This area is currently in pastoral land use (grazing). The existing disposal sites are either referred to as 'existing disposal sites' or landfills in this report, depending on the context.

E2. Intrusive Investigation Findings

The Tokanui Hospital Landfill Closure Assessment of Environmental Effects (AEE) (Worley, 1998) describes the landfill as comprising one fenced off area, within which there are several distinct areas that have been used for different types of refuse disposal. This investigation identified nine areas for intrusive investigation of which all but two were found to contain landfill material. Estimated landfill areas and volumes; closure dates; topsoil, cover and fill characteristics and contamination status are summarised in Table E1. It is important to note that estimated areas and volumes have ±10-30% accuracy, with the higher 30% range allowing for the method and nature of filling in Areas A, H and F (uncontrolled filling).

Overall, the aerial photographs and desktop information show that the portions of the site assessed as part of this investigation were subject to landfilling from at least 1943 through to 1979 and possibly into the 1980s, while information in the 1998 AEE indicates Area A was closed in 1988 and Area C in 1997. Suspected additional filling areas outside of the primary landfilling areas (Areas H & I), east of the existing disposal sites were also assessed, given visual identification of potential filling activities during the historical review and onsite interviews with local Kaumātua.

The geotechnical information available has confirmed the site underlying geology is non-volcanic, and consists largely of alluvial material belonging to the Tauranga Group. Laboratory testing of soil samples confirmed there are high levels of contamination present within the various areas of the existing disposal sites, with exceedances of both the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS) rural residential/lifestyle block- no produce (unpublished) land use criteria and the NESCS commercial/industrial outdoor worker (unpaved) land use criteria. In addition, there were numerous exceedances of the BRANZ asbestos in soil guidelines for both residential and commercial/industrial sites. There were also numerous exceedances of the Class 1 (municipal solid waste) Landfill acceptance criteria in Areas A, C, D & H, which are predominantly located within the areas where disposed material was burnt.

Toxicity Characteristic Leaching Procedure (TCLP) testing was undertaken on the samples exhibiting the highest levels of contamination across the existing disposal sites. Thirteen samples were analysed, with all results indicating the various soil & fill materials across the existing disposal sites would be suitable for disposal off-site, to a Class 1 Landfill.

Given the extent and nature of the fill material found and the contamination identified thus far, it is considered unlikely that the contaminated fill materials could be separated from other materials within Areas A, B, C, D & H.

The areas of the site investigated as part of this Intrusive Investigation have been reinstated in recent months and returned to farming/grazing use. The reinstatement measures consisted of:

1) Additional material compaction where test pits have been backfilled;
2) Track rolling the existing test pit locations;
3) Retopsoiling the depressions that have appeared after backfilling the test pits; and
4) Regrassing the deposited topsoil to reestablish a vegetative cover over the testpit areas.

E3. Critical Assessment of Landfill Construction

The fill material within the landfill would generally be classified as Class 1 landfill material, along with some managed fill and cleanfill materials, as well as some special wastes (i.e., medical wastes, asbestos). A critical assessment of landfill construction identified the following key items of concern:

- Lack of landfill base and side liner and groundwater subsoil drainage allows groundwater to come into direct contact with buried refuse in some locations.
- Refuse burning was common practice over much of the period that the hospital's landfill has been in operation. It was a cheap method of reducing waste volumes (thus maximising landfill lifetime), minimising leachate generation and landfill gas production from the decomposition of combustible organic wastes and providing rudimentary "sterilisation" of some wastes.
- The deposition of boiler ash within landfilling areas, either directly or for use as cover material has likely introduced a significant boron reservoir into the landfill. Boron is relatively soluble and hence likely to leach over a long period, while once boron gets into water it is very difficult and costly to remove. In our opinion, the ash disposed of in Areas A and C of the landfill is the likely source of elevated boron levels in groundwater sampled from the landfill monitoring bores and in the adjacent stream.
- Some areas have non-compliant clay capping (i.e., inadequate thickness and/or permeability) and/or topsoil cover in relation to the approved resource consent for the landfill site.
- There is no leachate collection or landfill gas collection systems, this being consistent with landfilling practice at the time the landfilling areas were constructed.

- The proximity to the Wharekōrino Stream means the site is potentially subject to inundation by flood waters (refer further discussion in section E5).

E4. Landfill Lifecycle Status

The landfill aftercare period refers to the duration of ongoing monitoring for site integrity and environmental effects until the landfill no longer has the potential for adverse environmental effects, effectively defining the landfill "end of life". All landfill areas were assessed to be in the latter stages of the aftercare period, which typically lasts 30-50 years post-closure, as Area C was closed about 26 years ago, Area A 35 years ago and the other areas likely as long as 44 years ago. This is supported by:

- Typical leachate parameters (ammoniacal-nitrogen and chloride) having relatively low concentrations in groundwater and pH being approximately neutral.
- No landfill gas being detected on-site during the 2022 or 2023 intrusive investigations.
- The majority of landfill settlement is inferred to have already occurred.

However, the complicating factor here is the presence of boron in the landfilled materials, which is inferred to derive from coal ash deposition within the landfill. This has resulted in elevated boron levels in the groundwater and stormwater, which are still occurring in 2023. In our opinion, this "potential adverse environmental effect" endpoint has yet to be reached for boron and hence ongoing monitoring should be continued.

E5. Landfill Risk Assessment

The landfill risk assessment found the main issues to be:

- Groundwater contamination from passage through the landfill, with groundwater flowing into the adjacent stream, with boron being the main contaminant of concern, as explained above.
- Culvert 3 (1350dia) pipes the Wharekōrino Stream through Area H of the landfill. This culvert is estimated to be 44-65 years old and could be subject to differential settlement from landfill activity, leading to leaking joints and ultimately possible pipe failure. Attempts have been made to CCTV this culvert but have not been successful to date, due to significant flows through the culvert.
- Flood modelling of the Wharekōrino Stream has shown that the landfill areas A, B, C, G and H are currently likely to be inundated to varying extents during a 1% AEP (annual exceedance probability) storm event, particularly if the two downstream culverts on the stream are blocked or become blocked during the storm, with these effects worsening with predicted climate change. Areas D, E and F have been found unlikely to be affected by flooding. Flooding impacts could potentially be significantly mitigated by the removal of Culvert 2 and the associated embankment, which forms a redundant road crossing over the stream, located below the landfill and above the culvert on Te Mawhai Rd.

Table E1: Landfill Areas/Volumes and Topsoil/Cap/Fill Characteristics (calculation provided as Appendix G; values rounded to nearest 10)

Item	Area								
	A	B	C	D	E	F	G	H	I
Area (m^2)	7,990	2,790	1,180	2,440	660	930	1,310	1,980	1,570
Fill Volume (m^3)	12,960-16,310*	3,420	1,350	3,870	0	3,730	0	910	3,080
Estimated Date for End of Filling	1988	1979	1997	~1979	~ 1979	~ 1979	~1979	~1979	~1974
Topsoil cover – range (average) (mm)	100-300 (145)	100-200 (157)	100-200 (162)	50-200 (139)	100	200	100-200 (151)	0	0-200 (102)
Topsoil contamination	83% > BG but < GL; 9.5% > RR/CI (Asb)	All > BG but < GL	50% > BG but < GL; 50% > RR/CI (Asb)	All > BG < GL	All < BG	All > BG < GL	All > BG < GL	All > BG but < GL; 20% > RR/CL (Asb)	87.5% > BG but < GL; 12.5% > RR/CL (Asb)
Landfill Cap Thickness – range (avg, mm)	100-800 (522)	100-400 (275)	400-600 (476)	0-250 (155)	200 (1 Testpit)	300 (1 Testpit)	0	0	0
Cap permeability (m/s)	$<10^{-7}$ except TP2	$<10^{-7}$	$<10^{-7}$	$<10^{-7}$	$<10^{-7}$	$<10^{-7}$	Not applicable	Not applicable	Not applicable
Fill Description (main content)	Construction & general waste, burnt material, inferred boiler ash, asbestos	Construction/demolition waste, some burnt debris	General & construction waste	Construction waste, including wood, metal, concrete and bricks	None	Medical waste buried in multiple small offal pits	Reworked Material	Construction & general waste, burnt material, tree stumps/wood fragments	Construction & general waste, brick concrete, and plastic bottles
Fill contamination status (% samples)	Landfill (90%), Managed Fill (10%)	Landfill (40%), managed fill (20%), cleanfill (40%)	Landfill (100%)	Landfill (100%)	N/A	Landfill (100%) due to hazardous medical waste	N/A	Landfill (100%)	Landfill (14%), Managed Fill (43%) Cleanfill (43%)

Notes: BG = background, RR = rural residential, C/I = commercial/industrial, GL = guideline, Asb = asbestos, * - range accounts for potential fill volume based on filling method in cells rather than uncontrolled filling.

E6. Recommended Repair/Maintenance Works

The following repair/maintenance works are recommended for consideration by LINZ, as part of a long term management strategy for the landfill:

- Repair (e.g. lining), replacement or removal of Culvert 3. With culvert removal, this would involve transferring buried refuse in this area to another portion of the landfill, outside the floodplain.
- Removal of culvert 2, which will significantly lower flood levels adjacent to the landfill, subject to further investigation, design and an assessment of potential effects on upstream and downstream neighbours.
- Replacement of the landfill cap with a low permeability cap, complying with the consent conditions and/or current best practice. Associated ponding, settlement/subsidence areas would be repaired at the same time.
- Possible installation of a groundwater cut-off trench or similar to divert upgradient groundwater from passing through the landfill, so that it is no longer in contact with buried refuse.

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1 INTRODUCTION

This report comprises an Intrusive Investigation Report (IIR) for the existing disposal sites at the Former Tokanui Psychiatric Hospital (FTPH). It presents the results of a desktop study, site walkover, intrusive testpit and trench investigations, laboratory sampling and analysis, as well as a landfill construction/risk assessment. The existing disposal sites are either referred to as 'existing disposal sites' or landfills in this report, depending on the context.

The key objectives for this report were:

(a) To summarise previous investigations by others relating to the existing disposal sites area.
(b) To undertake intrusive investigations to provide a more detailed characterisation of the existing disposal sites, including the disposal area extents, type and depth of cover, depth of fill and depth to natural ground; and the extent and severity of soil/fill contamination.
(c) To provide a critical assessment of construction of the existing disposal sites, landfill risk assessment and consent compliance.

This investigation has been managed, reviewed and approved by a Suitably Qualified and Experienced Practitioner (SQEP), as defined in the National Environment Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS) and by suitably qualified and experienced staff with landfill experience.

2 SCOPE

The scope of this investigation is set out below:

(a) Review of all available information and data from the reports provided by LINZ.
(b) Identify any information gaps and request this information from relevant sources (e.g. Council, LINZ).
(c) Receive and review missing information.
(d) Undertake additional intrusive geotechnical and contamination investigations, appraisal and reporting of the disposal site areas, based on the desktop study findings.
(e) Preparation of site plan(s) using ArcGIS or AutoCAD, as appropriate, providing the best understanding of disposal area extents, type and depth of cover, depth of fill and depth to natural ground; and the extent and severity of soil/fill contamination.
(f) Critical assessment of construction of the existing disposal sites, including assessing compliance of the final cover over the landfilled areas with the resource consent requirements.
(g) Landfill risk assessment addressing the risk to the environment from a range of factors.

(h) Estimating where the disposal sites sit in relation to the lifecycle of a closed landfill.

(i) Assessment of consent compliance issues and recommendations for possible repair/maintenance works as part of a long term management strategy for the closed landfill.

(j) Associated reporting including summarising site details, relevant aspects of the existing disposal sites history, including historical aerials review, its environmental context, lab results and presenting a Conceptual Site Model (CSM) and exposure path assessment.

3 INVESTIGATION METHODOLOGY

The methodology used for this investigation is summarised below:

1. Desktop study involving review of existing historical information for the subject site including previous investigations by others, aerial photographs (Appendix A), and interviews with relevant people.
2. Site walkover investigation of the landfill areas within the subject site, with a visual appraisal to identify any disturbed and potentially contaminated areas. Relevant photographs are set out in Appendix B.
3. Intrusive geotechnical (Appendix C) and soil sampling investigation and laboratory analysis (Appendix D).
4. Preparation of an Intrusive Investigation Report (this report) including the results of the desktop study, site walkover survey, laboratory analysis, conclusions and recommendations.
5. Provision of site plans, relevant documentation and representative photographs as appendices to this report.
6. Critical assessment of construction of the existing disposal sites, landfill risk assessment and consent compliance.

Fraser Thomas Limited Health and Safety Management Plan procedures were followed throughout the duration of the investigation. In addition, all individuals involved in the field work were provided with a copy of the Fraser Thomas Limited Job Safety & Environmental Analysis/Safe Work Method titled JSA-01 and the Site-Specific Health & Safety Plan dated 18th October 2022 and subsequent updates of these documents.

4 SITE DETAILS

4.1 LOCATION, ZONING AND LAND USE

The subject site is located at 149 Te Mawhai Road, RD 5 Te Awamutu, 3875 and encompasses an area approximately 79 hectares in size. The legal description of the site is SECS 1 3 SO 44852, SEC 1 SO 59771 BLKS X XI PUNIU SD -TOKANUI HOSP-.

The site is zoned 'Rural Zone' (Waipa District Plan, 2019 – Map 12).

This intrusive investigation report covers the existing disposal sites portion of the site. This is located off Farm Road (private road), directly east of the Wharekōrino Stream. The investigation area is approximately 7.7ha, of which the existing disposal sites make up approximately 2.1ha in area, including some areas of additional filling not shown on the original disposal sites plans. This area is currently in pastoral land use (grazing).

4.2 TOPOGRAPHY, GEOLOGY AND SOILS

The site is located in a predominantly undulating area. A tributary of the Wharekōrino Stream bisects the landfill area east to west and converges with the Wharekōrino Stream near the northern end of the site.

In carrying out the appraisal of the site, reference has been made to the Institute of Geological and Nuclear Sciences geological web map (NZ 1:250,000). The map indicates that the site is predominantly underlain by middle Pleistocene to late Pleistocene River deposits consisting of locally derived pumiceous clays, sandy clays and gravels of the Tauranga Group.

A small portion of the former hospital and existing disposal sites is underlain by early Pleistocene to middle Pleistocene River and igneous deposits consisting of alluvium dominated by primary and reworked, non-welded ignimbrite of the Walton Subgroup, which is part of the Tauranga Group.

As part of this Intrusive Investigation Report, Fraser Thomas Limited has also undertaken a Geotechnical Factual report, which identified the same geological units present across the areas of filling. This is included in Appendix C.

4.3 SURFACE WATER

The landfill is effectively sited between the Wharekōrino Stream and its tributaries, with one tributary entering the stream just upstream of the landfill and another two tributaries converging just south-east of the landfill and entering the Wharekōrino Stream within the landfill paddock downstream of the main landfill areas (refer Figure 2).

The Wharekōrino Stream and its tributaries above the landfill serve a combined approximately 570ha catchment of rural farmland. Hence, the stream upgradient of the landfill can reasonably be expected to contain:

- Suspended solids from any exposed areas of land, atmospheric deposition and land erosion.
- Nutrients such as nitrogen and phosphorus from soil fertilisers, animal faeces, organic debris and atmospheric deposition.
- Faecal coliforms and other bacteria from grazing and other animals/birds.

Just downstream of the landfill, the Wharekōrino Stream passes under Te Mawhai Rd and enters the Pūniu River. The Pūniu River flows south-west, adjacent to Waikeria Road.

4.4 GROUNDWATER

An Environment Waikato database search was done for all groundwater bores within 1km radius of the landfilling area, the results of which are shown on Figure 1, and attached as Appendix F. This search showed there are six groundwater bores within 1km of the site, of which only one is located downgradient (north) of the landfill. This bore (Bore 72, Station 10906) uses water for nursery irrigation. There is one further downgradient bore just outside the 1km limit - Bore 72, Station 4997 – which takes water for household supply and stock watering purposes, according to the Environment Waikato database.

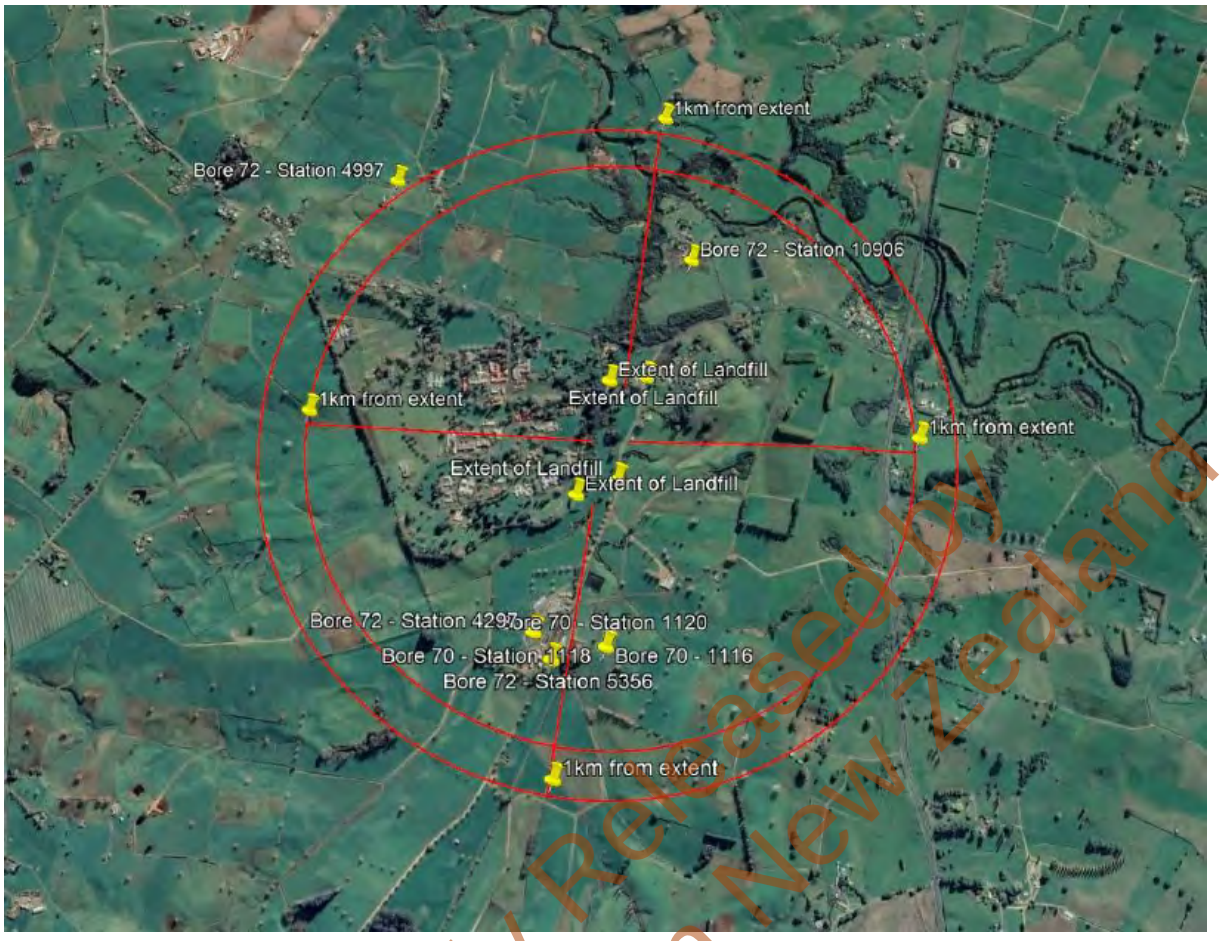


Figure 1: Environment Waikato Groundwater Bore Database Search Results

5 DESKTOP STUDY AND SITE WALKOVER FINDINGS

The results of the desktop study and the site walkover survey are summarised in this section, along with historical aerial photographs (Appendix A), site walkover photographs (included as part of Appendix B) and onsite interviews conducted during the intrusive investigation. Throughout the site walkover survey, a visual assessment was used to classify any foreign materials as particular contaminants, without any formal identification. Hence, reference to a specific contaminant in the survey should essentially be read as "suspected contaminants", unless otherwise stated.

5.1 SITE IDENTIFICATION AND USE

The site details and ownership history are summarised below.

Table 1: Site Details and Ownership History

Registered Owners	His Majesty the King
Street Address	149 Te Mawhai Road, Tokanui
Legal Description	SECS 1-3 SO 44852, SEC 1 SO 59771 BLKS X XI PUNIU SD -TOKANUI HOSP-
Total Area (ha)	~79ha
Zoning	Rural Zone (Waipa District Plan, 2019 – Map 12)

Information provided by LINZ indicates that the Tokanui hospital site was part of a land package taken under the Public Works Act in 1910, which included approximately 93ha for health services. The hospital site has remained under Crown ownership since then and was transferred to the LINZ landbank in July 2016.

5.2 PREVIOUS INVESTIGATIONS

This section covers previous investigations relating specifically to the existing disposal sites. Additional regular monitoring has been undertaken over the years as required by resource consent and these results are discussed separately later in this report.

5.2.1 Tokanui Hospital Landfill Closure AEE (Oct 1998)

The Tokanui Hospital Landfill Closure Assessment of Environmental Effects (AEE, October 1998) describes the landfill as comprising one fenced off area, within which there are several distinct areas that have been used for different types of refuse disposal. These areas are illustrated in Figure 2 below and summarised in Table 2. The AEE refers to Figure 2 as being a "rough sketch", which indicates, from discussions held with people on site and aerial photographs, the approximate locations of where refuse cells may have been constructed – it states that this sketch should be treated as "indicative only".

Table 2: Summary of Landfilling Areas (AEE, Oct 1998)

Area	Description
A	Main landfill area used for general hospital and domestic waste. Closed in 1988 and was operational for at least 40 years. Currently grassed and grazed by stock. Typical operation in this area consisted of long cells dug out of ground ~3m wide and 25-30m long with ~1m between cells. Refuse was placed in cells and then burnt. Cell was covered with ash from hospital boilers when full. Exact number of cells estimated to be in range of 3-5, based on local anecdotal information. At least 1m of material covers these cells based on hand augers, comprising largely a sandy silt with some clay and light topsoil layer, with permeability of ~$2x10^{-4}$m/s (based on 1 permeability test). Refuse estimated to be ~1.8m deep based on 1 piezometer log (P4). Refuse volume was conservatively estimated to be 810m^3 (based on 5 cells x 3m wide x 30m long x 1.8m deep).
B	Used for disposal of old building materials, concrete and pipes (iron and ceramic). Covered in places with soil and grass; edge ~1-1.5m from stream bank in places.
C	Was used until late 1997 for dumping of refuse, comprising coal ash, wastewater sludge, garden waste and general refuse. Stream ponds in swampy area at base of this area. Appendix E of the AEE shows a closure plan for Area C and how it was to be pulled back from the stream edge, placed behind a confined bund, capped with 600mm low permeability clay and 150mm topsoil, with the swampy area backfilled with clean material, (refer Figure 3).
D	Mainly building materials/concrete from demolished site buildings (referred to as cleanfill materials in AEE); fill extends partially into gully area, obstructing stormwater flow path from road, causing some ponding.

E	Site where runoff from road ponds as Area D blocks natural flow path. Remains of old concrete and asphalt also seen scattered around this general area.
F	6 x offal pits; thought to be 4-6m deep. Used to dispose of drugs, needles, etc.
Other (Areas H& I)	Discussions with others indicated that the area directly opposite Wharekōrino Stream from Area A may have been filled at some time earlier than construction of the cells in Area A, with the stream being culverted through this area at the same time. In addition, an area directly south of FTPH buildings 30 & 31 appears to have likely been filled during construction of the southern area of FTPH.

Main source: Tokanui Hospital Landfill Closure AEE (Oct 1998)

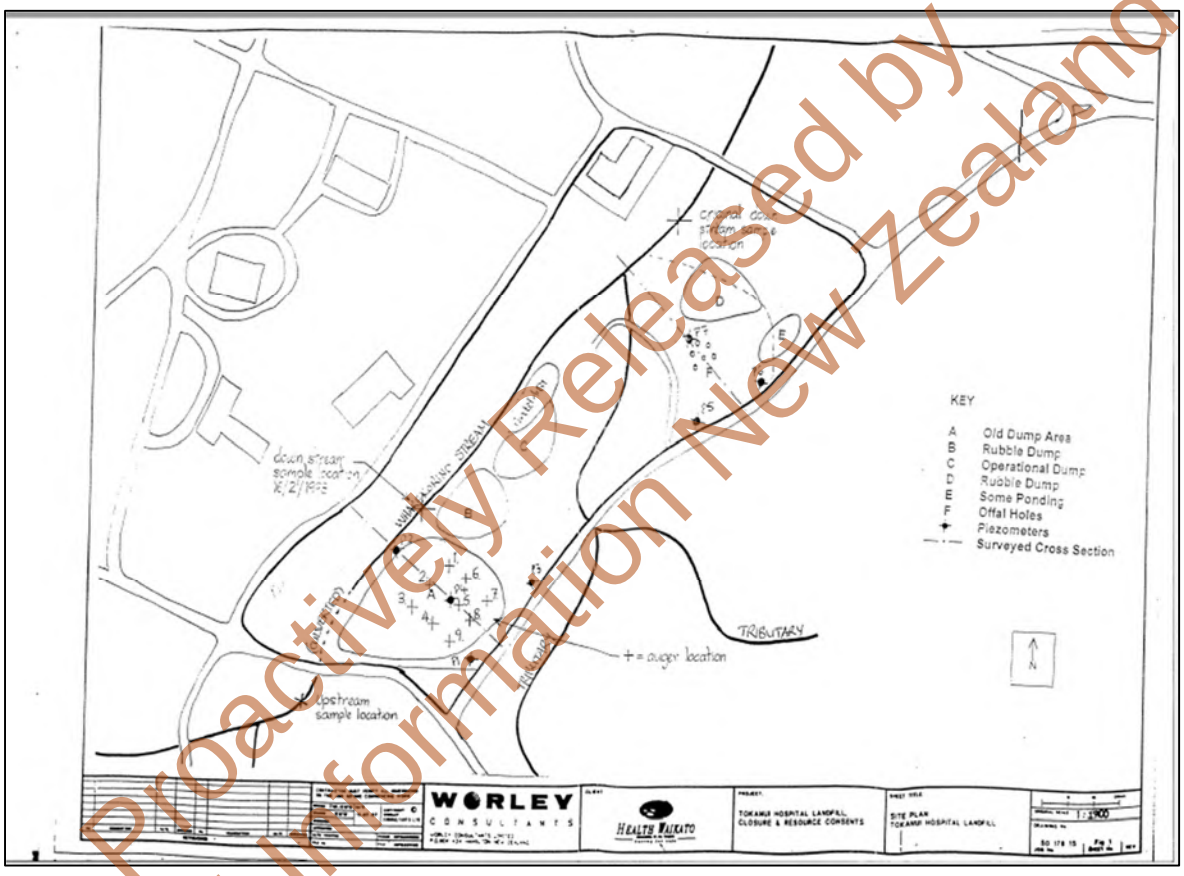


Figure 2: Closed Landfill Site Plan ex Worley

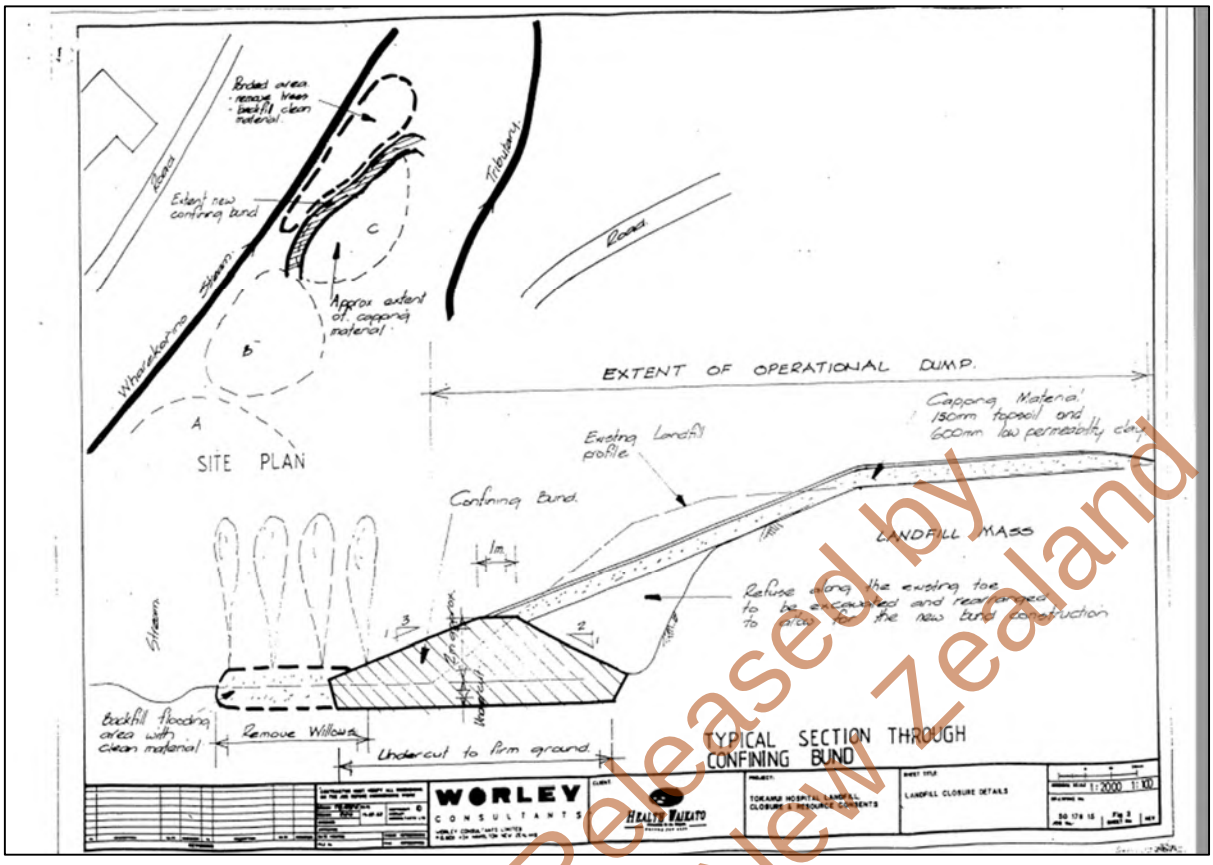


Figure 3: Closed Landfill – Closure Details for Area C (ex Worley)

5.2.2 Meritec Developed Site Plan (Oct 2000)

The Meritec "Developed Site Plan" (Oct 00) (Figure 4) has modified the area and extent of some of the landfill areas A-F from the Worley AEE (Figure 2) and shows five cross-sections through Areas A, B, C, D (part) and E, none of which were included in the CWR documentation. This plan also shows:

- Two piezometers. P2 and P7, which were to remain and be upgraded, for ongoing monitoring use, while the rest of the piezometers were to be decommissioned by grouting.
- Area C is shown as having an existing bund between it and the stream, and there is reference to a new imported clay bund, indicating that at least some of the closure works referred to in Figure 3 were completed for this area.
- Two additional areas (directly north of Area C and west of Area D were labelled as being part of a borrow area to be used initially to store and consolidate sludge and dirty water from existing ponds, with the borrow area to be later graded to fall, topsoiled and grassed.
- It also refers to the final cover comprising:
  - Areas A, C and F: 100mm topsoil on 100mm subsoil layer on low permeability clay layer. Thickness to be determined by permeability testing as per specification; minimum 450mm.
  - Areas B, D and E: 100mm topsoil on 200mm thick low permeability clay layer.
  - Subsoil layer: sand or free draining material from the site.
  - Compaction: compacted clay shall be compacted in layers or no more than 150mm thickness to ensure even compaction and maximum cap effectiveness.

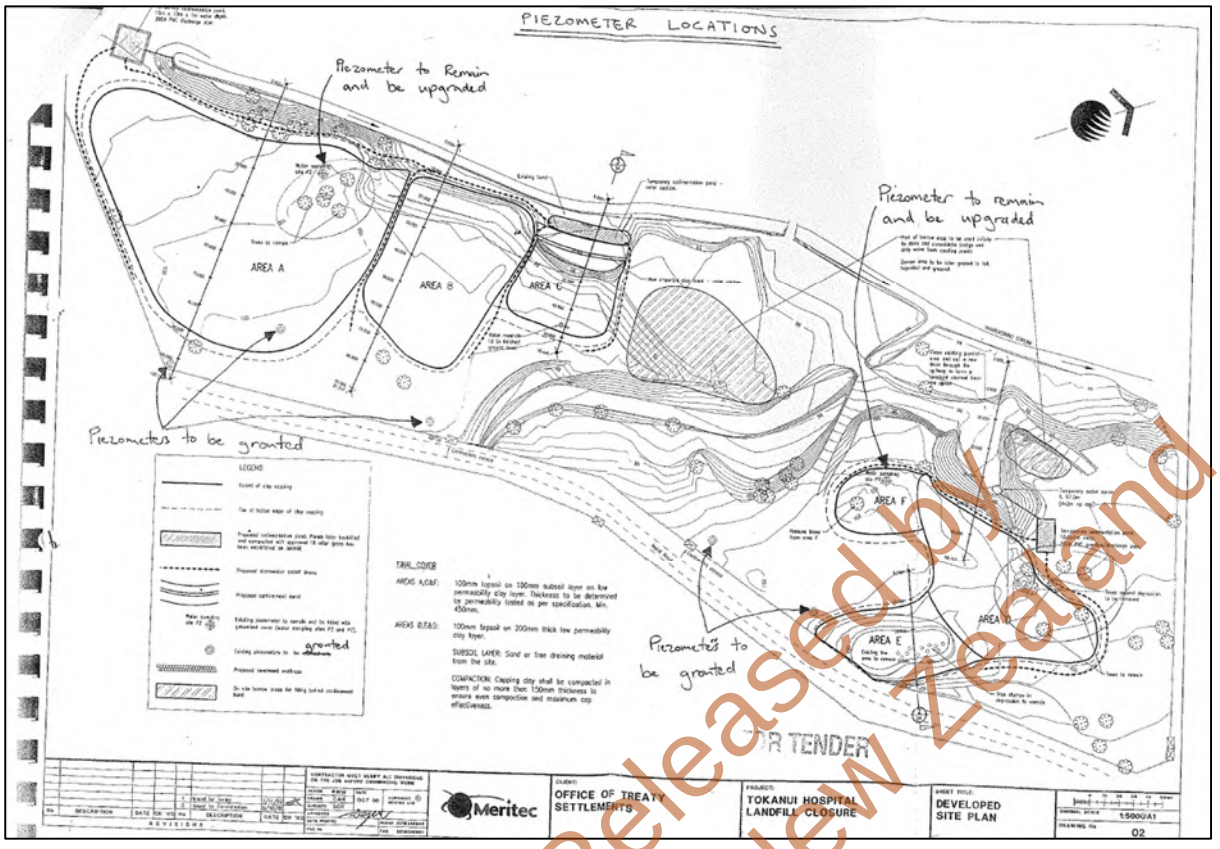


Figure 4: Meritec Developed Site Plan (October 2000)

5.2.3 Data Gaps

From the desktop review of relevant reports provided by LINZ and others, the following key data gaps were identified. These were discussed with LINZ with the outcome also recorded below.

Table 3: Identified Data Gaps and Outcome

Data Gap	Outcome
Lack of historical topographical survey data showing landfilling contours, ideally in CAD format.	Best historical contour information is a pdf copy of the Meritec 2000 Developed Site Plan (Figure 4 above). No other topo information found.
Worley closed landfill site plan (Figure 2) shows the locations of some hand augers (9 in Area A) and piezometers (P1-P7).	Hand auger borehole logs and piezometer P1-P7 logs were requested but have not been found.
Meritec 2000 drawing (Figure 4) includes a number of cross-sections.	Cross-sections requested but not found.
Any additional landfill cover composition, thickness and permeability data.	None found

Meritec 2000 drawing (Figure 4) is stamped for tender and would be part of a much larger tender package.	No other tender drawings or corresponding technical specification or any supporting technical report have been found. Similarly, no construction observation or certification documentation has been found.

5.3 AERIAL PHOTOGRAPHS

Historical aerial photographs dating from 1943 through to 1979, and 1995 through to 2021 have been reviewed as part of this desktop aerial photograph review. It should be noted that no historical aerial photographs of the FTPH were found during the 1980s.

5.3.1 Area A

The area of filling shifts east and north east from as early as 1957, filling the area, marked as Area A in the 1998 AEE (Figure 2). Early aerials show some buildings/dwellings in this area, but the majority of these were removed between 1966-1974. It was not possible to verify the closing year of the landfill (1988 from Table 2) due to the lack of any historical aerials covering the 1980s.

5.3.2 Area B

Multiple structures appear in this area from as early as 1943, that look to be dwellings. These structures remain in place until approximately 1974, where they are all removed. It is not clear where the building materials have been removed to; however, there are clear signs of soil disturbance visible, and infilling of depressions in this area of the site. The 1961 aerial shows two depressions adjacent to the stream path and the two most southern dwellings. The depression located to the south may relate to waste filling in Area B. Based on this, it is inferred that building demolition materials were dumped in this area. The 1979 aerial then shows the area as grassed over with some vegetation growing. From 1979 to present no further signs of ground disturbance are apparent.

5.3.3 Area C

Land depressions are visible in this area from 1943, and the area appears to be disturbed until 1979. Due to vegetation growth, it is difficult to delineate extents of filling from the historical aerials. There appears to be some soil disturbance through the centre of this area in the 1995 aerial photograph, which appears as vehicle tracks, indicating this was potentially one of the last filled areas, or that some capping materials were possibly sourced from this area.

5.3.4 Area D and E

A noticeable change in topography occurs between 1966 to 1974. It is during this period that the buildings and structures (4-5) in the area were demolished and cleared. Based on this, it is assumed that construction debris was disposed in these areas. The 1974 aerial appears to show a reasonably uniform settlement zone, gully or pit for filling; however, it is unclear which of these this feature is. In the 1979 aerial, this area appears to have been filled. By 1995, the area appears fully vegetated with no signs of soil disturbance visible.

5.3.5 Area F

There are clear signs of soil disturbance visible in the historical aerials from 1943 through 1979 in this area, with some small, possibly circular holes visible directly east of the Wharekōrino Stream, which

may be offal pits. There is also possible construction debris from removal of nearby structures that has been deposited within the gully/settlement zone in the southern portion of this area. By 1995, the area appears fully vegetated with no signs of soil disturbance visible.

5.3.6 Other Areas

The 1943/44 aerials show a depressed area west of Area A with the Wharekōrino Stream flowing through it. This is likely to be part of the stream floodplain. From 1957 until the late 1960s, aerials show the ground in this area as disturbed, and being filled in with the stream channel no longer visible by 1979. This is consistent with the information included under "other" in Table 2. This area has been labelled Area H and added to the intrusive investigation.

The 1943-44 aerials also clearly show a low-lying area west of Area H, on the other side of an access road that bisects Area H and this low-lying area (Area I). The 1974-79 aerial shows some indications of soil disturbance activities in this area, while more recent aerials and the LiDAR survey data for the site suggest this area may have been filled at least in part.

An additional area, termed 'Area G' has been identified directly north of Area C, where the potential for building demolition debris is considered likely. This is based on historical aerials for the area showing structures (likely residential buildings) directly east of the stream in the 1940s-1960s From the 1970s onwards, these structures are no longer visible. This area has been added to the intrusive investigation.

5.4 SITE INTERVIEWS

Given the time period of active filling at the site, very few people were able to be interviewed as part of the desktop study. One individual, a local Kaumātua, made himself available to discuss the history of the site.

During various discussions onsite with this person, it was made clear that the extent of fill in Area A was more extensive than first understood, potentially capturing Areas B & C as well. The contents of the landfill were also discussed, with Area A being identified as the original dumping area, and there being little discretion on the type of material deposited in this portion of the landfill.

It was revealed that the interviewee knew the member of staff who managed the landfill while it was operational, and this past staff member came to site the following day and was also interviewed. This past staff member stated that the landfill cells and contents were set on fire and left for multiple days, and that all material deposited within the cells was burnt, including building materials. In addition, the interviewee stated that no fill was deposited within Area G, nor was any fill deposited north of Areas D & E.

Furthermore, the interviewee revealed that when the FTPH proposed closure was made public knowledge, there was an increase in materials that were deposited within the landfilling areas, understood to be materials from the FTPH buildings.

5.5 SITE WALKOVER RESULTS

A walkover of the portion of the site assessed as part of this investigation was undertaken by FTL Environmental Scientist, Elliot Bish, on 1st November 2022 and 17th April 2023. The hospital existing

disposal sites is located within a paddock currently leased to AgResearch, which is usually grazed but sometimes mown for silage.

Across the existing disposal sites, there were various areas showing minor localised patchiness/die off. Some kanuka trees adjacent to the landfill (western side of existing disposal sites) also showed signs of dieback. There were various instances of individual refuse pieces protruding through the cap at the extents of the landfill. In addition, there was one area which showed small localised damage to the cap of the landfill.

There appears to be minor to moderate settlement and ponding in some areas, which has appeared largely unchanged from previous investigations. Area C has continued to show frequent ponding conditions.

Some subsidence was observed around the site, forming an uneven ground profile. No erosion was observed. There was no obvious evidence of contaminant leaching at any of the landfill sites. Wharekōrino Stream had an overall clear and slightly cloudy appearance, with debris build-up at the fence line and ponding in the paddock indicative of stream bank overtopping during periods of high stream flows.

An in-depth site walkover discussion, and associated photos are provided in the FTL report titled *"Tokanui Closed Landfill, Te Awamutu, Wharekōrino Stream & Bore Water Sampling, Water Quality Annual Report 2022"*, dated December 2022.

As part of the additional investigation, which was undertaken on the western side of the Wharekōrino stream, and below FTPH buildings 30 & 31, another site walkover was completed on 17th April 2023. This area of the site, referred to as Area I, appeared undeveloped, and likely used for grazing purposes. There was a farm access track observed running north-south along the eastern boundary of Area I. The area adjacent to the farm track was observed partially swampy underfoot, with moderate to steep slopes observed west and north of the swampy area. It should be noted the 'swampy' conditions may have been due to severe rainfall recently experienced. No areas of stunted grass growth or discolouration were observed. A single area of subsidence was observed, adjacent to the west of an established tree, directly south of FTPH buildings 30 & 31.

6 INTRUSIVE SAMPLING

6.1 INTRODUCTION

The intrusive sampling investigation of the former hospital existing disposal sites was completed between the 1st-11th November 2022 and 17th-20th April 2023. The April 2023 investigation focussed on delineating Area A, and investigating suspected additional filling areas. Due to relatively limited information obtained from the desktop study, an extensive investigation was undertaken to confirm the horizontal landfill extent, cap/refuse depths, coal ash distribution (if possible) and underlying soils. Permeability testing of selected samples from Areas A, C and F was also undertaken to check the permeability of the landfill cap. During the course of the investigation, a total of 56 machine excavated test pits, 40 machine excavated trenches and 11 hand augered boreholes were put down across the existing disposal sites, suspected additional filling areas and the Wharekōrino stream bank.

6.2 RATIONALE

Targeted intrusive soil sampling was conducted across the existing disposal sites and suspected additional filling areas based on the findings of the desktop study and information gathered from onsite interviews to:

(a) Check the nature of the soil and fill materials (visual observation, soil sampling) underneath the site.
(b) Determine the nature and severity of contamination (if any) in the soil and fill materials.
(c) Determine whether the soil/fill can be retained on-site or where it can be disposed to off-site (cleanfill, managed fill or landfill); and
(d) Determine whether the existing disposal sites and suspected additional filling areas are a potential risk to human and/or environmental health.
(e) Check the permeability of the landfill cap.

The intrusive investigation focused on the potential presence of Heavy Metals, Boron, Polycyclic-Aromatic Hydrocarbons (PAHs) and Semi-Quantitative Asbestos in soil.

6.3 DATA QUALITY OBJECTIVES & CONCEPTUAL SITE MODEL

In accordance with MfE Contaminated Land Management Guidelines (CLMG) No.5, the Data Quality Objectives (DQOs) and Conceptual Site Model (CSM) for this investigation are summarized below in Table 4.

Table 4: DQOs and CSM

Item	Description	
Purpose of investigation	To assist with developing a long term management strategy for the site, consistent with consenting requirements, best practice and to manage and/or mitigate potential human health and environmental effects.	
Date quality objectives	To determine the contamination status of the soil & fill materials contained within the existing disposal sites & suspected additional filling areas, and assess the human and environmental health risks posed by the existing disposal sites and suspected additional filling areas	
Define boundaries	Investigation focused on the extent of the existing disposal sites and suspected additional filling areas determined from the desktop study.	
Develop Conceptual Site Model	Known/possible HAIL land use	Landfill Sites HAIL category: G3 Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition: E1 Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment: I

	Contaminants of concern	Heavy Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Nickel & Zinc), Boron, Polycyclic-Aromatic Hydrocarbons (PAHs) and Semi-Quantitative Asbestos in Soil
	Distribution of contaminants	Lateral – across the existing disposal sites and suspected additional filling areas Vertical – depending on the soil type & depth of filling
	Receptors	Site users (long term) and construction/maintenance workers (short term)
	Potential pathways	Dermal contact, ingestion and inhalation.
	Applicable land use scenario	NESCS Rural Residential/Lifestyle Block – no produce (unpublished) NESCS Commercial/Industrial outdoor worker (unpaved)
Additional information required (Sampling and Analysis Plan)	144 soil samples collected from 56 test pits, 40 trenches & 11 hand augers at varying depths (Surface (0.0m) – 4.80m) below ground level (BGL) 135 soil samples analysed for Heavy Metals, PAHs & Semi Quantitative Asbestos. 11 Duplicate samples analysed for Heavy Metals for quality assurance/quality control purposes.	

6.4 EVALUATION BASIS

The sampling results have been compared with the NESCS Soil Contaminant Standards (SCS) for Rural Residential/Lifestyle Block – No Produce (unpublished) and Commercial/Industrial Outdoor Worker (Unpaved) land uses. In addition, an assessment against the adopted Waikato Regional Council cleanfill criteria, Envirofill South managed fill and Hampton Downs landfill acceptance criteria has been undertaken.

6.5 METHODOLOGY

Between the 1st-11th of November 2022, a total of 118 soil samples were collected from varying depths at 42 locations across 8 potential filling areas within the identified existing disposal sites and suspected additional filling areas. In addition, across the 8 potential filling areas, 16 permeability samples were collected for geotechnical analysis to assess the permeability of the existing landfill cap, while an additional 40 trenches were excavated to confirm the horizontal fill extent in the different landfill areas.

Between the 17th – 20th April 2023, a total of 37 soil samples were collecting from varying depths at 21 locations across 2 known filling areas (A & H) and 1 potential filling area (I) within the identified existing disposal sites and suspected additional filling areas.

Throughout the intrusive investigations, landfill gas was measured using a GA5000 Landfill Gas Analyser.

The sampling locations and results are shown on FTL Drawings 33097/003 – 33097/006 appended to this report and in the attached Appendix D. Test Pit logs are provided as part of the geotechnical factual report in Appendix C. Test pits TP41 – TP45 were not logged, as they were landfill cap sampling locations only. The numbers 1 to 6 below relate to the soil/fill matrix each sample was collected from.

All test pits and trenches were temporarily reinstated by placing excavated materials back into the pits/trenches in the same order as the material was removed, with the soil/fill being compacted using the excavator bucket. Hand auger locations were reinstated and compacted with the auger head.

Table 5: Soil Sample Information

ID	Depth (mm)	Soil/Fill Matrix	Test
TP1 – TP33, TP35, TP37 – TP39, TP46 – TP52, TP54 – TP56 SUR	0-150	Rootlets, Topsoil (1)	Heavy Metals (As, Cd, Cr, Cu, Pb, Ni, Zn), B, PAHs & SQ Asbestos
TP1, TP11 0.6m	550-650	Landfill Cap (2)	
TP8 1.0m	950-1050		
TR9 0.2m	150-250		
TR10 0.5m	450-550		
TR11, TR27 0.3m	250-350		
TR16 0.4m	350-450		
TP38 0.3m	250-350		
TP39 0.5m	450-550		
TP40 0.6m	550-650		
TP41 0.2m	150-250		
TP42 0.2m	150-250		
TP42 1.0m	950-1050		
TP43 0.3m	250-350		
TP43 0.7m	650-750		
TP44 0.4m	350-450		
TP45 0.2m	150-250		
TP3, TP17 0.7m	650-750	Interface of Landfill Cap and Mixed Fill (3)	
TP4 1.0m	950-1050		
TP10 0.8m	750-850		
TP15 0.5m	450-550		
TP44 1.0m	950-1050		
TP1, TP3, TP5, TP8, TP10, TP38 2.0m	1950-2050	Mixed Fill (4)	
TP2, TP7 1.8m	1750-1850		
TP2, TP5, TP6 3.0m	2950-3050		
TP6, TP9, TP30, TP26, TP57 1.5m	1450-1550		
TP9, TP35 2.5m	2450-2550		
TP12 1.2m	1150-1250		
TP13, TP27, TP35, TR22, TP40 1.0m	950-1050		

ID	Depth (mm)	Soil/Fill Matrix	Test
TP14, TP15, TP26, TP57 0.8m	750-850		
TP16, TP46, TP50 0.3m	250-350		
TP17 3.7m	3650-3750		
TP32, TP50 0.5m	450-550		
TP34 SUR	0-150		
TP51 0.25m	200-300		
HA1	200-600		
TP4 4.0m	3950-4050	Interface of Mixed Fill and Natural Ground (5)	
TP7 3.0m	2950-3050		
TP12 2.7m	2650-2750		
TP13 3.2m	3150-3250		
TP14, TP18 1.2m	1150-1250		
TP16 0.5m	450-550		
TP21 1.0m	950-1050		
TP30 3.5m	3450-3550		
TP56 2.3m	2250-2350		
TP11, TP32 1.5m	1450-1550	Natural Ground (6)	Heavy Metals (As, Cd, Cr, Cu, Pb, Ni, Zn), B, PAHs & SQ Asbestos
TP19 0.8m	750-850		
TP20, TP24 1.5m	1450-1550		
TP23 1.2m	1150-1250		
TP25 2.0m	1950-2050		
TP27 1.7m	1650-1750		
TR27 4.8m	4750-4850		
TP28, TP33, TP34 0.5m	450-550		
TP29 0.3m	250-350		
TR29 2.9m	2850-2950		
TP31, TP22 1.0m	950-1050		
TP40 2.1m	2050-2150		
HA2 – HA7, HA9, HA10	0-1000		Not Sampled
HA8	0-2000		
HA11	0-1500		

7 INTRUSIVE INVESTIGATION RESULTS AND DISCUSSION

7.1 SOIL/FILL PHYSICAL OBSERVATIONS

The geotechnical factual report in Appendix C includes all testpit & hand auger logs from the intrusive investigations. Test pit logs of the shallow trenches are not appended to this report as these trenches were used to determine the extent of fill. Key physical observations from this investigation are summarised below:

(a) The areas where landfill material was encountered were generally observed to comprise grassed, flat lying farm paddocks. Evidence of shallow soil creep, including terracettes and hummocky

topography, were observed in areas where the site topography sloped at, or was steeper than, 14° to the horizontal (1V:4H), as shown on the appended Fraser Thomas Ltd drawing 65547/101.

(b) A 'tomo', or area of subsidence, up to approximately 1 m² in plan area and up to 0.6 m deep, was noted in the northern part of the site, within close proximity to TP36, where construction debris were encountered from 0.2 m to 1.8 m depth below the ground surface.

(c) Area A: Landfill material was confirmed to be present in Area A at variable depths (refer TP1-TP12, TP35 and TP38-TP45) comprising a mixture of construction debris, general refuse, burnt material, tree stumps/wood fragments inferred boiler ash and some sharps and asbestos. This was overlain by a silt capping/cover layer and topsoil. The cap appeared to be continuous across Area A. Evidence of trenches where fill was deposited and burnt was identified across Area A; however, it was not possible to confirm trench dimensions due to frequent trench collapse during excavations.

(d) Area B: Landfill material was confirmed to be present in Area B (TPs 13-16) at variable depths comprising a mixture of mainly construction/demolition waste and some burnt debris and sharps. This was overlain by a silt capping/cover layer and topsoil.

(e) Area C: Landfill material was confirmed to be present in Area C (TPs 17-18) at variable depths comprising a mixture of general and construction waste, including some potential ACM (asbestos containing materials), barbed wire and sharps. This was overlain by a silt capping/cover layer and topsoil.

(f) Area G: Landfill material was not found in Area G (refer TPs 19-24 and TR 21 and 22), although some non-engineered fill (reworked natural) was present at three test pits in this location (possibly from capping of adjacent area or from reworking of natural ground in this area as part of post-landfilling works).

(g) Area E: Landfill material was not found in Area E (TP25 and TR37-40).

(h) Area F: Medical waste (needles, razors, blood bags and bottles; no soil matrix) was found in Area F at TP26, where 7 x 600mm diameter bored offal pits were encountered within the test pit and surrounding area. Inferred boiler ash was also noted in one of the offal pits. Table 2 refers to there being a total of 6 offal pits used for medical waste in this area. No other offal pits were found in the three trenches excavated in this area. Low density construction and demolition debris as well as non-engineered fill (likely reworked natural ground) was also identified in this area.

(i) Area D: Landfill material was confirmed in this area (TPs 27, 30, 36) mainly comprising construction waste, including wood, metal, concrete, bricks and some sharps. No landfill material was found in the other test pits (TPs 28, 29, 31) and trenches excavated in this area.

(j) Area H: Landfill material was confirmed to be present in Area H at variable depths (refer TP32, TP33, TP34, TP54 & TP55) comprising a mixture of construction debris, general refuse, burnt material and sharps. It was partially overlain by a silt capping/cover layer and topsoil, with some areas having no capping layer and just being covered with topsoil.

(k) Area I: Landfill material was confirmed in this area (TP50, TP56 & TP57) at variable depths mainly comprising construction debris, general refuse and large quantities of buried topsoil.

The waste materials found in Areas A-F are generally consistent with the waste descriptions from the 1998 AEE in Table 3 of this report.

The test pitting work was relatively difficult for a number of reasons, including:

- Excavating into historic landfill areas.
- In some locations, test pit side wall collapse meant the test pits were terminated before natural ground was reached.
- It was sometimes difficult to determine the fill/natural ground interface due to the depth of the test pits and groundwater infiltration.

7.2 SHEAR VANE RESULTS

In situ undrained shear strength measurements were carried out in the sides and base of the test pits using hand held field shear vane equipment in accordance with the NZ Geotechnical Society 'Test Method for Determining the Vane Shear Strength of a Cohesive Soil using a Hand-Held Shear Vane, August 2001'. These tests were carried out in the walls and floor of the test pits at 0.5 m depth intervals, where possible, enabling a strength profile of cohesive soils to be obtained from the test pits.

It is noted that in situ undrained shear strength measurements were not generally undertaken in the granular material i.e., landfill refuse.

It is also noted that due to instability of the area surrounding the test pits, dynamic cone (Scala) penetrometer (DCP) tests were not undertaken in the landfill refuse.

In situ undrained shear strength values measured in the landfill capping material were generally greater than 100 kPa, corresponding to a very stiff to hard consistency.

In situ undrained shear strength values measured in the Hamilton Ash and Tauranga Group alluvial sediments ranged between 31 kPa and greater than 200 kPa, corresponding to a firm to hard consistency.

7.3 GENERAL COMMENTS

Throughout the investigation, no putrescible waste (i.e., odorous or decaying waste) was observed within the refuse. In addition, there were no organics observed within the fill apart from some wood.

ACM were not easily identifiable within the fill, given the wide range of refuse observed within the fill and poor condition of much of the fill contents. However, some test pits contained stacked asbestos roof tiles (super six cement) and other ACM such as pipe lagging.

The systematic approach to test pitting adopted is considered to be the most appropriate and representative method for capturing typical refuse composition and contaminant concentrations within the various landfill areas, while the number of test pits and trenches put down is also considered to be appropriate based on the investigation objectives. However, the observed heterogenity of the fill material in many locations and small volume of the samples collected for testing from each test pit means that the sampling results could potentially miss localised contamination hotspots. Furthermore, the presence of hazardous materials within various landfill areas is important in determining the overall human health risk. These hazardous materials are generally present in small quantities dispersed throughout the waste mass, apart from the "offal pits" in Area F that contain mainly medical waste.

7.4 SOIL/FILL ANALYTICAL RESULTS

All soil/fill results are provided in tabulated form as Appendix D.

7.4.1 Area A

A. Topsoil (15 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in all 15 topsoil samples within Area A. Concentrations of boron detected in samples TP1 SUR, TP2 SUR, TP3 SUR, TP5 SUR, TP7 SUR, TP10 SUR,TP12 SUR, TP35 SUR, TP38 SUR & TP39 SUR exceeded the Waikato Regional Council cleanfill acceptance criteria (noting that the lab detection limit for boron (20mg/kg) is greater than the cleanfill criteria, but not including these samples). Concentrations of boron detected in samples TP2 SUR, TP5 SUR & TP12 SUR exceeded the managed fill acceptance criteria. Furthermore, concentrations of boron detected in sample TP12 SUR also exceeded the Class 1 landfill acceptance criteria, but were below the relevant NESCS guidelines.
- PAHs were elevated above the analytical limit of detection in 14 of 15 topsoil samples within Area A. The concentrations of BaP Eq. in sample TP12 SUR were also elevated above the Class 1 Landfill acceptance criteria, but were below the relevant NESCS guidelines.
- Asbestos (AF/FA portion) was detected in 5 (TP5 SUR, TP12 SUR, TP35 SUR & TP38 SUR) of the 15 topsoil samples within Area A. Concentrations of free fibres in samples TP5 SUR & TP12 SUR exceeded the relevant BRANZ Asbestos in Soil guidelines for both residential (proxy for maintenance workers exposure) and commercial/industrial sites.

B. Landfill Cap (17 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in 14 of the 17 landfill cap samples within Area A. Concentrations of boron detected in sample TP1 0.6m, TR11 0.3m, TP38 0.3m, TP39 0.5m, TP40 0.6m & TP43 0.7m exceeded the Waikato Regional Council cleanfill acceptance criteria; however, there were no exceedances of the managed fill or Class 1 landfill acceptance criteria, nor the relevant NESCS guidelines.
- Residual concentrations of PAHs were detected in 5 of the 17 landfill cap samples within Area A, while a further 5 landfill cap samples had concentrations of PAHs elevated above background concentrations for the site. There were no exceedances of the NESCS or any waste acceptance criteria noted for PAHs.
- Residual concentrations of Asbestos fibres were detected in 2 of the 17 landfill cap samples; however, no exceedances of the NESCS or waste acceptance criteria was noted for Asbestos.

C. Mixed Fill (21 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in all 21 mixed fill samples within Area A. Concentrations of arsenic detected in samples TP1 2.0m, TP3 2.0m, TP5 2.0m, TP9 2.5m,TP10 2.0m, TP35 2.5m & TP38 2.0m also exceeded the NESCS rural residential/lifestyle block- no produce (unpublished) land use criteria, and sample TP38 2.0m also exceeded the NESCS commercial/industrial outdoor worker (unpaved) land use criteria. Concentrations of lead detected in mixed fill samples TP2 1.8m, TP2 3.0m, TP3 2.0m, TP5 2.0m, TP5 3.0m, TP8 2.0m, TP9 2.5m, TP10 2.5m, TP35 1.0m, TP35 2.5m & TP38 2.0m exceeded the NESCS rural

residential/lifestyle block - no produce (unpublished) land use criteria, but did not exceed the NESCS commercial/industrial outdoor worker (unpaved) land use criteria. Concentrations of boron, copper, lead and zinc all exceeded the Class 1 landfill acceptance criteria in samples between 0.9m-3.0m depth, indicating the mixed fill materials within this layer exhibit the highest levels of contamination within Area A.

- Residual concentrations of PAHs were detected in 7 of 21 samples, while PAHs were elevated above the analytical limit of detection in a further 13 of 21 mixed fill samples within Area A. The concentrations of BaP Eq. in sample TP12 1.2m was also elevated above the Class 1 Landfill acceptance criteria, but were below the relevant NESCS guidelines.
- Asbestos (AF/FA Portion) was detected in 16 of the 21 mixed fill samples within Area A. Six of the 21 samples (TP1 2.0m, TP3 2.0m, TP10 2.0m, TP12 1.2m, TP3 2.5m & TP40 1.0m) had concentrations of free fibres that exceed the relevant BRANZ Asbestos in Soil guidelines for both residential (proxy for maintenance workers exposure) and commercial/industrial sites. Sample TP3 2.0m also had concentrations of asbestos containing materials (%ACM portion) that exceeded both BRANZ residential and commercial/industrial sites guidelines.

D. Natural Ground (5 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in 4 of the 5 natural ground samples within Area A. Boron was also elevated above the WRC Cleanfill criteria in samples TP4 4.0m, TP7 3.0m & TP40 2.1m and was elevated above the Class 1 landfill acceptance criteria in sample TP12 2.7m.
- PAHs were not detected in any of the natural ground samples within Area A.
- Asbestos (AF/FA & %ACM portions) was not detected in any of the natural ground samples within Area A.

7.4.2 Area B

A. Topsoil (4 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in all 4 topsoil samples within Area B. Boron was also elevated above the WRC Cleanfill criteria in sample TP14 SUR.
- PAHs were elevated above the analytical level of detection in all 4 topsoil samples within Area B. The concentration of BaP Eq. in sample TP14 SUR was also elevated above the Class 1 landfill acceptance criteria, but was below the relevant NESCS guidelines.
- Asbestos (AF/FA & %ACM Portions) was not detected in any of the topsoil samples within Area B.

B. Mixed Fill (5 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in all 5 mixed fill samples within Area B. The concentration of lead detected in sample TP13 1.0m exceeded the NESCS rural residential/lifestyle block- no produce (unpublished) land use criteria, but did not exceed the NESCS commercial/industrial outdoor worker (unpaved) land use criteria.

- PAHs were elevated above the analytical level of detection in 3 of the 5 mixed fill samples within Area B. There were no exceedances of the NESCS or any waste acceptance criteria noted for PAHs.
- Residual concentrations of asbestos (AF/FA & %ACM Portions) were detected in 1 (TP16 0.3m) of the 5 mixed fill samples within Area B, exceeding the WRC Cleanfill acceptance criteria. However, no exceedance of the BRANZ Asbestos in Soil guidelines was noted.
- It is considered likely that samples TP15 0.5m & TP15 0.8m have been collected from the interface of landfill cap and fill (TP15 0.5m), and interface of fill and underlying natural ground (TP15 0.8m), which could explain the relatively low contaminant concentrations within these samples.

C. Natural Ground (3 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in all 3 of the natural ground samples within Area B. Boron, lead and zinc were also elevated above the WRC Cleanfill criteria in samples TP 13 3.2m (boron, lead, zinc), TP14 1.2m (boron) and TP16 0.5m (lead). No exceedances of the relevant NESCS guidelines were noted.
- PAHs were elevated above the analytical level of detection in 2 (TP13 3.2m, TP16 0.5m) of the 3 natural ground samples within Area B. There were no exceedances of the NESCS or any waste acceptance criteria noted for PAHs.
- Residual Asbestos (AF/FA Portions) was detected in 2 (TP13 3.2m & TP16 0.5m) of the natural ground samples within Area B, exceeding the WRC Cleanfill criteria. However, no exceedance of the BRANZ Asbestos in Soil guidelines was noted.

7.4.3 Area C

A. Topsoil (2 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in 1 of the 2 topsoil samples within Area C. Boron was also elevated above the WRC Cleanfill criteria in sample TP18 SUR. No exceedances of the relevant NESCS guidelines were noted.
- PAHs were elevated above the analytical level of detection in both topsoil samples within Area C, but was below the relevant waste acceptance criteria and NESCS guidelines.
- Asbestos (AF/FA portion) was detected in 1 (TP18 SUR) of the topsoil samples within Area B. The sample results identified concentrations of free fibres that exceed the relevant BRANZ Asbestos in Soil guidelines for both residential (proxy for maintenance workers exposure) and commercial/industrial sites.

B. Landfill Cap (1 sample)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in the single (TR16 0.4m) landfill cap sample within Area C. No exceedances of the relevant waste acceptance criteria or NESCS guidelines were noted.

- Residual concentrations of PAHs were detected above the analytical level of detection in the single landfill cap sample within Area C, but were below the relevant waste acceptance criteria and NESCS guidelines.
- Asbestos (AF/FA & %ACM portions) was not detected within the single landfill cap sample from Area C.

C. Mixed Fill (2 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in both (TP17 0.7m & TP17 3.7m) mixed fill samples within Area C (latter sample from interface of mixed fill and natural ground and included here, based on results). Lead was detected at levels that exceed the Class 1 Landfill acceptance criteria in both samples, was equal to the NESCS rural residential/lifestyle block – no produce (unpublished) guidelines in sample TP17 0.7m and, along with arsenic, exceeded the NESCS rural residential/lifestyle block – no produce (unpublished) guidelines in sample TP17 3.7m. Zinc was also detected in sample TP17 3.7m at levels that exceed the Class 1 Landfill acceptance criteria.
- PAHs were detected above the analytical level of detection in the 2 mixed fill samples within Area C, but were below the relevant waste acceptance criteria and NESCS guidelines.
- Asbestos (AF/FA portion) was detected within mixed fill sample TP17 3.7m. The sample result identified concentrations of free fibres that exceed the relevant BRANZ Asbestos in Soil guidelines for both residential (proxy for maintenance workers exposure) and commercial/industrial sites.

D. Natural Ground (1 sample)

- One heavy metal (lead) was elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in the single natural ground sample within Area C. No exceedances of the relevant waste acceptance criteria or NESCS guidelines were noted.
- PAHs were not detected in the single natural ground sample within Area C.
- Asbestos (AF/FA & %ACM Portions) was not detected in the single natural ground sample within Area C.

7.4.4 Area D

A. Topsoil (5 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in 4 of the 5 topsoil samples within Area D. Boron was also elevated above the WRC Cleanfill criteria in sample TP31 SUR. No exceedances of the relevant NESCS guidelines were noted.
- PAHs were elevated above the analytical level of detection in 4 of the 5 topsoil samples within Area D, but were below the relevant waste acceptance criteria and NESCS guidelines.
- Asbestos (AF/FA & %ACM portions) was not detected in any of the topsoil samples from Area D.

B. Mixed Fill (2 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in both (TP27 1.0m & TP30 1.5m) mixed fill samples within Area D. The concentrations of lead detected in sample TP30 1.5m exceeds the NESCS rural residential/lifestyle block – no produce (unpublished) guidelines, and the concentrations of lead detected in both samples exceed the Class 1 landfill acceptance criteria.
- PAHs were detected above the analytical level of detection in both mixed fill samples within Area D, but were below the relevant waste acceptance criteria and NESCS guidelines.
- Asbestos (AF/FA portion) was detected in sample TP27 1.0m from Area D. The sample result identified concentrations of free fibres that exceed the relevant BRANZ Asbestos in Soil guidelines for both residential (proxy for maintenance workers exposure) and commercial/industrial sites.

C. Natural Ground (6 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in 3 of the 6 natural ground samples within Area D. The concentrations of lead detected in sample TP30 3.5m exceed the NESCS rural residential/lifestyle block – no produce (unpublished) guidelines and the Class 1 landfill acceptance criteria.
- PAHs were not detected in the natural ground samples within Area D.
- Asbestos (AF/FA & %ACM Portions) was not detected in the natural ground samples within Area D.

7.4.5 Area E

A. Topsoil (1 sample)

- Heavy metals were detected in the single topsoil sample collected from Area E; however, all heavy metal concentrations were below the upper limit background concentrations for selected elements in soil from the Waikato Region.
- PAHs were not detected in the single topsoil sample from Area E.
- Asbestos (AF/FA & %ACM Portions) was not detected in the single topsoil sample within Area E.

B. Natural Ground (1 sample)

- Heavy metals were detected in the single natural ground sample collected from Area E; however, all heavy metal concentrations were below the upper limit background concentrations for selected elements in soil from the Waikato Region.
- PAHs were not detected in the single natural ground sample from Area E.
- Asbestos (AF/FA & %ACM Portions) was not detected in the single natural ground sample within Area E.

7.4.6 Area F

A. Topsoil (1 sample)

- One heavy metal (zinc) was elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in the single topsoil sample collected from

Area F. There were no exceedances noted for the relevant waste acceptance criteria or the NESCS guidelines.

- PAHs were not detected in the single topsoil sample within Area F.
- Asbestos (AF/FA & %ACM Portions) was not detected in the natural ground samples within Area F.

B. Landfill Cap (1 sample)

- Two heavy metals (nickel & zinc) were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in the single landfill cap sample collected from Area F. There were no exceedances noted for the relevant waste acceptance criteria or the NESCS guidelines.
- Residual concentrations of PAHs were detected in the single landfill cap sample collected from Area F. No exceedances of the relevant waste acceptance criteria or NESCS guidelines were noted.
- Asbestos (AF/FA & %ACM Portions) was not detected in the landfill cap sample within Area F.

C. Mixed Fill (2 samples)

- Two heavy metals (lead & zinc) were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in 1 of 2 mixed fill samples collected from Area F. There were no exceedances noted for the relevant waste acceptance criteria or the NESCS guidelines.
- PAHs were not detected in either mixed fill sample collected from Area F.
- Asbestos (AF/FA & %ACM Portions) was not detected in either mixed fill sample within Area F.
- It should be noted, Area F mixed fill samples were collected from materials in contact with medical waste containers (containing syringes & medicine bottles); therefore, a biohazard risk should be noted.

D. Natural Ground

- Heavy metals were detected in the single natural ground sample collected from Area F; however, all heavy metal concentrations were below the upper limit background concentrations for selected elements in soil from the Waikato Region.
- PAHs were not detected in the single natural ground sample from Area F.
- Asbestos (AF/FA & %ACM portions) was not detected in the single natural ground sample within Area F.

7.4.7 Area G

A. Topsoil (6 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in all 6 topsoil samples collected from Area G. The concentrations of boron detected in samples TP19 SUR, TP20 SUR, TP22 SUR & TP23 SUR

exceed the WRC Cleanfill criteria; however, no exceedances were noted for Class 1 landfill criteria or the NESCS rural residential/lifestyle block – no produce (unpublished) guidelines.

- PAHs were detected above the analytical level of detection in 5 of the 6 mixed fill samples within Area G, but were below the relevant waste acceptance criteria and NESCS guidelines.
- Residual concentrations of asbestos (AF/FA Portion) were detected in sample TP19 SUR, exceeding the WRC Cleanfill criteria. However, no exceedance of the BRANZ Asbestos in Soil guidelines was noted.

B. Mixed Fill (reworked natural material) (1 sample)

- Two heavy metals (lead & zinc) were marginally elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in the single mixed fill sample collected from Area G (and are considered to essentially be at background levels). No exceedances were noted for Class 1 landfill criteria or the NESCS rural residential/lifestyle block – no produce (unpublished) guidelines.
- Residual PAHs were detected above the analytical level of detection in the single mixed fill sample within Area G, however the concentrations were below the relevant waste acceptance criteria and NESCS guidelines and BAP(eq) was less than the lab detection limit – i.e., essentially at background levels.
- Asbestos (AF/FA & %ACM Portions) were not detected in the single mixed fill sample.
- In our opinion, the material termed 'Fill' at this location is likely to be reworked natural ground, likely disturbed during the removal of historical buildings in this area.

C. Natural Ground (6 samples)

- Heavy metals (lead & zinc) were detected in 1 (TP21 1.0m) of the 6 natural ground samples collected from Area G at levels elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region. The concentration of zinc detected in sample TP21 1.0m was also elevated above the WRC cleanfill acceptance criteria. The remaining 5 samples (TP19 0.8m, TP20 1.5m, TP22 1.0m, TP23 1.2m & TP24 1.5m) did not have any concentrations of heavy metals elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region.
- PAHs were not detected in any of the natural ground samples from Area G.
- Asbestos (AF/FA & %ACM Portions) was not detected in any of the natural ground samples within Area G.

7.4.8 Area H

A. Topsoil (5 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in all 5 topsoil samples within Area H. There were no exceedances of the Waikato Regional Council cleanfill acceptance criteria, Class 1 landfill acceptance criteria or the relevant NESCS guidelines noted for heavy metals.

- PAHs were elevated above the analytical limit of detection in 3 of the 5 topsoil samples within Area H. The concentrations detected were below both the Waikato Regional Council cleanfill acceptance criteria, the Class 1 Landfill acceptance criteria and the relevant NESCS guidelines.
- Asbestos (AF/FA Portion) was detected in 1 (TP35 SUR) of the 3 topsoil samples within Area H. The concentrations of free fibres detected were below the relevant BRANZ Asbestos in Soil guidelines for both residential (proxy for maintenance workers exposure) and commercial/industrial sites.

B. Mixed Fill (2 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in both mixed fill samples within Area H. Concentrations of arsenic detected in samples TP32 0.5m and both exceed the NESCS rural residential/lifestyle block- no produce (unpublished) land use criteria. Furthermore, the arsenic concentrations detected in sample TP32 0.5m also exceeds the NESCS commercial/industrial outdoor worker (unpaved) land use criteria. Concentrations of lead detected in all Area H mixed fill samples (TP32 0.5m, TP34 SUR, TP35 1.0m & TP35 2.5m) exceeded the NESCS rural residential/lifestyle block - no produce (unpublished) land use criteria, but did not exceed the NESCS commercial/industrial outdoor worker (unpaved) land use criteria. Concentrations of arsenic, boron, copper, lead & zinc all exceeded the Class 1 landfill acceptance criteria in samples between 0.0m-2.5m depth, indicating the mixed fill materials within this layer exhibit the highest levels of contamination within Area H. As this area is adjacent to Area A, it is considered this area of the landfill contains the highest levels of contamination.
- PAHs were elevated above the analytical limit of detection in 3 of the 4 mixed fill samples within Area H. The concentrations detected were below both the Class 1 Landfill acceptance criteria and the relevant NESCS guidelines.
- Asbestos (AF/FA Portion) was detected in all 4 mixed fill samples within Area H. The sample results identified concentrations of free fibres in samples TP34 SUR & TP35 2.5m that exceed the relevant BRANZ Asbestos in Soil guidelines for both residential (proxy for maintenance workers exposure) and commercial/industrial sites.

C. *Natural Ground (3 samples)*

- One heavy metal (lead) was detected in 1 (TP32 1.5m) of the 3 natural ground samples collected from Area H at levels marginally elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region. No other elevated concentrations of heavy metals were detected in the natural ground samples collected from Area H.
- PAHs were not detected in any of the natural ground samples from Area H.
- Asbestos (AF/FA & %ACM Portions) was not detected in any of the natural ground samples within Area H.

7.4.9 Area I

A. Topsoil (8 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in all 8 topsoil samples within Area I. There were no exceedances of the Waikato Regional Council cleanfill acceptance criteria, Class 1 landfill acceptance criteria or the relevant NESCS guidelines noted for heavy metals in Area I.
- PAHs were elevated above the analytical limit of detection in 3 of the 8 topsoil samples within Area I. In addition, residual concentrations of PAHs were detected in 3 of the 8 samples. The concentrations detected were below both the Waikato Regional Council cleanfill acceptance criteria, the Class 1 Landfill acceptance criteria and the relevant NESCS guidelines in all samples in Area I.
- Asbestos (AF/FA Portion) was detected in 1 (TP56 SUR) of the 8 topsoil samples within Area I. The concentrations of free fibres detected were in exceedance of the relevant BRANZ Asbestos in Soil guidelines for both residential (proxy for maintenance workers exposure) and commercial/industrial sites.

B. Mixed Fill (7 samples)

- One or more heavy metals were elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region in all 7 mixed fill samples within Area I. Concentrations of arsenic detected in sample HA01 0.2-0.6m, boron detected in sample TP50 0.5m and copper detected in sample TP57 0.8m all exceeded the WRC cleanfill criteria. Furthermore, the concentrations of copper detected in sample TP57 0.8m also exceed the Envirofill managed fill criteria. There were no exceedances of the Class 1 landfill acceptance criteria or the relevant NESCS guidelines noted for heavy metals in Area I.
- PAHs were elevated above the analytical limit of detection in 5 of the 7 mixed fill samples within Area I. The concentrations detected were below the WRC Cleanfill criteria, Class 1 Landfill acceptance criteria and the relevant NESCS guidelines.
- Residual concentrations of Asbestos (AF/FA Portion) were detected in 2 of the 7 mixed fill samples within Area I, exceeding the WRC Cleanfill criteria. However, the concentrations detected were below the relevant BRANZ Asbestos in Soil guidelines for both residential (proxy for maintenance workers exposure) and commercial/industrial sites, and the Class 1 Landfill acceptance criteria.

C. *Natural Ground (1 sample)*

- One or more heavy metals were detected in the single natural ground sample collected from Area I at levels elevated above the upper limit background concentrations for selected elements in soil from the Waikato Region. No other elevated concentrations of heavy metals were detected in the natural ground samples collected from Area I.
- PAHs were not detected in any of the natural ground samples from Area H.
- Asbestos (AF/FA & %ACM Portions) was not detected in any of the natural ground samples within Area H.

7.4.10 Summary

This section provides a summary of these results in terms of:

(a) Potential risks to human health;
(b) Potential risk to the environment; and,
(c) Disposal classification requirements.

These are summarised on a "layer by layer" basis in relation to topsoil, capping layer (where present), mixed fill and the underlying natural ground.

A. Human Health Risks

The topsoil quality is at or below background levels in Area E only. It is within adopted NESCS guidelines in Areas B, D, F, G and H and 50-83% of Area A and C samples. It exceeds the NESCS rural residential standards in 17% of Area A samples and exceeds both the NESCS rural residential and commercial/industrial guidelines in 50% of Area C, both due to asbestos contamination.

The landfill cap quality is within background levels in 33% of Area A samples and within adopted NESCS guideline levels in the rest of Area A and in Areas C, and F.

The mixed fill generally exceeded one or both of the adopted NESCS guidelines in Areas A, C, D and H for over half the samples collected. Area B, F and G samples were 80-100% within the adopted guidelines. No mixed fill was found in Area E. The Area G fill is considered to be reworked natural ground, with the contamination detected being marginal and essentially at background levels.

The natural ground was generally less than background in 25% of samples in Area A, 50% in Area D, 67% in Area H, 83% in Area G and 100% in Areas C, E and F. Natural ground sample was 100% within guidelines in Area B. It only exceeded NESCS rural residential guidelines in 17% of Area D samples.

All the commercial/industrial guideline exceedances relate to asbestos.

These results are summarised in tabular form below and by colour coding in the results tables and figures.

Table 6: Results Summary relative to human health risk

Area	Topsoil	Landfill Cap	Mixed Fill	Natural Ground
A	83% within GL, 9.5% > RR & C/I (Asb)	82% > background, 100% within GL	100% > background, 67% > RR < C/I, 33% > RR & C/I	80% > BG, 100% < GL
B	100% > background, 100% within GL	Not applicable	80% within GL, 20% > RR	100% within GL
C	50% within GL, 50% > RR & C/I (Asb)	Within GL	50% within GL, 50% > RR & C/I (Asb)	100% < GL
D	100% within GL	Not applicable	50% > RR < C/I, 50% > RR & C/I (Asb)	50% < BG, 17 > GL, 17% > RR
E	100% < BG	Not applicable	Not applicable	100% < BG
F	100% < GL	100% < GL	100% < GL (but medical waste)	100% < BG

G	100% within GL	Not applicable	100% within GL	83% < BG, 17% < GL
H	40% < GL, 20% > RR & C/I (Asb)	Not applicable	100% > RR < C/I, 50% > C/I (Asb)	67% < BG, 33% > BG, 100% < GL
I	87.5% < GL, 12.5% > RR & C/I (Asb)	Not applicable	100% within GL, but residual Asb.	100% within GL

Notes: RR = rural residential, GL = guideline, C/I =commercial/industrial, BG = background

B. Environmental Risk

Waikato Regional Council (WRC) does not have an environmental protection guideline for soil according to the best of our knowledge. Environment Canterbury use one based on the Interim Sediment Quality Guidelines (ISQGs) with three times dilution, which we have applied before on other projects in a number of regions around New Zealand. In this case, the main pathway for environmental effects is via groundwater to the adjacent stream – hence, the routine water quality sampling data from the groundwater and stream itself has been used to assess the environmental risk of the historical landfills.

Long term monitoring data appears to show that boron is leaching from the landfill into the stream, being consistently present at elevated levels in the groundwater in one monitoring bore (refer Figure 5). All stream samples have recorded boron levels below the ANZECC freshwater guidelines for protection of 95% aquatic species, but the monitoring data shows that boron levels are consistently higher downstream of the landfill, with some data indicating boron leaching may primarily be coming from landfill areas A, B or C (refer Figure 6).

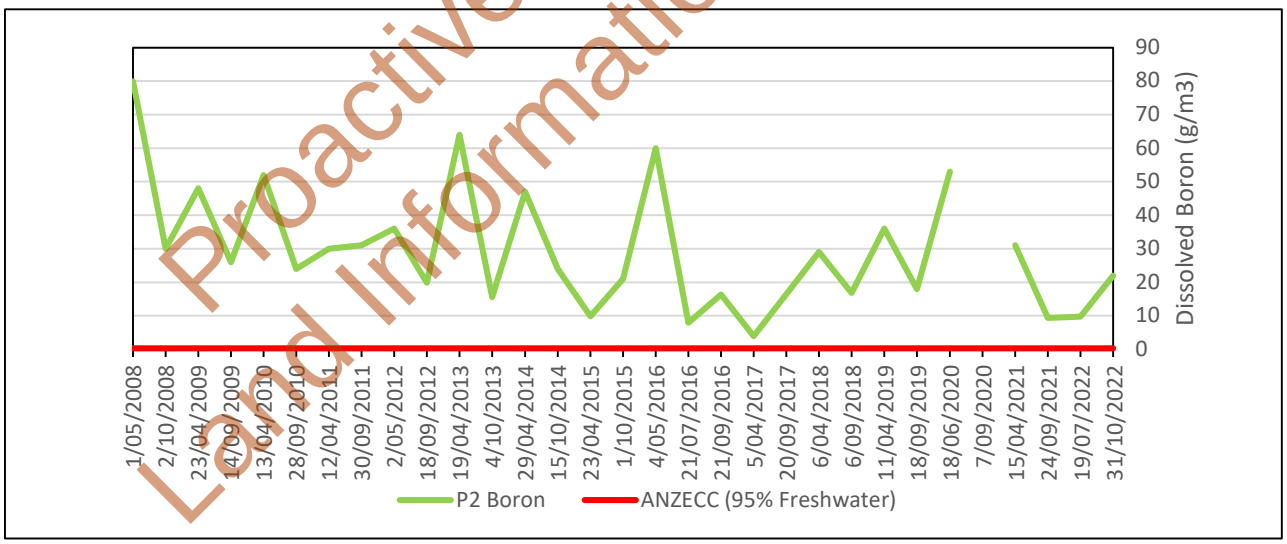


Figure 5: Long term dissolved boron levels (g/m³) in shallow groundwater from monitoring well P2

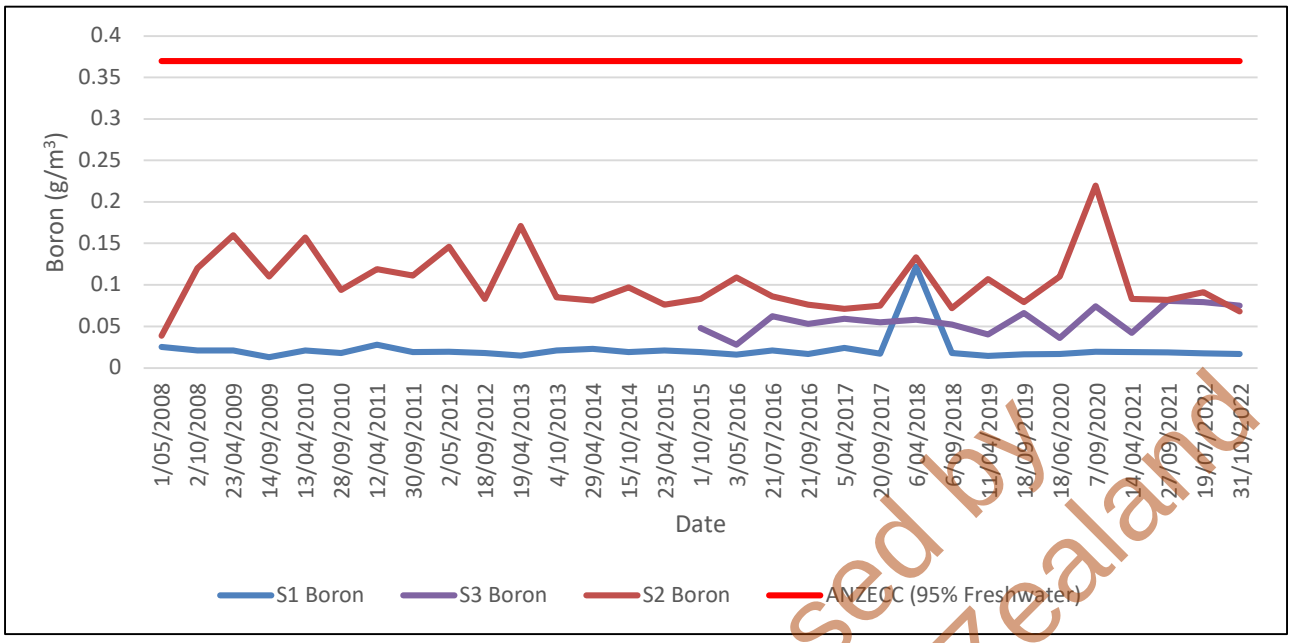


Figure 6: Long term boron levels (g/m^3) upstream (S1), midstream (S3), and downstream (S2) of the landfill in comparison to ANZECC 95% protection trigger value for aquatic species. See Figure 7 for sampling locations

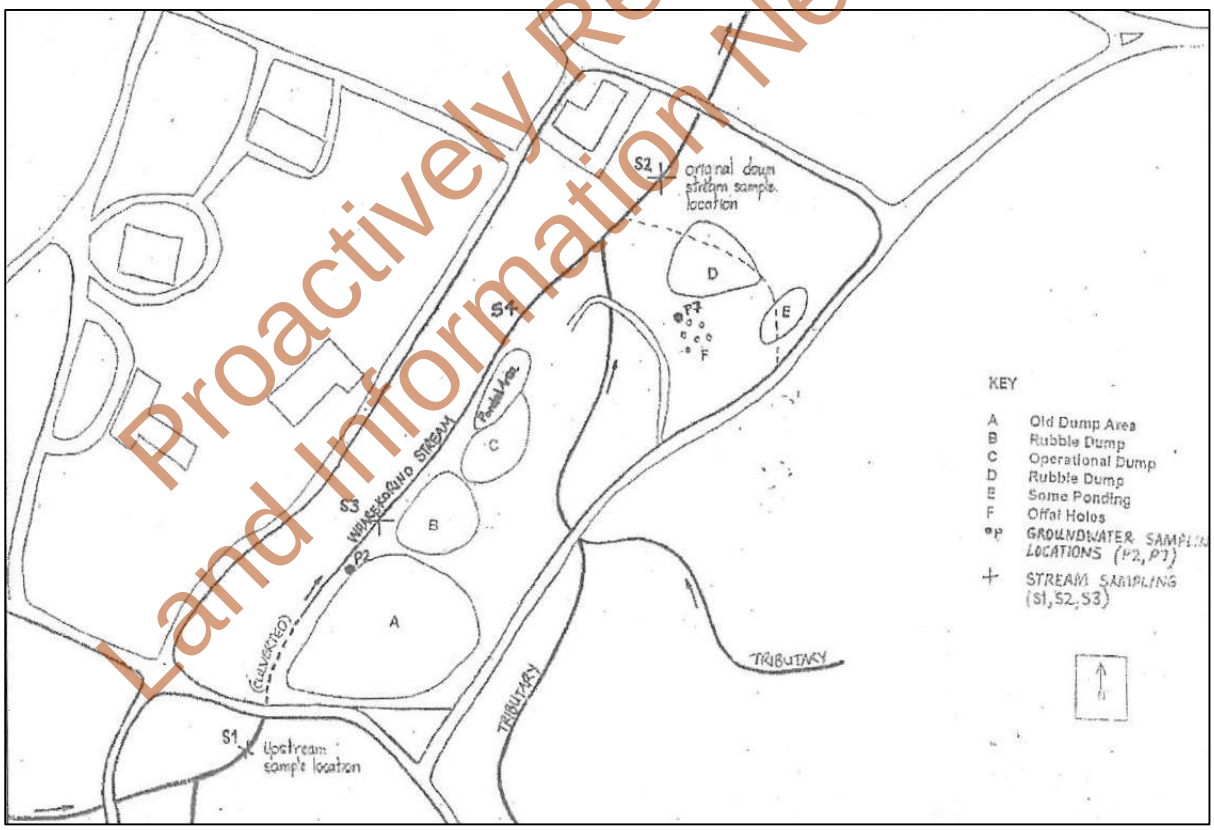


Figure 7: Location of stream and bore (groundwater) sampling sites relative to landfill areas

The likely source is coal ash, which is understood to have been used as a cover material in some landfilling areas.

Stream water samples typically have neutral to slightly acidic pH, low suspended solids and electrical conductivity, low boron and low chloride levels. Heavy metal concentrations are typically considerably lower than all ANZECC criteria assessed.

Iron concentrations are sometimes in exceedance of the ANZECC long term Irrigation (100 years), and the Drinking water standards for Aesthetics (2005-2008). These exceedances in Iron levels are only considered cause for concern in situations where the water is used for continuous long-term irrigation (100 years +). As noted in the 2021 WSP monitoring report, The Report to Hearings Committee (2000) states that due to the low flows in the vicinity of the site, the Wharekōrino Stream is highly unlikely to be used for irrigation purposes; therefore, these elevated iron levels are not a cause for concern.

Nitrate levels in the Wharekōrino stream have fluctuated from <0.10 to 3.3 g/m^3. These levels tend to be lower during low water levels (first half of the year) and higher during high water levels (second half of the year). The elevated levels are considered more likely to derive from upstream agricultural inputs (e.g., fertiliser) rather than the result of leaching from the landfill.

A single round of sediment sampling was undertaken by FTL in April 2023 from the four sampling locations S1-S4 shown in Figure 7. Cadmium and zinc were higher than the upstream sample (S1) in the downstream samples (S3, S4 and S2), while boron was only detected in one sample (S3) closed to landfill area A. The elevated concentrations were well within the ISQG-Low trigger values with three times dilution (and even without allowing for any dilution). GHD also did some stream sediment sampling but further downstream by the Wastewater Treatment Plant and found slightly elevated cadmium and zinc levels (relative to background) in some samples but did not detect any boron. As boron is relatively soluble, this is not unexpected.

Overall, the water quality results indicate in our opinion that the historic landfilling activity is not affecting the surface water quality in the stream, other than for boron, with the boron results in the stream being well within ANZECC protection criteria for 95% of freshwater species.

C. Disposal Requirements

The following outlines the disposal requirements for each component of the existing disposal sites, should there be any works in the future that would necessitate offsite disposal of material, such as during repair or maintenance works, although the need for this is considered unlikely.

The topsoil quality complies with Waikato region cleanfill waste acceptance criteria in Areas E and F and portions of Areas A, B, C, D, G, H & I. Topsoil quality exceeds managed fill waste acceptance criteria in 17-50% of Areas A, B, C, G and H & 12.5% of Area I.

The landfill cap quality complies with Waikato region cleanfill waste acceptance criteria in Areas C and F and 65% of Area A samples, with 100% of Area A cap samples complying with managed fill waste acceptance.

The mixed fill from Areas A, B, C, D, F, H & I would require disposal to an appropriate engineered landfill , as TCLP results have confirmed the material is suitable for disposal to a Class 1 Landfill. Area F has been included in this category due to the presence of medical waste in the waste offal pits found in this area. Area G fill can be classified as cleanfill. No mixed fill was found in Area E. Mixed fill from

Area I would require disposal to a Managed fill, licensed to accept low-level asbestos in soil. Removal of the landfill is not within the scope of the demolition and remediation project.

The majority of the natural ground samples comply with cleanfill waste acceptance criteria, particularly in Areas C to F and I. Portions of the natural ground in Areas A, B, D and G appears to be impacted by the overlying fill material.

These results are summarised in tabular form below and by colour coding in the results tables and figures.

Table 7: Results Summary relative to disposal requirements

Area	Topsoil	Landfill Cap	Mixed Fill	Natural Ground
A	33% cleanfill, 47% managed fill, 20% landfill*	65% Cleanfill/ 35% managed fill	Mainly landfill (90%)*, 10% managed fill	20% cleanfill, 60% managed fill, 20% landfill*
B	75% cleanfill, 25% managed fill	Not applicable	40% cleanfill, 20% managed fill, 40% landfill*	100% managed fill
C	50% cleanfill, 50% landfill	Cleanfill	Landfill*	Cleanfill
D	80% cleanfill, 20% managed fill	Not applicable	Landfill*	83% cleanfill, 17% landfill*
E	Cleanfill	Not applicable	Not applicable	Cleanfill
F	Cleanfill	Cleanfill	Landfill (due to medical waste)	Cleanfill
G	33% cleanfill, 67% managed fill	Not applicable	Cleanfill	83% cleanfill, 17% managed fill
H	80% cleanfill, 20% landfill	Not applicable	Landfill*	Cleanfill
I	87.5% cleanfill, 12.5% landfill	Not applicable	43% cleanfill, 43% managed fill, 14% landfill	Cleanfill

Notes: RR = rural residential, GL = guideline, C/I = commercial/industrial, BG = background.

* Landfill acceptability subject to TCLP test results

7.4.11 RPD RESULTS

As part of the quality control procedures followed during this investigation, relative percentage difference between the laboratory analysed samples was calculated, based on sample duplicate analysis. The highest RPD % results are provided in Table 8 below, and full RPD calculation are appended to this report as Appendix E.

Table 8: RPD Analysis

Parameter	Sample ID	Duplicate No	RPD %
Arsenic	TP27 1.0m	DUP04	*33.33*
Cadmium	TP6 SUR	DUP08	*43.48*
Chromium	TP4 SUR	DUP07	26.09
Copper	TP6 SUR	DUP08	*42.62*
Lead	TP27 1.0m	DUP04	20.41
Nickel	TP4 SUR	DUP07	*44.44*
Zinc	TP6 SUR	DUP08	*79.85*

Note: Results in *Italics* exceed 30% RPD. Results in red exceed 50% RPD.

With exception to the RPD % results for zinc, the remaining RPD results are elevated, but acceptable, and likely due to the relatively low concentrations of the parameters detected within the respective samples and poor homogeneity of the soils. The high RPD % result for zinc is likely due to the non-homogeneity of the material in this sample. Throughout the intrusive investigation, industry standard decontamination procedures were followed, and samples were collected from individual stockpiles, based on the strata defined in each test pit. Based on this, it is considered that the data gathered from this investigation is accurate, reliable, and repeatable.

7.5 LANDFILL GAS

Throughout the investigation, a GA5000 Landfill Gas Analyser device was utilised to identify and understand whether landfill gas was a potential risk at the site. The GA5000 was held adjacent to the areas of soil disturbance while test pits were being excavated. Where any suspect material was identified, a portion of this material was collected in a zip lock bag, and the GA5000 detector tube was inserted into the zip lock bag. Throughout the course of the investigation, no landfill gas was identified at any of the locations.

7.6 GROUNDWATER

Groundwater strikes were encountered in 15 test pits at depths ranging from 1.4 – 5.5m bgl. Standing groundwater was measured at depths ranging from 1.4 – 5.3m bgl. Groundwater generally appeared to be part of the groundwater table rather than perched groundwater, and was observed in direct contact with refuse. Small groundwater strikes were also noted in between compacted layers of clay and cap (likely perched groundwater).

Furthermore, based on cross-sections completed for the EDS, groundwater at monitoring location P2 is in direct contact with refuse, while groundwater at monitoring location P7 is just below the refuse, which is consistent with groundwater monitoring rounds completed to date, where P7 has consistently been dry.

It should also be noted that the groundwater levels used in the cross-sections were taken from the October/November monitoring round, which was undertaken following a wet spring.

8 CRITICAL ASSESSMENT OF LANDFILL CONSTRUCTION

8.1 INTRODUCTION

The landfill areas were constructed and used from at least the 1940s through to the late 1990s. Over this time period, landfilling in New Zealand and internationally evolved as a progression in the following order:

- **open dumping:** dumping waste on the ground without any protection measures, often as a means of reclaiming land;
- **controlled tipping:** dumping of waste under controlled conditions with some protection measures taken – e.g., daily soil cover, minimise filling area, odour/pest control, ban on fires, vehicle trip recording system, vehicle access road, litter fence; and
- **sanitary landfilling:** disposal of waste under highly controlled conditions to an engineered landfill where multiple protection measures are taken – e.g., base liner, leachate collection and treatment, landfill gas capture and use for generating electricity.

These changes have been prompted by:

- more stringent regulations (e.g., RMA) and consenting requirements;
- developments in landfilling practice and design and across the world. In New Zealand, the Centre for Advanced Engineering published their "Landfill Guidelines" in 2000 and the Ministry for the Environment published a "A Guide to the Management of Cleanfills" in 2002, which have recently been superseded by the WasteMINZ "Technical Guidelines for Disposal to Land" (Rev 3, Oct 2022);
- increasing environmental awareness and public expectations.

The fill material within the landfill would generally be classified as Class 1 landfill material, along with some managed fill and cleanfill materials, as well as some special wastes (i.e., medical wastes, asbestos). This section provides a critical assessment of landfill construction in relation to the following key items:

- Groundwater subsoil drainage.
- Landfill base and side liner (below refuse).
- Waste compaction.
- Waste burning and covering with boiler ash.
- Clay capping (thickness, permeability and compaction) and topsoil cover.
- Final surface grading.
- Leachate collection.
- Landfill gas collection.
- Proximity to Wharekōrino Stream

8.2 GROUNDWATER SUBSOIL DRAINAGE

It is expected that groundwater subsoil drainage would have been installed under different landfill areas as a means of keeping the groundwater table below the deposited refuse, so as to avoid direct contact of groundwater with refuse, due to elevated groundwater levels. However, none of the

information reviewed as part of this investigation refers to the landfill having any groundwater subsoil drainage.

The Worley AEE (1998) refers to the results of groundwater monitoring undertaken by them which indicates that the groundwater flow direction is towards the Wharekōrino Stream, the groundwater is above the invert of the stream and at a depth where it is likely to come into contact with refuse in both the areas investigated (Areas A and F). Refer to Section 4.2.2 of the Worley report.

Based on FTL cross-sections completed for the site, and as mentioned above, groundwater at monitoring location P2 is in direct contact with refuse, forming a pathway for contaminants to leach into the nearby Wharekōrino stream, while groundwater at monitoring location P7 is just below the refuse, which is consistent with groundwater monitoring rounds completed to date, where P7 has consistently been dry. Furthermore, cross-section analysis has confirmed the groundwater flow direction generally tracks east to west, towards the Wharekōrino stream.

The above findings and the lack of groundwater subsoil drainage results in a complete migration pathway for contaminants from the deposited fill material to be taken up by groundwater and flow into the Wharekōrino Stream.

8.3 LANDFILL BASE/SIDE LINER

None of the information reviewed as part of this investigation refers to the landfill having any base or side liners. Such liners are important to minimise seepage through the base of the landfill into the underlying groundwater and to capture any leachate generated from the landfill for conveyance to a leachate treatment/disposal system. However, the lack of a landfill liner is consistent with the era in which the landfill areas were constructed.

8.4 WASTE COMPACTION

Insitu refuse materials appeared relatively well consolidated, however when removed, the materials exhibited a lack of cohesion and stability. All material within the different areas of landfilling appeared to have been directly tipped into the disposal areas, with combustible materials typically being burnt, and is likely to have been compacted by tamping with an excavator bucket, if at all.

8.5 REFUSE BURNING AND COVERING WITH BOILER ASH

Refuse burning was common practice over much of the period that the hospital's closed landfills have been in operation. It was a cheap method of reducing waste volumes (thus maximising landfill lifetime), minimising leachate generation and landfill gas production from the decomposition of combustible organic wastes and providing rudimentary "sterilisation" of some wastes.

The Worley AEE refers to ash from the hospital boilers having been used as a cover layer in Area A and also having been disposed of in Area C. These boilers were used to generate steam which was piped around the hospital to provide heating inside buildings and hence it is expected that a reasonable volume of ash would have been produced over the hospital's lifetime. It is likely that coal was used to power these boilers and that this coal came from the Waikato area, where coal has been mined from the 1870s. Other work done by FTL relating to the disposal of Huntly coal ash to the North Waikato Regional landfill found that this ash has a very high boron content and that deposition of this coal ash within the landfill would create a significant boron reservoir. Boron is relatively soluble and hence likely to leach over a long period, while once boron gets into water it is very difficult and costly to

remove. In our opinion, the ash disposed of in Areas A and C of the landfill is the likely source of elevated boron levels in groundwater sampled from the landfill monitoring bores.

8.6 CLAY CAPPING AND TOPSOIL COVER

Resource consent condition 3 refers to the final cover over areas A, C and F comprising 600mm of earth cover with insitu impermeability of $1x10^{-7}$m/s overlain by 150mm minimum thickness of topsoil or topsoil/compost mix, or 500mm of $1x10^{-7}$m/s earth cover, overlain by 100mm subsoil layer, overlain by 100mm topsoil or topsoil/compost/mix or alternative cover approved by WRC in writing (Type A cover).

Resource consent condition 4 required the final cover over the filled areas B, D and E to consist of at least 300mm of clay/soil material and regrassing (Type B cover).

8.6.1 Clay Cap and Topsoil Thickness

Table 9 summarises the depths of topsoil and clay cap determined from the FTL field investigations and compares them with the resource consent requirements. This shows:

- Areas A and C have non-compliant topsoil and cap depths, and Area F has a non-compliant cap depth.
- Areas B and D have non-compliant combined cover depths in part.
- Area H is not covered by the resource consent, but would be expected to have similar cap and topsoil requirements to Area A. On this basis, the cap and cover in Area H are also non-compliant. Furthermore, Area H only had a small isolated portion of cover, which could be an extension of the cover from Area A.
- Area I is not covered by the resource consent, however given the localised area of filling identified in this area, this portion of Area I would be expected to have similar cap and topsoil requirements to Area A. on this basis, cap and cover in Area I is non-compliant.
- Area G also had landfill cap cover - however the fill identified here was found under to be reworked natural ground.

Table 9: Cap/Topsoil Assessment

Area	RC cover requirement		Actual Thickness - Range (average) (mm)		Fill
	Topsoil	Cap	Topsoil	Cap	
A	150	600	100 – 300(145)	100 800 (522)	Mixed
B	300 combined		100 – 200(157)	100 – 400(275)	Mixed
C	150	600	100 – 200(162)	400 – 600(476)	Mixed
D	300 combined		50 – 200(139)	0 – 250(155)	Mixed
E	300 combined		100 (1 Testpit)	200 (1 Testpit)	None
F	150	600	200 (1 Testpit)	300 (1 Testpit)	Mixed (in offal pits)
G	Not required – reworked natural ground		100 – 200(151)	0	None

H	Not stated – 150 expected	Not stated – 600 expected	0	0	Mixed
I	Not stated – 150 expected	Not stated – 600 expected	0 – 200 (102)	0	Mixed (in localised area)

Note: Red shading = non-compliance

8.6.2 Clay Cap Permeability

The only historical permeability test result found was from the 1998 AEE for the Area A landfill cover, which describes the cover sample as gravelly silty sand with a permeability of ~2x10^{-4}m/s, which is significantly more permeable than the consent requirement. The AEE does refer to Areas A, C and F having a higher level of capping in accordance with the consent conditions but with no supporting information included.

Fraser Thomas collected 16 cap samples and tested these for permeability, using the constant head permeability test. These results are summarised in Table 10. The permeability test results generally complied with the consent requirement, except in Area A (TP02).

Table 10: Permeability Results Summary

Area	Sample Number	Depth (m)	Coefficient of Permeability (m/s)	Consent Requirement
A	TP02	0.3 - 0.4	>8.6 x 10^{-6}**	1x10^{-7}m/s
	TP04	0.3 - 0.4	5.1 x 10^{-8}	
	TP07	0.2 - 0.3	1.6 x 10^{-8}	
	TP10	0.2 - 0.3	6.6 x 10^{-8}	
	TP12	0.2 - 0.3	3.8 x 10^{-9}	
	TR09	0.2 - 0.3	4.4 x 10^{-8}	
B	TP13	0.2 - 0.3	2.1 x 10^{-8}	Not specified
C	TP17	0.2 - 0.3	4.4 x 10^{-8}	1x10^{-7}m/s
	TP18	0.2 - 0.3	2.1 x 10^{-8}	
	TR16	0.2 - 0.3	1.1 x 10^{-8}	
	TR18	0.2 - 0.3	1.4 x 10^{-8}	
D	TP30	0.2 - 0.3	8.0 x 10^{-7}	Not specified
	TR34	0.2 - 0.3	1.0 x 10^{-7}	
E	TP25	0.2 - 0.3	>4.2 x 10^{-6}**	Not specified
F	TP26	0.2 - 0.3	2.0 x 10^{-8}	1x10^{-7}m/s
	TR27	0.2 - 0.3	5.7 x 10^{-8}	

Permeability Tests: BS EN ISO 17892-11:2019: Part 11

**This determined value is approximately equal to the measured permeability of the test equipment; therefore, the permeability of the sample should be regarded as being greater than this value.

8.7 FINAL SURFACE GRADING

It would be expected that the final surface of each landfill area would have been graded so as to shed runoff from the landfill areas, rather than allow for runoff to travel slowly over the landfill areas or pond, increasing potential infiltration into the landfill and thus leachate generation. Landfill settlement will occur over time as a result of refuse consolidation and decomposition, which can create ponding areas depending on the nature of the surface grading and particularly if differential settlement occurs. Refuse burning would have reduced the amount of settlement expected through waste decomposition.

The annual site walkovers for 2022 and 2023 observed ponding in multiple locations across the site and referred to ponding in Area C having been consistently observed since the 2017 WSP field visit. This does not comply with good practice.

8.8 LEACHATE COLLECTION

The landfill areas do not have any leachate collection system, which is consistent with them not having any base and side liner system. This is consistent with the time the landfills were constructed but not with current best landfill practice.

8.9 LANDFILL GAS COLLECTION

The landfill areas do not have any landfill gas system, which is consistent with the time they were constructed but not with current best landfill practice.

8.10 PROXIMITY TO WHAREKŌRINO STREAM

The Wharekōrino Stream total catchment area at the upgradient end of the landfill is approximately 570ha catchment, representing a moderate sized catchment. The landfill areas are located within close proximity of the Wharekōrino Stream, while Area H bridges the stream with a culvert piping the stream through it. It appears no consideration was given to the landfill's proximity to this stream during siting and design and the potential for a large flood event to encroach on the landfill potentially causing slips/erosion/scouring. Climate change considerations further exacerbate this risk. This risk is assessed further in Section 10 of this report.

8.11 SUMMARY

This critical assessment of landfill construction is summarised below.

Table 11: Summary – Critical Assessment of Landfill Construction

Criteria	Status	Impact	Significance
Groundwater subsoil drainage	None	Allows groundwater to come into direct contact with refuse and creates pathway for contaminants to leach to Wharekōrino Stream.	High
Landfill base and side liner	None	No containment of any leachate generated in the landfill.	Medium
Waste compaction	None	All waste appears to have been direct tipped into filling areas, with combustible materials burnt and with little or no compaction.	Medium
Waste burning and covering with boiler ash	Common operational practice at landfill	Boiler ash likely source of boron in waste which is present at elevated concentrations in groundwater.	High
Clay capping	Areas A, C and F capped to high standard, although cap is "skinnier" than consent in Areas A and C; areas B, D and E have lower specification cap. Newly found Areas H & I have no cap.	Reduces rainfall infiltration into landfill, thus reducing leachate generation.	High (Area H) Medium (other areas)
Topsoil cover	Average topsoil cover across the areas of landfilling ranges from 100mm-200mm	Helps maintain healthy vegetation cover on landfill surface and provides first barrier to rainfall infiltration.	Medium
Final surface grading	Landfill surface is prone to ponding, particularly in Area C	Potential increased infiltration through landfill, increasing risk of contaminant leaching	Medium
Leachate collection	None	Any leachate generated from refuse likely to enter groundwater	High
Landfill gas collection	No system installed, but no landfill gas detected during 2022 intrusive investigation.	Landfill gas can present explosion (methane) and asphyxiation (carbon dioxide) hazards at certain concentrations	Low
Proximity to Wharekōrino Stream	Landfill areas are located relatively close to stream	Potential flood hazard, causing slips, scour and erosion and possible remobilisation of buried refuse (extreme event).	High

9 LANDFILL RISK ASSESSMENT

This landfill risk assessment addresses the following issues:

- Topsoil contamination
- Cover/cap integrity
- Contact with contaminated materials/refuse
- Settlement, subsidence and erosion
- Stability
- Surface water runoff contamination
- Groundwater contamination
- Landfill gas
- Culvert failure
- Flooding

This risk assessment has been undertaken from an engineering perspective. The risk assessment findings have been used in assessing the status of the landfill in relation to its life cycle and a hazard risk matrix is presented at the end of this section.

An exposure pathway assessment, based on a contaminated land source – receptor – pathway assessment follows in section 11 of this report. There is some duplication of material between the two assessments.

9.1 TOPSOIL CONTAMINATION

Topsoil testing undertaken as part of this investigation has found that topsoil quality is at or below background levels in Area E only. It is within adopted NESCS guidelines in Areas B, D, F and G and 20-83% of Area A, C & H samples. It exceeds the NESCS rural residential standards in 9.5% of Area A samples, 20% of Area H samples, and exceeds both the NESCS rural residential and commercial/industrial guidelines in 50% of Area C and 12.5% of Area I samples (due to asbestos contamination in both cases). Hence, topsoil quality does pose a human health risk in relation to asbestos in parts of Areas A, C, H & I.

9.2 COVER/CAP INTEGRITY

The landfill areas generally comprise grassed, relatively flat farm paddocks, that are routinely grazed.

During the 2022 annual walkover survey (refer separate report for details and Appendix B for grid walkover findings), it was found that there were various instances of individual refuse items (e.g., wooden posts, planks, cement blocks) protruding through the landfill surface, consistently around the edges of the landfill areas (refer Figure 8, below). There was one area which showed small localised damage to the landfill cap of the landfill (refer Figure 9, below). These observations mainly apply to Areas A and D. They mean that the landfill cap has been breached in a number of locations. The protruding objects should be removed and the landfill cap reinstated.

Figure 8: Refuse protrusion across the site (ceramic pipe (B3), wooden post (E4), brick (D4, concrete (D4)) – for grid references, refer Appendix B for grid locations

Figure 9: Evidence of damage to landfill cap in Area E and at extent of Area A (Left N7, Right A3)

9.3 CONTACT WITH CONTAMINATED MATERIALS/REFUSE

Contact with refuse is directly related to the integrity of the landfill cap. If refuse is exposed through breaching of the landfill cap as a result of site disturbance works or natural hazards (e.g., extreme flood event causing slip), the nature of the fill material present in the landfilled areas presents a significant hazard to people, including:

(a) Potential physical injury through contact with sharp objects;
(b) Potential injury through contact with medical waste (Area F only);
(c) Possible contact with fill containing elevated contaminant levels;
(d) Possible contact with asbestos containing materials.

This risk can be mitigated by ensuring that appropriate cap and topsoil cover is maintained over the landfill area, with this being inspected regularly, as is currently done.

9.4 SETTLEMENT, SUBSIDENCE AND EROSION

Historical landfill area contour data was limited to the contours shown on the Meritec developed site plan from 2000, which was only available in pdf format. Comparison of this contour data with recent LiDAR survey data for the site suggests very little settlement has occurred over the intervening 22-year period. However, it is not clear if the contours shown on the Meritec plans are pre- or post-capping contours, reducing the reliability of this comparison.

Hence, more reliance has been placed on visual observations in assessing settlement, subsidence and erosion. These observations from the 2022 annual walkover and from review of previous WSP annual reports support that no significant erosion has occurred in recent years. Minor subsidence was observed around the site, resulting in an uneven profile across the landfill areas. It is unclear whether this is naturally occurring or influenced by the landfill. There have been no new instances since the previous inspection, based on comparison with photos in the WSP 2021 report.

There are localised ponding areas, which seem more related to final surface grading or lack of it, and to landfilling areas being a number of discrete, small individual areas, tying in with existing topography. Observations for different landfilling areas are summarised below:

- In Area A, ponding was observed at Grid D7, surrounding a permanent water trough. Subsidence was visible at grid A3 at the fence line boundary.
- Area C was observed as having large portions of ponding and some visible settlement and subsidence. Significant ponding was observed at H4 and minor ponding at K5, both located between the extent of area C and the Wharekōrino stream. Ponding at both locations has been noted in previous years, and high stream flow is likely a large contributor. Localized settlement is observable at I5 at the extent of area near the fen cline. Subsidence was noted at K6 at the north-eastern extent of area C.
- Area D was observed as having very uneven topography including patches of settlement. Significant subsidence was observed at grid N7.
- Area E was primarily in good condition. The only feature of note was general sloping settlement of the land. Previous visits have noted ponding filling this settled area, but none was observed during 2022.

Figure 10: Instances of subsidence visible on site at areas E and A respectively (Left N7, Right E4)

As stated earlier, landfill settlement will occur over time as a result of refuse consolidation and decomposition, which can create ponding areas depending on the nature of the surface grading and particularly if differential settlement occurs. Refuse burning would have reduced the amount of settlement expected through waste decomposition. As the last landfilling areas was closed over 20 years ago, it is expected that most settlement would have occurred by now.

Figure 11: Areas of ponding observed across the landfill site (Top Left H4, Top right D7, Bottom Left K4, Bottom Right I7)

9.5 LANDFILL STABILITY

The geotechnical factual report noted some evidence of shallow soil creep, including terracettes and hummocky topography, were observed in areas where the site topography sloped at, or was steeper than, 14° to the horizontal (1V:4H). Areas with gradients exceeding 1V:4H have been plotted using site LiDAR data on Fraser Thomas Ltd drawing 65547/101. These steeper areas are almost entirely located along or adjacent to the western extremities of the landfill areas. This suggests that landfill instability is low risk. A site-specific stability assessment would be required to confirm this, but this is outside the scope of this investigation.

9.6 SURFACE WATER RUNOFF CONTAMINATION

Contamination of surface water runoff is considered a low risk, as surface water will only come into contact with the landfill surface soils – i.e., topsoil of which only a small portion (9.5% Area A, 50% Area C, 20% Area H & 12.5% Area I) represents a human health risk as explained earlier. The contaminants found in the topsoil are expected to generally be well bound to the soil matrix and hence would primarily be lost to runoff as particulate material, associated with soil scour/erosion. There is relatively low evidence of this occurring.

9.7 GROUNDWATER CONTAMINATION

As explained earlier, the 1998 AEE refers to the results of groundwater monitoring undertaken by them which indicates that the groundwater flow direction is towards the Wharekōrino Stream, the groundwater is above the invert of the stream and at a depth where it is likely to come into contact with refuse in both the areas investigated (Areas A and F).

Groundwater was encountered in multiple test pits during the FTL intrusive investigation, while two cross-sections plotted across the landfill indicate there is a direct connection of the groundwater with refuse and a direct pathway to the stream at groundwater monitoring location P2.

This means there is a complete migration pathway for contaminants from the deposited fill material to be taken up by groundwater and flow into the Wharekōrino Stream. The main contaminant of concern identified from regular groundwater and surface water monitoring is boron. This is believed to be associated with the presence of coal ash in the existing disposal sites, with the historical documentation reviewed referring to it having been used as a cover layer in Area A and also for it to have been disposed of in Area C. Other work done by FTL relating to the disposal of Huntly coal ash to the Hampton Downs landfill found that the ash has a very high boron content with high leaching potential. Boron is relatively soluble and hence likely to leach over a long period, while once boron gets into water it is very difficult and costly to remove.

The monitoring undertaken to date has confirmed elevated boron levels in the groundwater and within the stream, but the stream levels are much lower than in groundwater and within the ANZECC guidelines for the protection of 95% of freshwater species. This means there is significant attenuation and mixing within the stream, so that any contaminants present would not pose an unacceptable risk to ecological receptors.

9.8 LANDFILL GAS

The landfill gas (LFG) risk is considered low for the following reasons:

- The extent of LFG emissions is typically controlled by the integrity of the landfill containment systems, the nature of the landfill, the landfill materials and landfill age.
- The fill material observed in landfill areas contains very little, if any, decomposable material that is necessary to generate landfill gas.
- It has been over 34 years since Area A was reportedly closed to landfilling (1998) and 25 years since Area C was closed to landfilling, while other areas may have been closed as long as 44 years ago, meaning that landfill gas generation from any decomposable material present in the waste material would be tapering off by now and expected to be at low levels, if any.
- No landfill gases were detected by gas monitoring during the FTL 2022 intrusive investigation.
- The landfill has no passive or active LFG extraction system and there are no known services trenches, drains or penetrations within the landfill areas that could provide a preferential pathway for LFG migration, other than likely some shallow water reticulation to the animal water troughs, which would likely be buried in the ground with no drainage media around it and thus not providing a preferential pathway for LFG migration.
- The landfill areas can be classified as a "shallow" landfill, with LFG able to escape from it relatively easily through the landfill cap or laterally. The LFG will seek to escape from the landfill by the easiest pathway. The main components of LFG are methane, which can pose an explosion hazard, and carbon dioxide which can pose an asphyxiation hazard, while odour nuisance can also be a concern. Methane and carbon dioxide are both greenhouse gases. Lighter gases such as methane will tend to want to migrate upwards and where avenues exist, laterally. Hence, methane emissions in this case are most likely to occur through the landfill surface (e.g., cracks or through the cap itself) to the atmosphere. Heavier gases such as carbon dioxide tend to sink and can accumulate in depressions/cavities, of which only one structure was observed on-site in Area H, as shown below (Figure 12). This appears to be a redundant manhole chamber.

B1 – cement block/piping debris

B1 – manhole

Figure 12: Obsolete MH chamber in Area H

9.9 CULVERT 3 LEAKS/FAILURE

Culvert 3 comprises a 1350mm diameter pipe that pipes the Wharekōrino Stream through Area H of the landfill (refer Figure 14 for its location). Its condition is unknown, although it appears to not be subject to any significant blockage. Aerial photographs indicate this area was infilled over the period from at least 1957 to 1979, meaning that Culvert 3 is likely to be somewhere in the range of 44-65 years old, compared with a typical design life in the range of 50-100 years, depending on

manufacturing standards at the time of culvert installation. This pipe could be subject to differential settlement associated with the landfilling activity. If its joints were to leak or the pipe to fail, this would result in significant stream flows being piped through the Area H landfill, which would likely lead to landfill washout and collapse.

CCTV survey has been attempted of this culvert, but was unsuccessful, due to high water flows through the culvert.

If a significant risk is confirmed, damaged culvert sections should be replaced, or the culvert lined, or the stream reinstated through this area, which would involve significant removal of Area H fill.

9.10 FLOODING

Flooding of the Wharekōrino Stream is considered to potentially be the most significant landfill risk, as it was to encroach on the landfill, it may cause slips, erosion and/or scouring.

HEC-RAS modelling has been undertaken to assess this risk. This modelling has shown that the landfill areas A, B, C, G, H are currently likely to be inundated to varying extents during a 1% AEP storm event, particularly if the two downstream culverts on the stream are blocked or become blocked during the storm, with these effects worsening with predicted climate change. Areas D, E and F have been found unlikely to be affected by flooding. These results are shown in Figure 13, below.

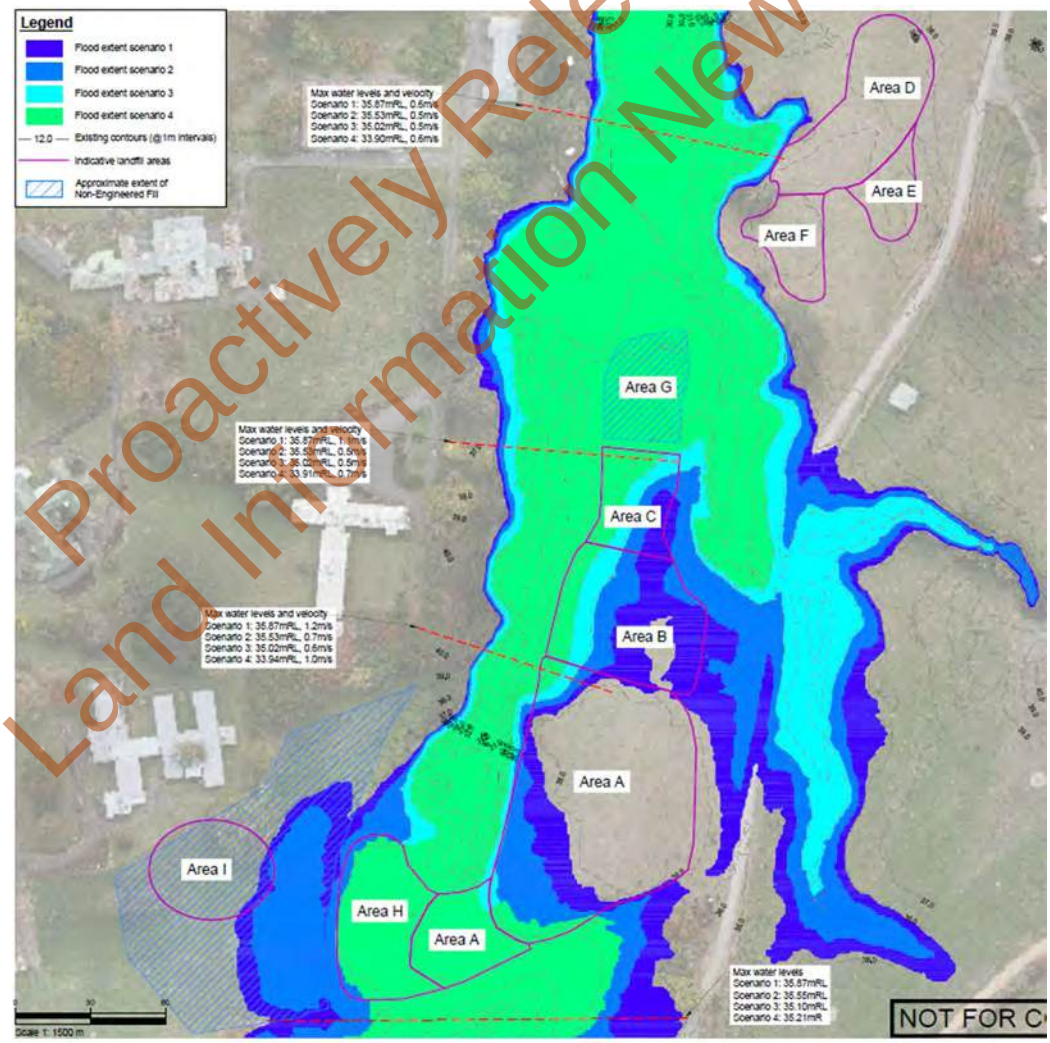


Figure 13: Flood Modelling Results:

- Scenario 3 = 1% AEP storm event, all culverts operational (light blue)
- Scenario 2 = 1% AEP + climate change event, all culverts operational (medium blue)
- Scenario 1 = 1% AEP + climate change event, all culverts blocked (dark blue)
- Scenario 4 = 1% AEP + climate change event with culvert 2 and associated embankment removed (green)

Site inspections of the culverts (refer Figure 14) found that culverts 3 and 4 appear to be fully operational while both culverts 1 and 2 could not be located – some ponding does occur upstream of both of these culverts, suggesting that they are partially blocked to a reasonable extent. Hence, the most realistic scenarios, representing the actual current situation, allowing for climate change, are considered to be somewhere between Scenarios 1 and 2.

Scenario 4 was included as a possible mitigation option. The culvert 2 embankment comprises a former road crossing of the stream into the hospital site, which is now redundant, and is at approximately 36.3m RL. The culvert 2 embankment level is approximately 34.6m RL, while the Te Mawhai Road embankment (over Culvert 1) is approximately 33m RL. Preliminary flood modelling showed flood levels are largely controlled by these embankments. Modelling of this scenario found that removal of Culvert 2 and associated embankment would result in a significant reduction in flood levels due to the elevation difference of the two embankments.

This would prevent the inundation of the majority of the landfill areas during a 1% AEP storm. However, it should be noted that this access road acts to detain water within the catchment, and removing it may result in higher peak flows downstream. Downstream discharges were calculated as 2.5m^3/s for the completely blocked scenario 1, 10.7m^3/s for the unblocked scenario 2, and 33m^3/s for scenario 4 which allowed for the culvert 2 embankment being removed. Overall, this shows that the bund performs a good detention function for the overall catchment.

Below Culvert 1, the stream flows approximately 700m before entering the considerably larger Pūniu River. Mangatoatoa Marae is located on the eastern side of the stream before the confluence with the Pūniu River. There are no other buildings along this section of the stream. Downstream effects of culvert 2 removal are considered likely to be less than minor, as the Marae is approximately 9m above the level of the stream, and as such should not be affected by an increase in the stream flows. This can be checked as part of further design work for removal of this culvert.

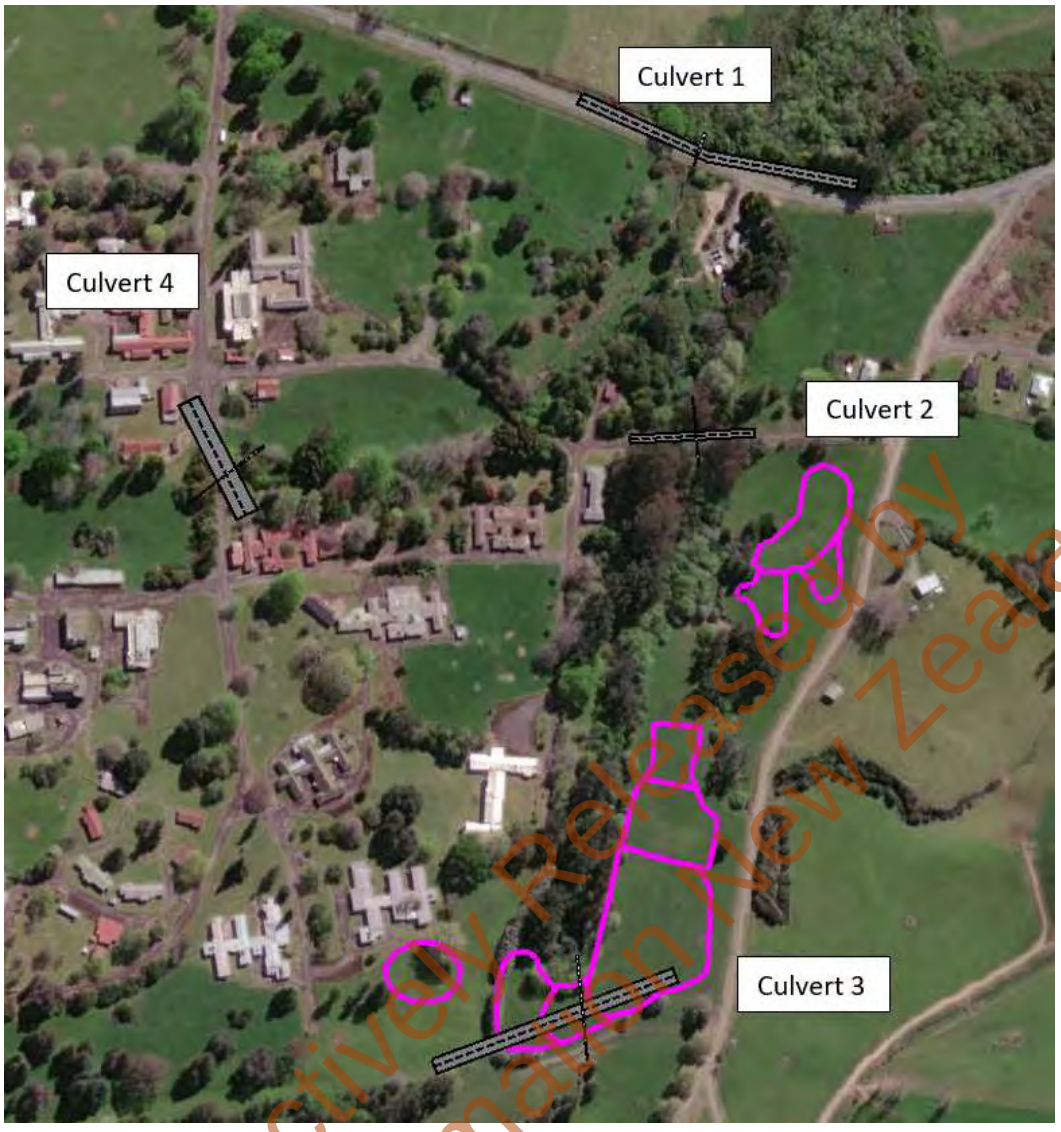


Figure 14: Culvert locations relative to the landfill areas

Landfill area A effectively dams the stream, with culvert 1 passing under it. Modelling has shown this area to be inundated during a 1% AEP event, with the culvert being overtopped and flood waters flowing overland through Areas A & H. Velocities over the bunded area where the culvert passes may be quite high. This could result in localised scour/erosion along the overland flow path, potentially exposing the underlying landfill materials, and in the worst case, uplifting some of these materials and carrying them into the stream. This effect has not been quantified as part of the modelling done to date.

9.11 HAZARD RISK MATRIX

A hazard risk matrix addressing the above issues and possible control/management methods is included in Figure 15, with the legend shown below.

			Impact						
			1	2	3	4	5		Risk Level
			Insignificant	Minor	Moderate	Major	Extreme		1-4 Low
Probability (Likelihood)	1	Rare	1	2	3	4	5		5-14 Medium
	2	Unlikely	2	4	6	8	10		15-25 High
	3	Moderate	3	6	9	12	15		
	4	Likely	4	8	12	16	20		
	5	Very likely	5	10	15	20	25		

Figure 15: Hazard Risk Matrix

Hazard	Description	Consequences and Effects	Risk assessment			Control/Management Method	Risk assessment (post-control)		
			Likelihood (1-5)	Impact (1-5)	Risk Level (RAG)		Likelihood (1-5)	Impact (1-5)	Risk Level (RAG)
Topsoil contamination	Topsoil in 9.5% Area A, 50% Area C, 20% Area H & 12.5% Area I exceeds NESCS rural residential and commercial/industrial standards (asbestos)	Potential human health risk	3	2	6	Human contact with topsoil in these areas will be intermittent and short duration and hence unlikely to pose a significant health risk, except if this area was to be remediated or redeveloped in the future. Affected topsoil could be replaced with clean topsoil to mitigate risk.	1	2	2
Landfill cover/cap integrity	Breach of landfill cap/cover may result in sharp objects protruding from landfill surface	Potential injury to humans/animals	2	3	6	Remove protruding objects and reinstate landfill cap in these areas	1	1	1
Contaminated materials/ refuse	Exposure to contaminated material/refuse, including sharp objects, medical waste, contaminated fill material and asbestos	Potential injury/health impacts	2	3	6	Main risk applies to contractors during soil disturbance or in other areas with inadequate cap. Intrusive investigations undertaken to delineate this risk, with areas where contaminated soils and/or refuse may be encountered shown on Fraser Thomas drawings and explained in the intrusive investigation report. Any contractors undertaking soil disturbance work are to review this information to fully understand requirements relating to contaminated soil/refuse management during works and address them in their Construction Management Plan. Work areas will be cordoned off from public access.	2	2	4
Settlement, subsidence, erosion	Changes in ground level may create uneven, unsafe surface, will erosion may expose landfill material	Potential injury/health impacts	2	3	6	Regular monitoring is undertaken to check settlement, subsidence and erosion. Affected areas should be remediated as required.	1	2	2

Landfill stability	Soil creep and instability issues affecting landfill long term integrity for refuse containment, particularly along western side close to stream	Landfill batter failure, exposing refuse	2	4	8	Check by regular monitoring (current system). Undertake slope stability analysis of any critical slopes and implement any remedial works identified as necessary from this analysis.	1	4	4
Surface water runoff contamination	Contamination of surface water runoff from overland flow across landfill areas	Stream contamination - adverse effects on aquatic life	2	3	6	Remediate contaminated topsoil areas	1	2	2
Groundwater contamination	Contamination of groundwater from passage through landfill, with groundwater flowing into adjacent stream (main contaminant is boron)	Potential human health/environmental effects on any groundwater and surface water users	5	2	10	Continue ongoing monitoring to quantify risk and long-term trends. Current monitoring confirms elevated boron levels in stream are within acceptable levels for the protection of 95% of freshwater species. No remedial works necessary at this stage.	5	2	10
Landfill gas	Landfill gas escaping through landfill surface	Injury or death	1	5	5	Landfill gas considered low risk, based on nature of landfill, landfill materials, age and containment systems. No action required.	1	5	5
Culvert 3 leaks/failure	Culvert 3 pipes the Wharekōrino Stream through Area A of the landfill. This culvert is estimated to be 44-65 years old and could be subject to differential settlement from landfill activity, leading to leaking joints and ultimately possible pipe failure	Landfill washout and collapse, with refuse being washed down the stream	2	5	10	Likelihood of leaks/failure estimated but needs confirming through further investigation, if possible. If a significant risk is confirmed, damaged culvert sections should be replaced, or the culvert lined or the stream reinstated through this area, which would involve significant removal of Area A fill.	2	5	10
Flooding	Flooding of Wharekōrino Stream inundating landfill and threatening integrity of steeper slopes along western side	Ponding, increased infiltration into landfill, scour/erosion, slips	2	5	10	Potentially reinforce steeper slopes on western side of landfill and/or remove culvert and redundant road crossing on stream below landfill (culvert 2 crossing)	1	3	3

9.12 LANDFILL LIFECYCLE STATUS

Landfills have a life cycle, that is typically divided into site development, operation and aftercare phases. The development phase relates to construction of landfilling facilities pre-waste deposition. The operation phase relates to the period over which waste materials are deposited in the landfill until it is closed. The aftercare period relates to the post-closure period, where the landfill must continue to be actively monitored for site integrity and environmental effects until the landfill no longer has the potential for adverse environmental effects.

The duration of the operational period depends on the size of the landfill and how quickly it is filled up, while the aftercare period for a Class 1 (municipal solid waste) landfill is likely to be at least 30-50 years according to the WasteMINZ Land Disposal Guidelines.

The physical, chemical and biological breakdown of waste within a Class 1 or Class 2 (construction and demolition) landfill produces leachate and landfill gas, which typically will continue to be produced for many years post-closure.

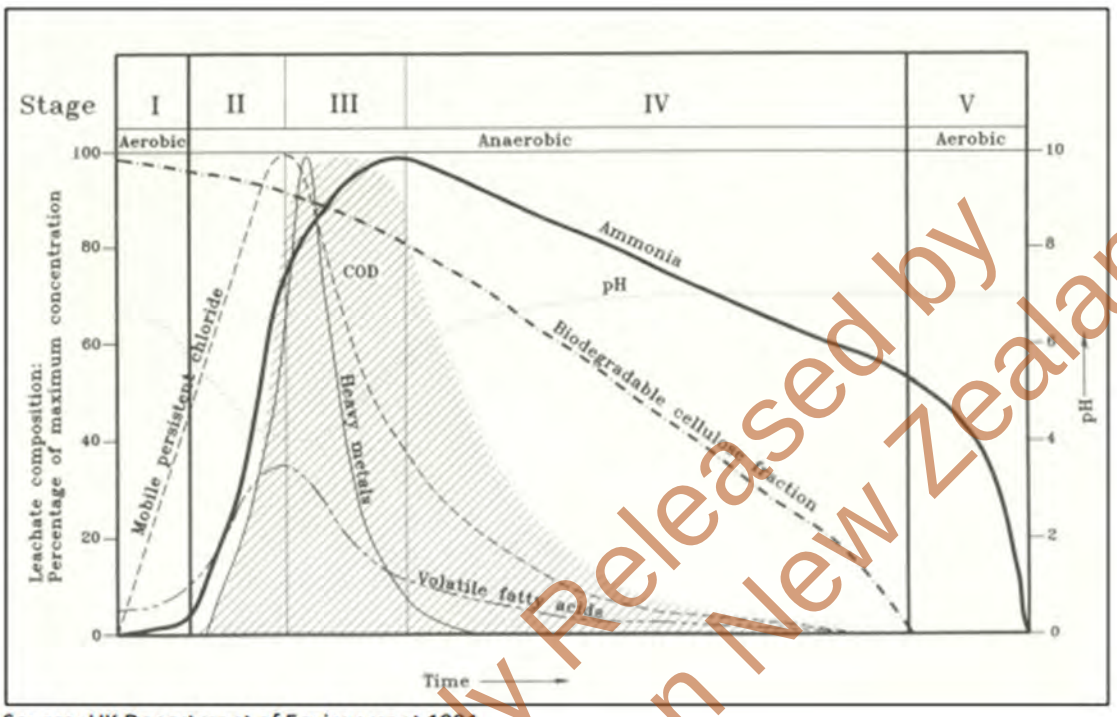
Monitoring of groundwater, surface water and landfill gas needs to be continued during the aftercare period of the landfill, until the strength of any discharges has reduced to a level at which they are unlikely to have any adverse effects on the environment. Settlement monitoring is also important to check when the landfill has reached its final or near final ground level.

Leachate is produced primarily form rainfall infiltration into a landfill leaching contaminants from the deposited waste. Landfill gas is a by-product of the decomposition of waste within the landfill (Class 1 and Class 2). Different reactions occur at different times in the process of waste decomposition. See Figure 16-17. The waste decomposition process is generally acknowledged to occur in five phases:

- During Phase 1, the decomposable organic components of the waste undergo aerobic decomposition, resulting in the production of simpler organic compounds, carbon dioxide and water. Heat is generated, and the aerobic organisms multiply. Phase 1 commences just after the placement of the waste and lasts for a number of months.
- Phase 2 commences due to the depletion of available oxygen and marks the commencement of the anaerobic stage. Aerobic organisms, which thrived when oxygen was available, then die-off. The degradation process is then taken over by facultative organisms that can thrive in either the presence or absence of oxygen. These organisms continue to break down the organic material present into simpler compounds such as hydrogen, ammonia, water, carbon dioxide and organic acids. During this stage carbon dioxide concentration can reach a maximum of 90 percent, although concentrations of about 50 percent are more usual. Phase 2 can last a number of months.
- Phase 3 is marked by the transformation of complex materials such as cellulose, fats, proteins and carbohydrates into simple organic materials such as fulvic and acetic acids. Phase 3 can last from a number of months to a number of years.
- Phase 4 represents the consumption of the acids developed in Phase 3 by specialised anaerobic methanogenic bacteria that convert them into methane and carbon dioxide: the principal components of landfill gas. Ammonia concentrations in leachate drop over this period, while the pH increases and stabilises. This phase usually lasts a significant number of years.

- Phase 5 signals the decline of landfill gas production because most of the nutrients required to sustain the methanogenic bacterial population have been depleted during previous phases. This stage typically lasts a number of years.

These phases are illustrated in Figures 16 and 17 for leachate and landfill gas respectively. In an actual landfill, different areas may be in different stages of the landfill cycle at the same time.



Source: UK Department of Environment 1991

Figure 16: Changes in Leachate Composition over Time (from WasteMINZ Land Disposal Guidelines, Figure 5-3)

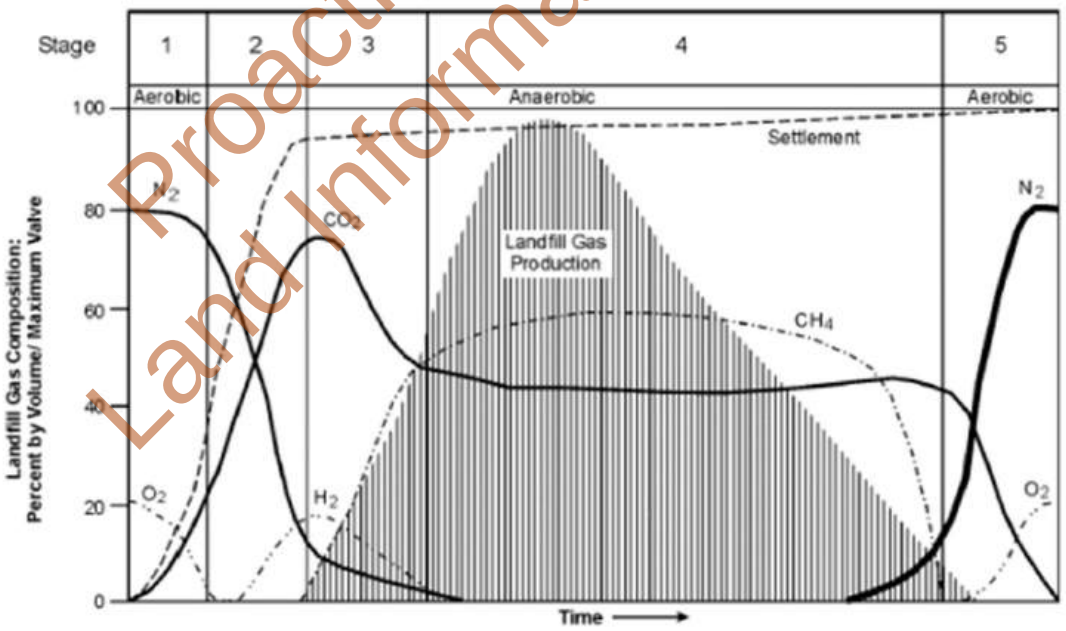


Figure 17: Changes in Landfill Gas Composition over Time (from WasteMINZ Land Disposal Guidelines, Figure 5-7)

Table 12 provides estimated landfill area closing dates, based on the information presented in this report. This shows that Area C was closed about 26 years ago, Area A 35 years ago and the other areas likely as long as 44 years ago. Hence, all landfill areas are assessed to be in the latter stages of the aftercare period.

Table 12: Estimated Landfill Area Closure Dates and Predominant Type of Landfill

Area	Closure Date	Source	Landfill Type
A	1988	1998 AEE	Landfill
B	1979	Aerials	Landfill
C	1997	1998 AEE	Mainly C&D
D	Likely 1979, well grassed in 1995	Aerials	Mainly C&D
E	Likely 1979, well grassed in 1995	Aerials	Not applicable
F	Likely 1979	Aerials	Medical waste
G	Likely 1979	Aerials	Non-Engineered Fill
H	Likely 1979	Aerials	Landfill
I	Likely 1974 or earlier	Aerials	Mainly C&D

This is supported by:

- Typical leachate parameters (ammoniacal-nitrogen and chloride) having relatively low concentrations in groundwater and pH being approximately neutral.
- No landfill gas being detected on-site during the 2022 intrusive investigation.
- The majority of landfill settlement is inferred to have already occurred.

However, the complicating factor here is the presence of boron in the landfilled materials, which is inferred to derive from coal ash deposition within the landfill. As discussed earlier, such practice is likely to have created a significant boron reservoir, with boron being soluble and likely to leach out slowly over a long period, resulting in elevated boron levels in the groundwater and stormwater, which are still occurring in 2022. Inspection of Figure 5 suggests that boron levels in the groundwater at monitoring bore P2 have decreased from around 40-50g/m^3 in 2008 to around 10-20g/m^3 in 2022 but there is no corresponding clear downward trend in the stream water quality results (Figure 6).

The aftercare period refers to ongoing monitoring for site integrity and environmental effects until the landfill no longer has the potential for adverse environmental effects. In our opinion, this endpoint has yet to be reached for boron and hence ongoing monitoring should be continued. Further analysis may be required of this issue.

10 EXPOSURE PATH ASSESSMENT

This section provides an exposure path assessment for the landfill areas. Table 13 provides a summary of relevant baseline data used in the assessment, while Table 14 provides the exposure path assessment.

Table 13: Summary – Baseline Data

Item	Area								
	A	B	C	D	E	F	G	H	I
Area (m^2)	7,990	2,790	1,180	2,440	660	930	1,310	1,980	1,570
Fill Volume (m^3)	12,960-16,310*	3,420	1,350	3,870	0	3,730	0	910	3,080
Topsoil cover – range (average) (mm)	100-300 (145)	100-200 (157)	100-200 (162)	50-200 (139)	100	200	100-200 (151)	0	0-200 (102)
Topsoil contamination	83% > BG but < GL; 9.5% > RR/CI (Asb)	All > BG but < GL	50% > BG but < GL; 50% > RR/CI (Asb)	All > BG < GL	All < BG	All > BG < GL	All > BG < GL	All > BG but < GL; 20% > RR/CL (Asb)	87.5% > BG but < GL; 12.5% > RR/CL (Asb)
Landfill Cap Thickness – range (average mm)	100-800 (522)	100-400 (275)	400-600 (476)	0-250 (155)	200 (1 Testpit)	300 (1 Testpit)	0	0	0
Cap perm-eability (m/s)	$<10^{-7}$ except TP2	$<10^{-7}$	$<10^{-7}$	$<10^{-7}$	$<10^{-7}$	$<10^{-7}$	Not tested	Not tested	Not tested
Fill Description (main content)	Construction & general waste, burnt material, inferred boiler ash, asbestos	Construction/demolition waste, some burnt debris	General & construction waste	Construction waste, including wood, metal, concrete and bricks	None	Medical waste buried in multiple small offal pits	Non-engineered (reworked natural)	Construction and general waste, burnt material, tree stumps/wood fragments	Construction and general waste, brick concrete, and plastic bottles
Fill contamination status (% samples)	Landfill (90%), Managed Fill (10%)	Landfill (40%), managed fill (20%), cleanfill (40%)	Landfill (100%)	Landfill (100%)	N/A	Landfill (100%) due to hazardous medical waste	N/A	Landfill (100%)	Landfill (14%), Managed Fill (43%) Cleanfill (43%)

Notes: BG = background, RR = rural residential, C/I = commercial/industrial, GL =guideline, Asb = asbestos, * - range accounts for potential fill volume based on filling method in cells rather than uncontrolled filling.

Table 14: Exposure Pathway Assessment (note source = fill material in landfilled areas)

Potential Pathways	Potential Receptors	Likelihood of linkage	Likely Consequence of linkage	Risk Pathway Status	Comments
Ingestion and dermal contact of contaminated materials	Site users	Low	High	Complete (Parts of Areas A, C, H & I only – asbestos); Incomplete – other areas	**Current use = pastoral farming (animal grazing) and animal food crops (e.g., maize).** **Surficial soil (topsoil) contains some minor elevated contaminant levels, including some asbestos contamination >0.001% in Areas A, C, H & I, while depth to fill varies within and across different landfilled areas. Areas D, H & I have no landfill cap in some areas. The landfill area is subject to intermittent access by site users and more frequent but still intermittent animal grazing. It is considered unlikely there would be an unacceptable risk of contaminant exposure to humans associated with ongoing direct soil contact, except in the portions of Areas A, C, G, H & I with asbestos contamination. This risk can be further mitigated through providing relevant H&S advice to site users and through appropriate management controls.**
	Maintenance and excavation workers	High	High	Complete	**Surficial soil (topsoil) contains some asbestos contamination >0.001% in Areas A C, H & I representing risk to outdoor workers, while fill also contains elevated asbestos > C/I levels in Areas A, C, D and H as well as medical waste in Area F. Depth to fill varies within and across different landfilled areas, with Areas D and H having no clay cap in some locations. Hence, fill materials exceeding human health protection criteria for maintenance/excavation workers and waste materials are present within the fill profile. If soil disturbance activities (e.g., repair or replacement of farm water pipe network feeding troughs in landfill areas) are to be undertaken then specific contaminated land management controls would**

					need to be implemented to manage potential risks.
Inhalation of contaminated soils (dust)	Site Users Neighbouring site users	Low	High	Potentially complete	Inhalation of contaminated dusts and asbestos fibres generated during any disturbance of soils within the site presents a risk to site users, maintenance/excavation workers and neighbouring site users. The risk is considered low for existing site users and neighbours and can be mitigated through specific land management controls during any such works.
	Maintenance and excavation workers	High	High	Complete	
Inhalation landfill gas	Site users Maintenance and excavation workers Neighbouring site users	Low	Low	Incomplete	Potential for landfill gases to be generated within the fill profile due to disposal of putrescible materials, including green waste, is considered low, based on the landfill areas having been closed for at least 25 years, the nature of the fill observed from FTL test pits and no landfill gases being detected during the FTL intrusive investigation. Any landfill gas that was generated would likely be vented through the surface of the fill material to atmosphere. Main possible risk relates to accumulation of landfill gas within confined spaces (e.g., manholes or pump chambers, etc.) of which only one was found within or close to the fill area
Overland transport of contaminants within surface water and sediments	Downgradient receiving environments	Low	Low	Potentially complete	The landfill area generally has good grass cover, except for the FTL testpit/trench investigation areas, where grass is slowly reestablishing. There are also some areas of exposed soils and some ponding areas around the landfill areas. Hence, there is potential for surficial silt/sediment from topsoil across the fill area containing above background but within guideline levels of heavy metals and PAHs and some asbestos fibres to be transported in surface runoff to the Wharekōrino Stream. Six monthly monitoring of Wharekōrino Stream water quality samples both upstream and downstream of the site has found heavy metal concentrations to be lower than the adopted ANZECC guidelines, but iron concentrations often exceed ANZECC long term irrigation and

					aesthetics drinking water standards. The Wharekōrino Stream in the vicinity of the site is typically subject to low flows and is considered unlikely to be used for water consumption or long-term irrigation. Furthermore, the Wharekōrino Stream merges with the much larger Pūniu River approximately 670m downstream of the landfill site, where it is considered unlikely, that after attenuation and mixing, contaminants would be recorded in concentrations that would pose an unacceptable risk to ecological receptors. If uncontrolled soil disturbance (e.g., ploughing of landfill area) is undertaken, then potential exists for contaminant release to the downgradient receiving environment via soil erosion and stormwater runoff. This is considered unlikely based on existing use of the landfill paddocks.
Leaching of contaminants to groundwater	Downgradient groundwater users Downgradient receiving environments	High	Low	Complete	A complete pathway exists for contaminants to leach from fill materials to shallow groundwater beneath the site and discharge to the Wharekōrino Stream. Long term groundwater and stream water quality monitoring has shown elevated boron levels within the groundwater and corresponding elevated groundwater levels mid-stream and downstream of the site in excess of upstream boron levels, but with all results complying with ANZECC 95% freshwater protection level standards. As there is only one groundwater abstraction bore within 1km downstream of the site where water is used for nursery irrigation, it is considered unlikely that any potential contaminant migration via groundwater would pose an unacceptable risk to human health. Furthermore, it has been confirmed that there is a direct pathway for shallow groundwater under the landfill to flow in to the Wharekōrino Stream and hence be subject to attenuation and mixing, so that any contaminants present would not pose an unacceptable risk to ecological receptors.

11 CONSENT COMPLIANCE AND RECOMMENDED REPAIR/MAINTENANCE WORKS

Resource consents for the closed landfill are summarised in Table 15. These consents allow for the discharge of leachate to land, discharge of stormwater into the Wharekōrino Stream and discharge of contaminants to air. They all expire in March 2035.

Table 15: Existing Closed Landfill Consents

Resource Consent	Status	Description	Commenced	Expiry
AUTH102269.01.01 (269)	Current	Discharge leachate into land in circumstances that may result in contaminants entering groundwater	17/04/2000	10/03/2035
AUTH102270.01.01 (270)	Current	Divert & discharge stormwater into the Wharekōrino Stream	17/04/2000	10/03/2035
AUTH102271.01.01 (271)	Current	Discharge contaminants to air	17/04/2000	10/03/2035
AUTH102272.01.01 (272)	Current	Undertake earthworks within 5 metres of the Wharekōrino Stream	17/04/2000	10/03/2035

Compliance has been assessed against these consent conditions, and is summarised below:

(a) The landfill cap does not comply in some areas with consent requirements for cap thickness and/or permeability and for topsoil thickness (consent 269, conditions 3 and 4). Refer sections 8.6.1 and 8.6.2 of this report for further details.

(b) Some ponding and settlement/subsidence has been observed at localised locations within the landfill area. Consent 269 requires any such defects noticed during site inspections to be remedied immediately (condition 5).

(c) Consent 269, condition 9, refers to a monitoring report being provided to Env-Waikato within three years of granting the consent, that shall include proposals for additional remediation works or monitoring requirements that the consent holder considers necessary in light of the monitoring results. Whilst it is now over 20 years since this consent was granted, ongoing monitoring data, as required under consent 269, condition 7, confirms leachate is entering groundwater and the Wharekōrino Stream, with boron being the main contaminant of concern, and that some remedial works would be beneficial to reduce leachate discharges to ground and groundwater.

(d) Consent 269, condition 10 requires the consent holder to develop, implement and maintain a riparian margin along both banks of the Wharekorino Stream. A Riparian Planting Plan was required under this condition and this was provided in Attachment 2 of the Aftercare Plan for the

existing disposal sites, which is understood to have been prepared around the same time as the Meritec capping works (2000). According to WRC compliance records (2012), the plan was approved and implemented, and this condition has been met. Ongoing stock exclusion and regular removal of nuisance plant species is required. It is considered that a critical review of this plan would be required if the existing riparian planting is proposed to be altered by any proposed remedial works, and that this would be more appropriately addressed by the project ecologists.

Furthermore, whilst not consent compliance issues, the following risks are considered to need addressing:

(a) Potential leakage/failure of Culvert 3 due to its age and unknown condition.
(b) Identified flood risk, particularly given recent severe flooding events in New Zealand and the increased awareness of climate change issues and associated predicted increases in rainfall, compared with when these consents were granted in 2000.

For these reasons the following repair/maintenance works are recommended for consideration by LINZ, as part of a long term management strategy for the landfill:

(a) Repair (e.g. lining), replacement or removal of Culvert 3. With culvert removal, this would involve transferring buried refuse in this area to another portion of the landfill, outside the floodplain.
(b) Removal of culvert 2, which will significantly lower flood levels adjacent to the landfill, subject to further investigation, design and an assessment of potential effects on upstream and downstream neighbours.
(c) Replacement of the landfill cap with a low permeability cap, complying with the consent conditions and/or current best practice. Associated ponding, settlement/subsidence areas would be repaired at the same time.
(d) Possible installation of a groundwater cut-off trench or similar to divert upgradient groundwater from passing through the landfill, so that it is no longer in contact with buried refuse.

12 CONCLUSIONS & RECOMMENDATIONS

The 1998 AEE describes the landfill as comprising one fenced off area, within which there are several distinct areas that have been used for different types of refuse disposal. This investigation identified nine areas for intrusive investigation of which all but two were found to contain landfill material. Estimated landfill areas and volumes; closure dates; topsoil, cover and fill characteristics and contamination status are summarised in Table E1. It is important to note that estimated areas and volumes have ±10-30% accuracy, with the higher 30% range allowing for the method and nature of filling in Areas A, H and F (uncontrolled filling).

Overall, the aerial photographs and desktop information show that the portions of the site assessed as part of this investigation were subject to landfilling from at least 1943 through to 1979 and possibly into the 1980s, while information in the Worley AEE indicates Area A was closed in 1988 and Area C in 1997. Suspected additional filling areas outside of the primary landfilling areas (Areas H & I), east of the existing disposal sites were also assessed, given visual identification of potential filling activities during the historical review and onsite interviews with local Kaumātua.

The geotechnical information available has confirmed the site underlying geology is non-volcanic, and consists largely of alluvial material belonging to the Tauranga Group. Laboratory testing of soil samples

confirmed there are high levels of contamination present within the various areas of the existing disposal sites and suspected additional filling areas, with exceedances of both the NESCS rural residential/lifestyle block- no produce (unpublished) land use criteria and the NESCS commercial/industrial outdoor worker (unpaved) land use criteria. In addition, there were numerous exceedances of the BRANZ asbestos in soil guidelines for both residential and commercial/industrial sites. There were also numerous exceedances of the Class 1 Landfill acceptance criteria in Areas A, C, D & H, which are predominantly located within the 'old landfill' areas where disposed material was burnt.

Toxicity Characteristic Leaching Procedure (TCLP) testing was undertaken on the samples exhibiting the highest levels of contamination across the existing disposal sites and suspected additional filling areas. Thirteen samples were analysed, with all results indicating the various soil & fill materials across the existing disposal sites and suspected additional fill areas would be suitable for disposal off-site, to a Class 1 Landfill.

Given the extent and nature of the fill material found and the contamination identified thus far, it is considered unlikely that the contaminated fill materials could be separated from other materials within Areas A, B, C, D & H.

The areas of the site investigated as part of this Intrusive Investigation have been reinstated in recent months and returned to farming/grazing use. The reinstatement measures consisted of:

1) Additional material compaction where test pits have been backfilled;
2) Track rolling the existing test pit locations;
3) Retopsoiling the depressions that have appeared after backfilling the test pits; and
4) Regrassing the deposited topsoil to reestablish a vegetative cover over the testpit areas.

The fill material within the landfill would generally be classified as Class 1 landfill material, along with some managed fill and cleanfill materials, as well as some special wastes (i.e., medical wastes, asbestos). A critical assessment of landfill construction identified the following key items of concern:

- Lack of landfill base and side liner and groundwater subsoil drainage allows groundwater to come into direct contact with buried refuse.
- Refuse burning was common practice over much of the period that the hospital's closed landfills have been in operation. It was a cheap method of reducing waste volumes (thus maximising landfill lifetime), minimising leachate generation and landfill gas production from the decomposition of combustible organic wastes and providing rudimentary "sterilisation" of some wastes.
- The deposition of boiler ash within landfilling areas, either directly or for use as cover material has likely introduced a significant boron reservoir into the landfill. Boron is relatively soluble and hence likely to leach over a long period, while once boron gets into water it is very difficult and costly to remove. In our opinion, the ash disposed of in Areas A and C of the landfill is the likely source of elevated boron levels in groundwater sampled from the landfill monitoring bores and in the adjacent stream. However, ongoing monitoring has confirmed that boron levels in the adjacent stream comply with ANZECC criteria for the protection of 95% of freshwater species.
- Some areas have non-compliant clay capping (i.e., inadequate thickness and/or permeability) and/or topsoil cover in relation to the approved resource consent for the landfill site.

- There is no leachate collection or landfill gas collection systems, this being consistent with landfilling practice at the time the landfilling areas were constructed.
- The proximity to the Wharekōrino Stream means the site is potentially subject to inundation by flood waters.

The landfill aftercare period refers to the duration of ongoing monitoring for site integrity and environmental effects until the landfill no longer has the potential for adverse environmental effects, effectively defining the landfill "end of life". All landfill areas were assessed to be in the latter stages of the aftercare period, which typically lasts 30-50 years post-closure, as Area C was closed about 26 years ago, Area A 35 years ago and the other areas likely as long as 44 years ago. This is supported by:

- Typical leachate parameters (ammoniacal-nitrogen and chloride) having relatively low concentrations in groundwater and pH being approximately neutral.
- No landfill gas being detected on-site during the 2022 or 2023 intrusive investigations.
- The majority of landfill settlement is inferred to have already occurred.

However, the complicating factor here is the presence of boron in the landfilled materials, which is inferred to derive from coal ash deposition within the landfill. Such practice is likely to have created a significant boron reservoir, with boron being soluble and likely to leach out slowly over a long period, resulting in elevated boron levels in the groundwater and stormwater, which are still occurring in 2023, although boron levels in the stream have always complied with ANZECC 95% freshwater species protection levels. In our opinion, this "potential adverse environmental effect" endpoint has yet to be reached for boron and hence ongoing monitoring should be continued.

The landfill risk assessment found the main issues to be:

- Groundwater contamination from passage through the landfill, with groundwater flowing into the adjacent stream, with boron being the main contaminant of concern, as explained above.
- Culvert 3 (1350dia) pipes the Wharekōrino Stream through Area H of the landfill. This culvert is estimated to be 44-65 years old and could be subject to differential settlement from landfill activity, leading to leaking joints and ultimately possible pipe failure. Attempts have been made to CCTV this culvert but have not been successful to date, due to significant flows through the culvert.
- Flood modelling of the Wharekōrino Stream has shown that the landfill areas A, B, C, G and H are currently likely to be inundated to varying extents during a 1% AEP storm event, particularly if the two downstream culverts on the stream are blocked or become blocked during the storm, with these effects worsening with predicted climate change. Areas D, E and F have been found unlikely to be affected by flooding. Flooding impacts could potentially be significantly mitigated by the removal of Culvert 2 and the associated embankment, which forms a redundant road crossing over the stream, located below the landfill and above the culvert on Te Mawhai Rd.

The following repair/maintenance works are recommended for consideration by LINZ, as part of a long term management strategy for the landfill:

- Repair (e.g. lining), replacement or removal of Culvert 3. With culvert removal, this would involve transferring buried refuse in this area to another portion of the landfill, outside the floodplain.

- Removal of culvert 2, which will significantly lower flood levels adjacent to the landfill, subject to further investigation, design and an assessment of potential effects on upstream and downstream neighbours.
- Replacement of the landfill cap with a low permeability cap, complying with the consent conditions and/or current best practice. Associated ponding, settlement/subsidence areas would be repaired at the same time.
- Possible installation of a groundwater cut-off trench or similar to divert upgradient groundwater from passing through the landfill, so that it is no longer in contact with buried refuse.

13 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.

Figures

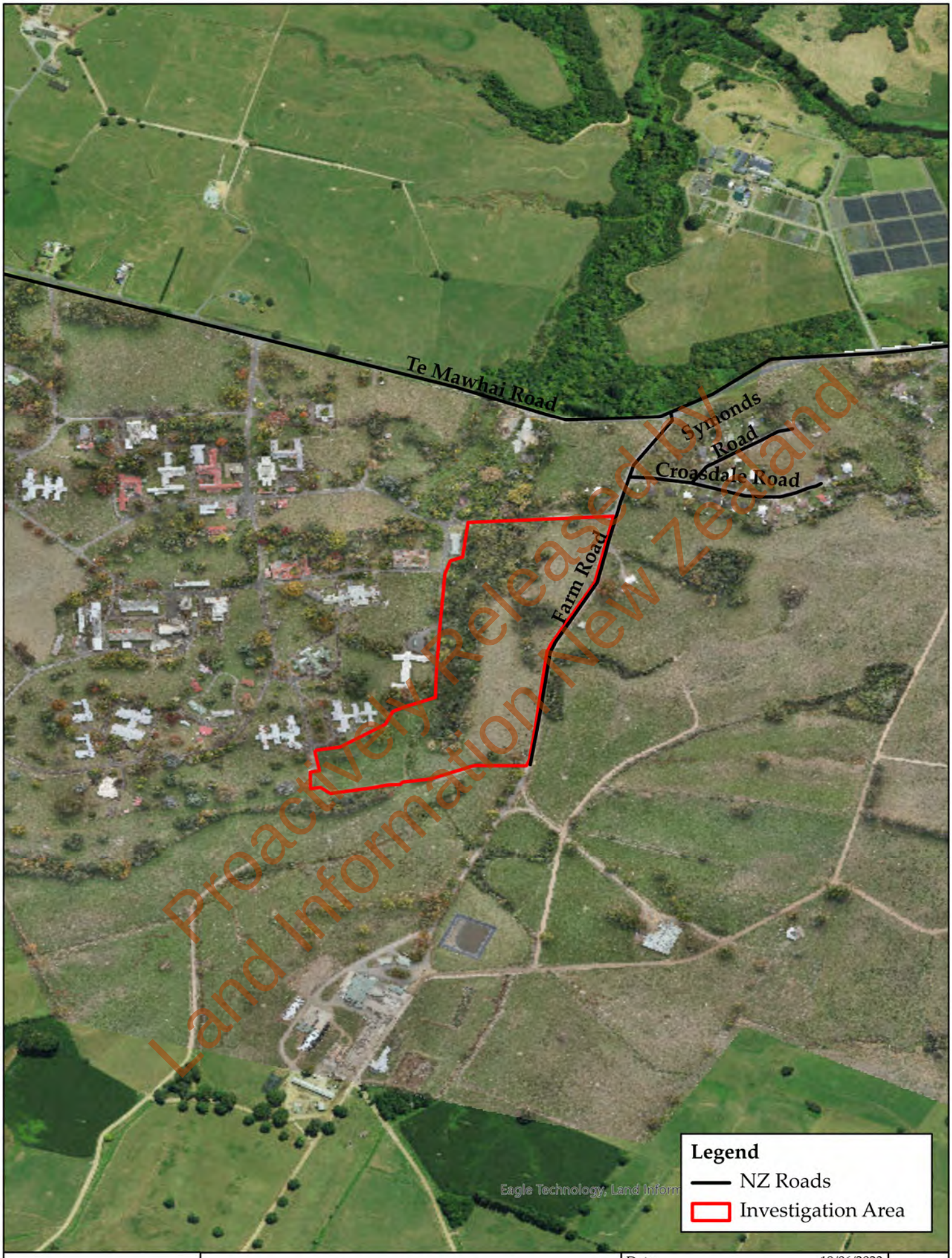


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Figure 1: Site Location Plan

Toitū Te Whenua Land Information New Zealand
Intrusive Investigation
Former Tokanui Hospital Demolition and Remediation Project
Tokanui
Te Awamutu

Date:	19/06/2023
Figure Reference:	33097/001
Drawn by:	EB
Reviewed by:	SF
Job Number:	33097

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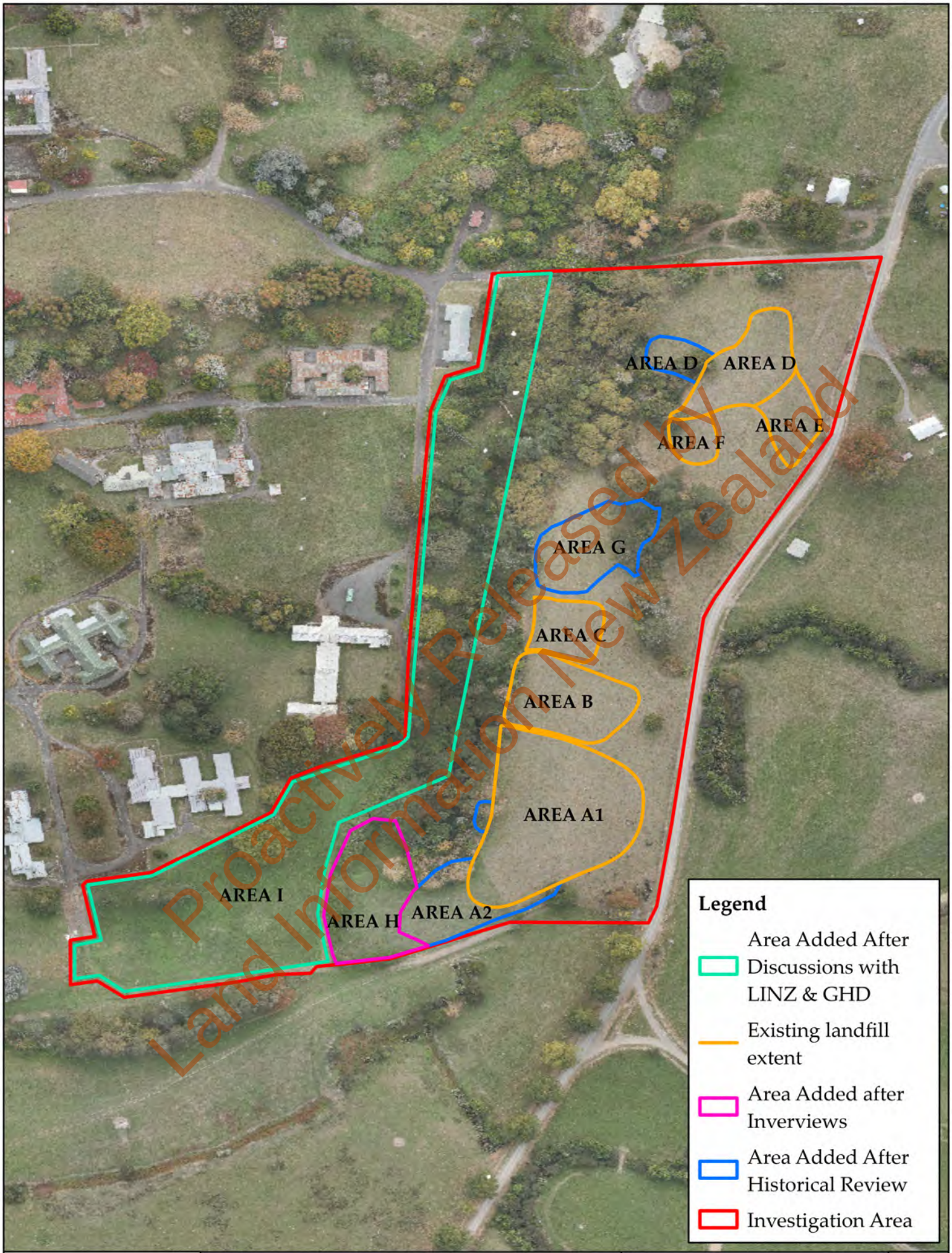

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Figure 2: Landfill Location Plan

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Intrusive Investigation
Former Tokanui Hospital Demolition and Remediation Project
Tokanui
Te Awamutu

Date:	24/11/2023
Figure Reference:	33097/002
Drawn by:	EB
Reviewed by:	SF
Job Number:	33097

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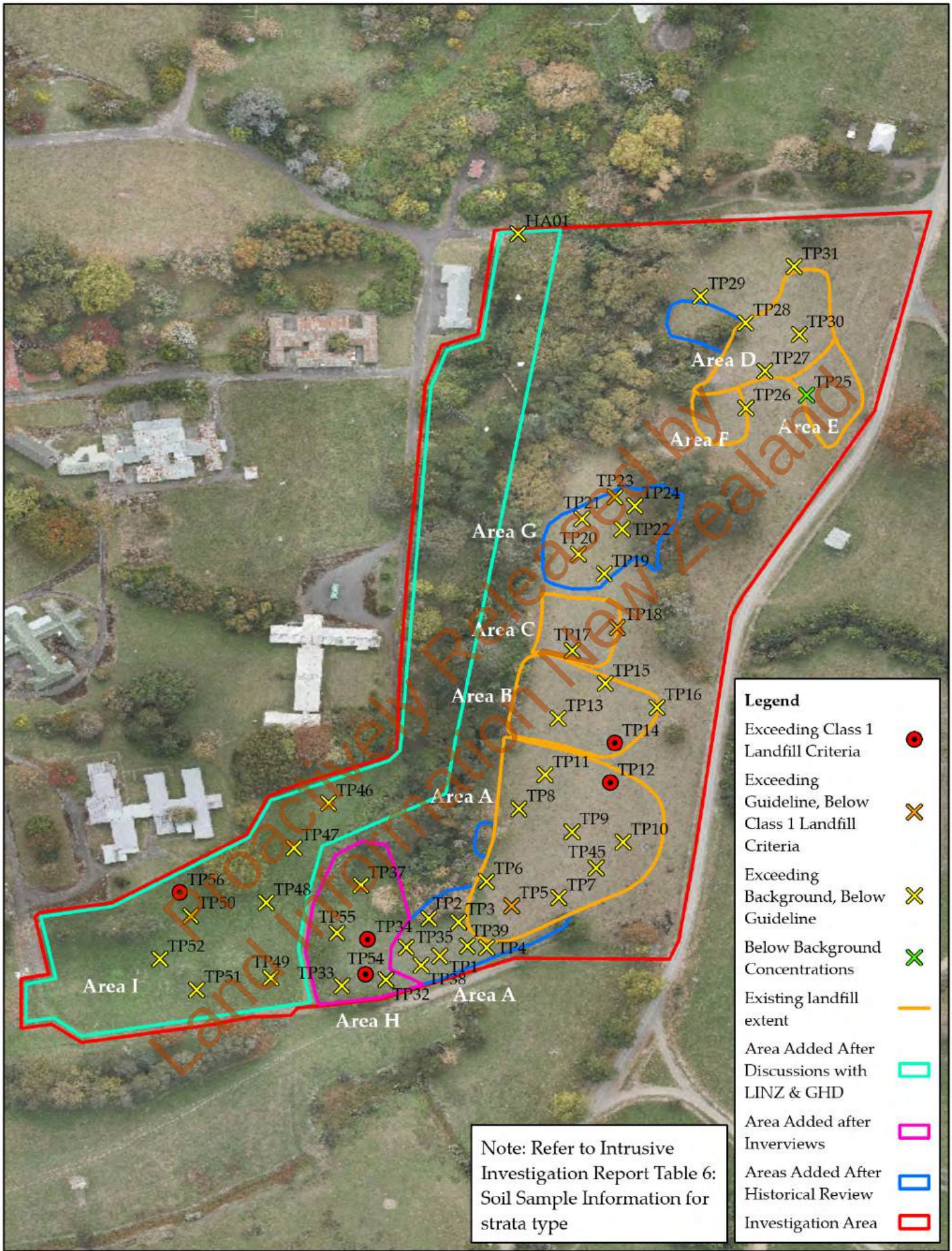

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Figure 3: Topsoil Contamination Plan

Toitū Te Whenua Land Information New Zealand
Intrusive Investigation
Former Tokanui Hospital Demolition and Remediation Project
Tokanui
Te Awamutu

Date:	09/02/2023
Figure Reference:	33097/003
Drawn by:	EB
Reviewed by:	SF
Job Number:	33097

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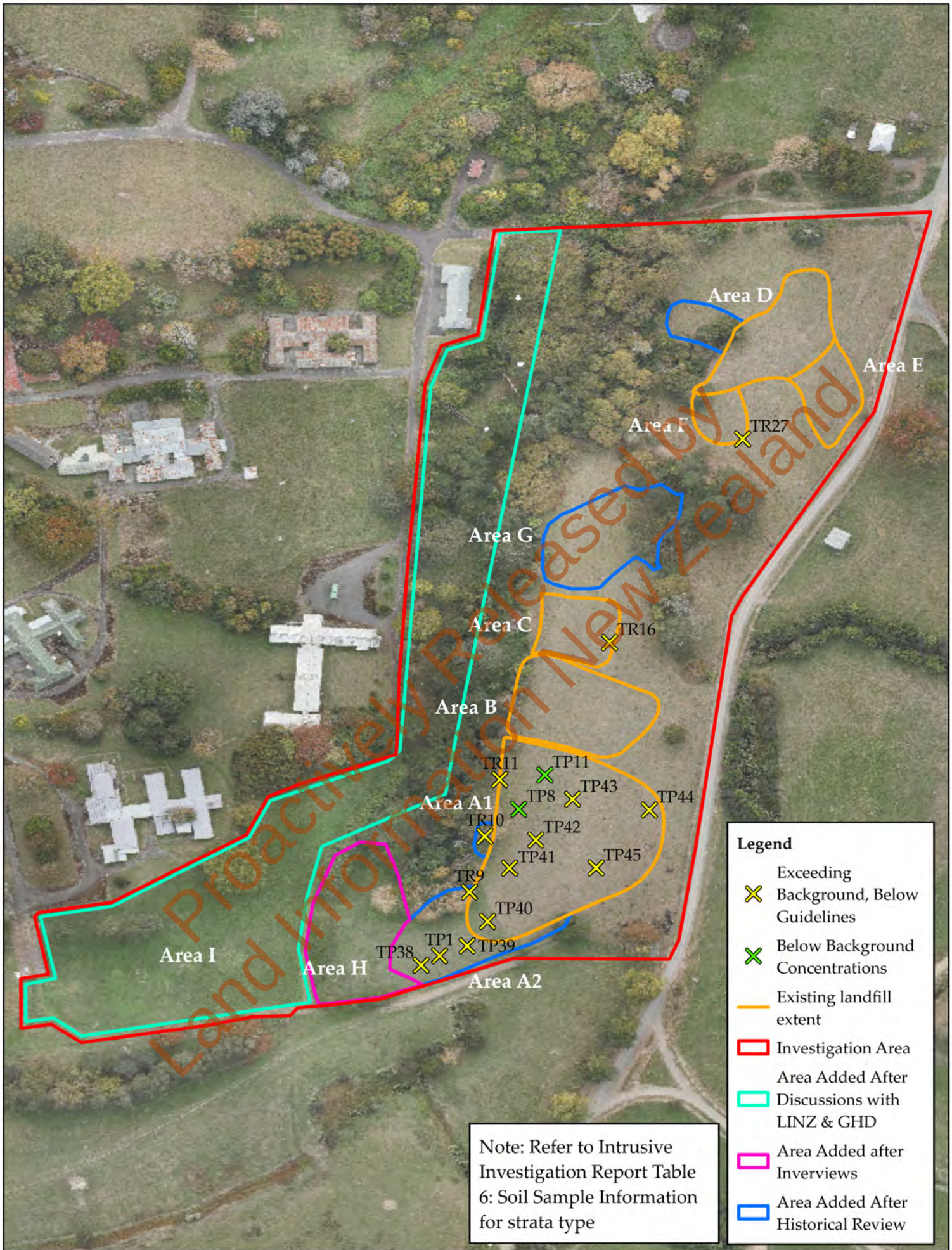

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Figure 4: Landfill Cap Contamination Plan

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Te Awamutu

Date:	23/11/2023
Figure Reference:	33097/004
Drawn by:	EB
Reviewed by:	SF
Job Number:	33097

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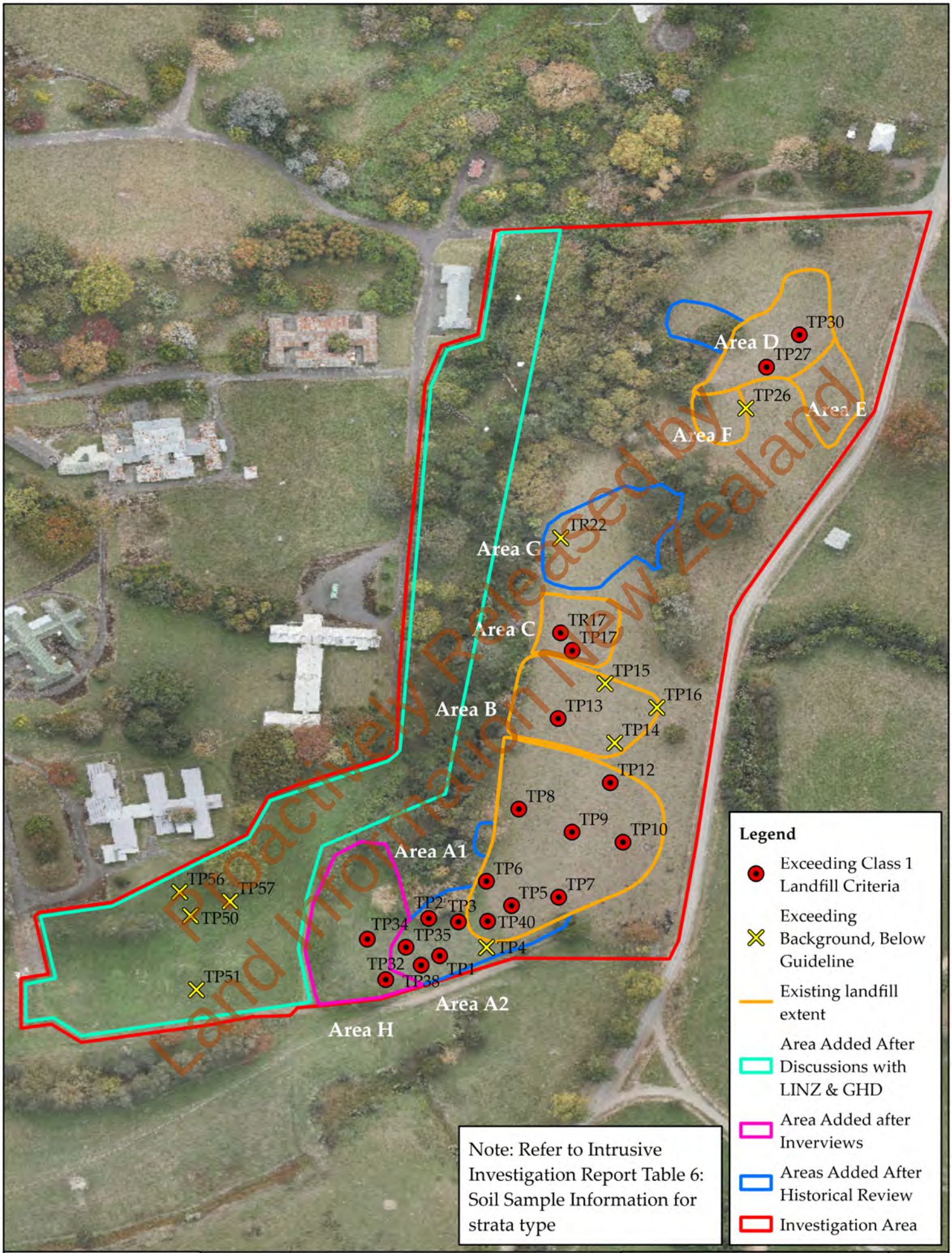

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Figure 5: Fill Contamination Plan

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Tokanui
Te Awamutu

Date:	23/11/2023
Figure Reference:	33097/005
Drawn by:	EB
Reviewed by:	SF
Job Number:	33097

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0 28 56 112 168
Meters

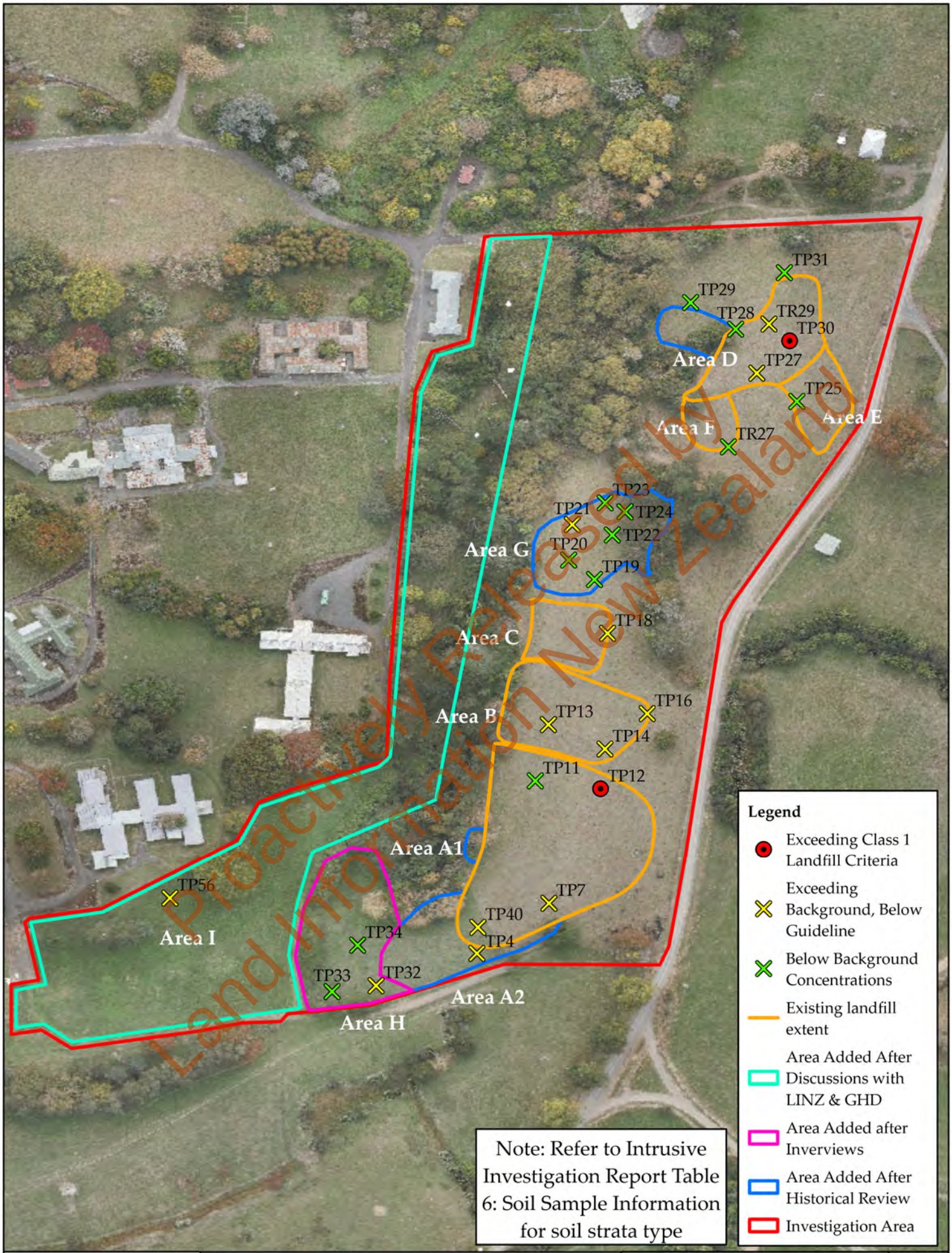

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Figure 6: Natural Ground Contamination Plan

Toitū Te Whenua Land Information New Zealand
Intrusive Investigation
Former Tokanui Hospital Demolition and Remediation Project
Tokanui
Te Awamutu

Date:	23/11/2023
Figure Reference:	33097/006
Drawn by:	EB
Reviewed by:	SF
Job Number:	33097

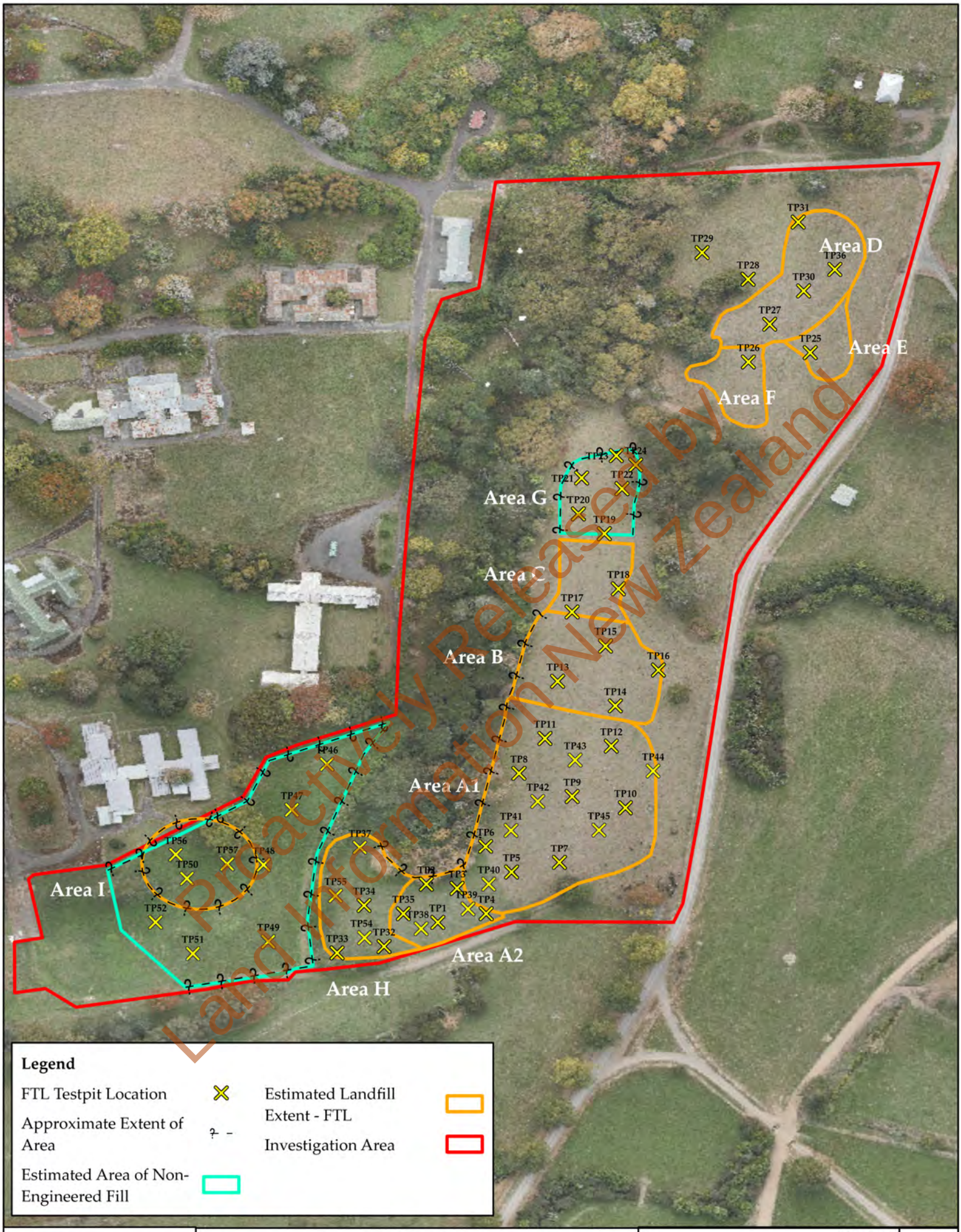

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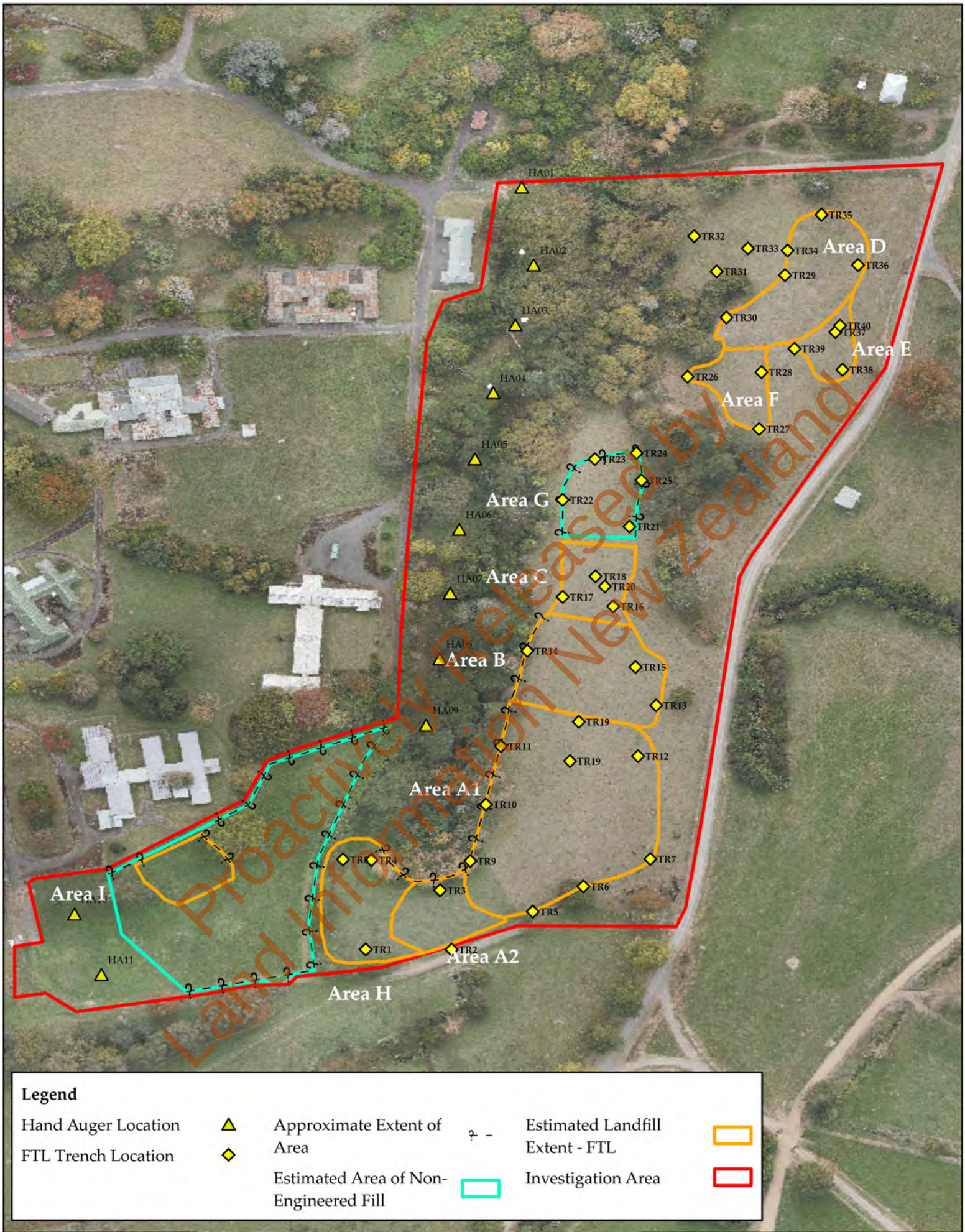
Figure 7: Test Pit Location Plan

Toitū Te Whenua Land Information New Zealand
Intrusive Investigation
Former Tokanui Hospital Demolition and Remediation Project
Tokanui
Te Awamutu

Date:	24/11/2023
Figure Reference:	33097/007
Drawn by:	EB
Reviewed by:	SF
Job Number:	33097

N

0 27 54 108 162
Meters



Legend

Hand Auger Location

FTL Trench Location

Approximate Extent of Area

Estimated Area of Non-Engineered Fill

Estimated Landfill Extent - FTL

Investigation Area

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Figure 8: Trench & Hand Auger Location Plan

Toitū Te Whenua Land Information New Zealand
Intrusive Investigation
Former Tokanui Hospital Demolition and Remediation Project
Tokanui
Te Awamutu

Date:	13/08/2023
Figure Reference:	33097/008
Drawn by:	EB
Reviewed by:	SF
Job Number:	33097

N

0 27 54 108 162
Meters

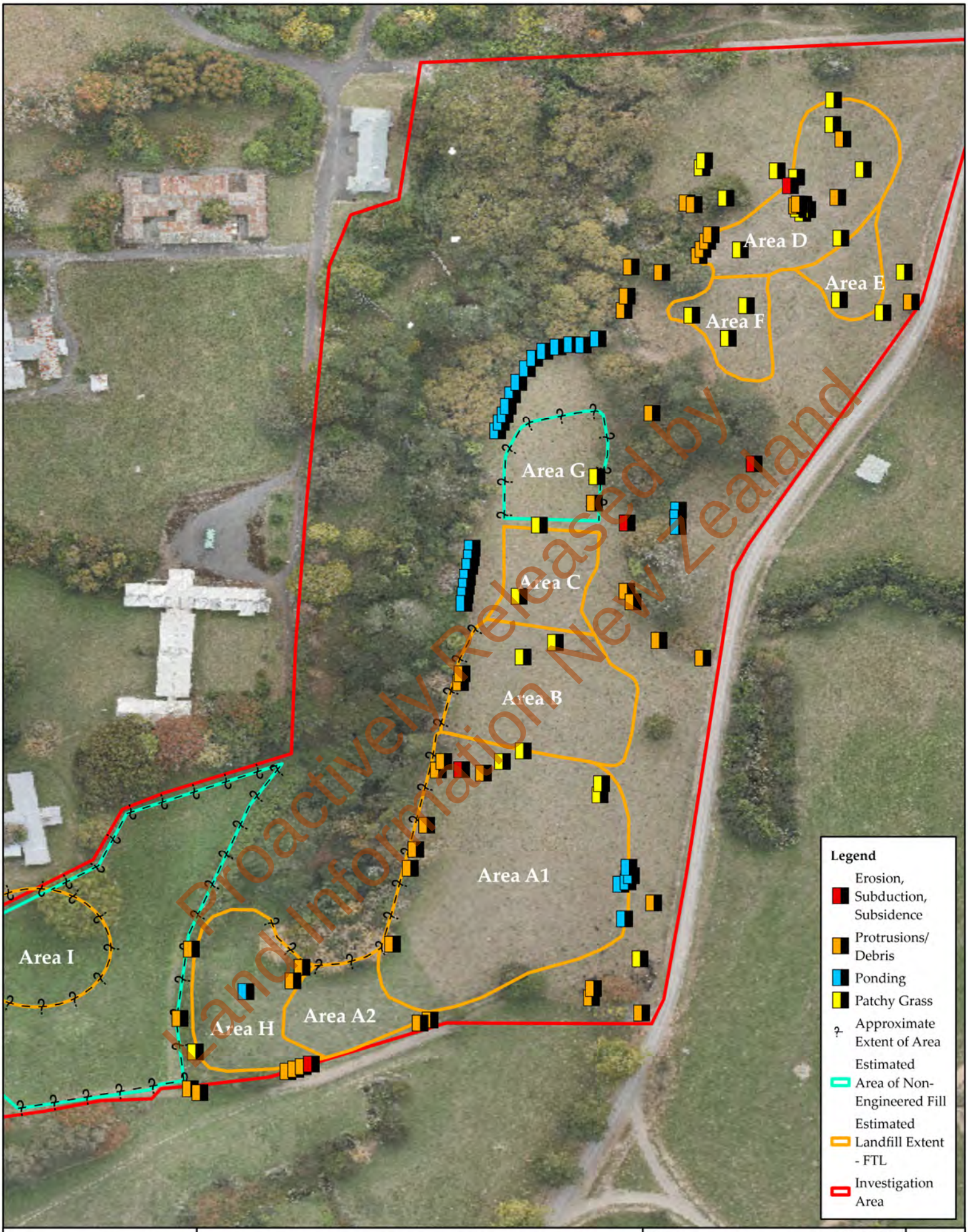

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Figure 9: Landfill Cover Condition Plan

Toitū Te Whenua Land Information New Zealand
Intrusive Investigation
Former Tokanui Hospital Demolition and Remediation Project
Tokanui
Te Awamutu

Date:	24/11/2023
Figure Reference:	33097/009
Drawn by:	EB
Reviewed by:	SF
Job Number:	33097

N

0 16 32 64 96 128
Meters

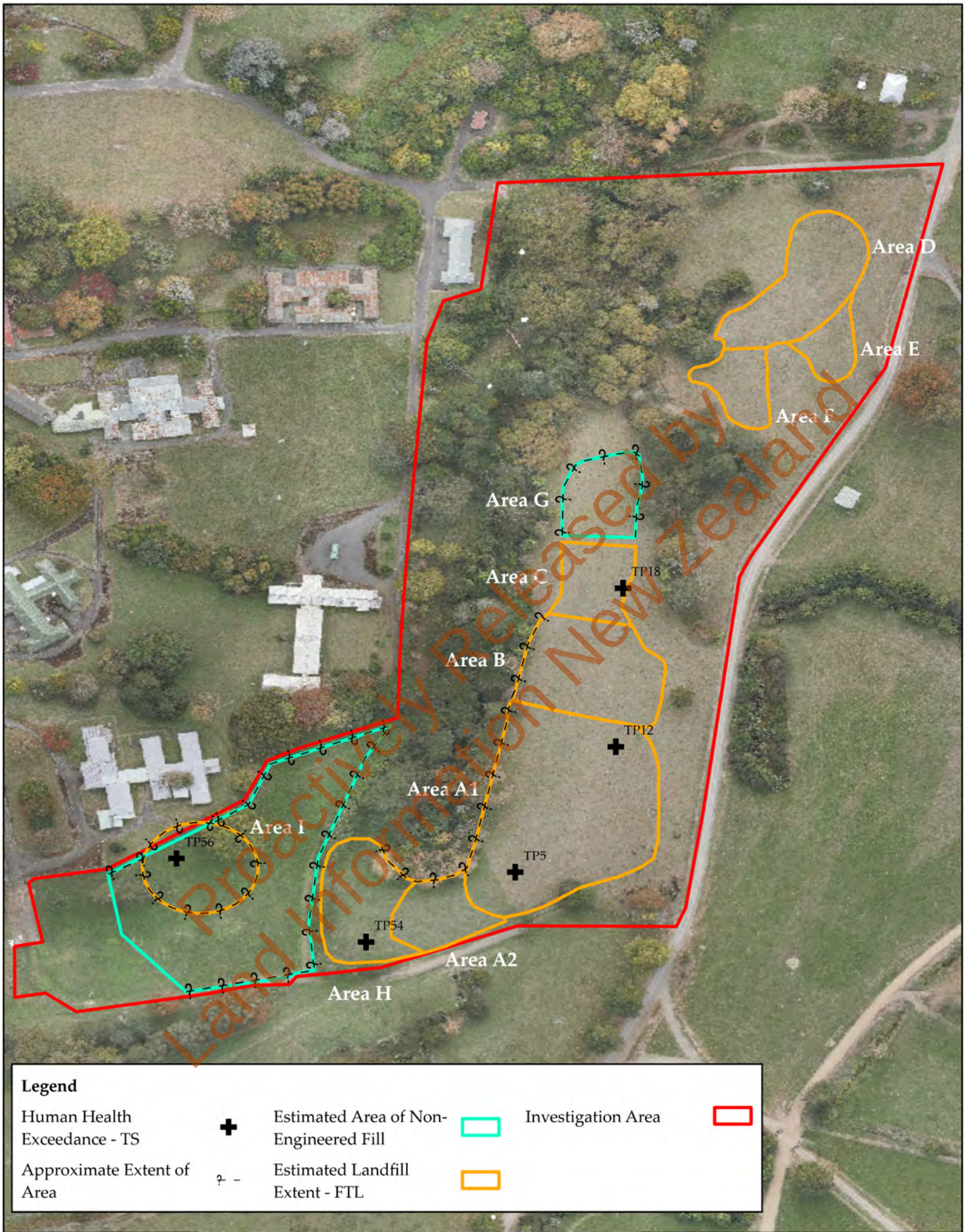

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Figure 10: Human Health Exceedance Plan - Surface

Toitū Te Whenua Land Information New Zealand
Intrusive Investigation
Former Tokanui Hospital Demolition and Remediation Project
Tokanui
Te Awamutu

Date:	24/11/2023
Figure Reference:	33097/010
Drawn by:	EB
Reviewed by:	SF
Job Number:	33097

N

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Meters

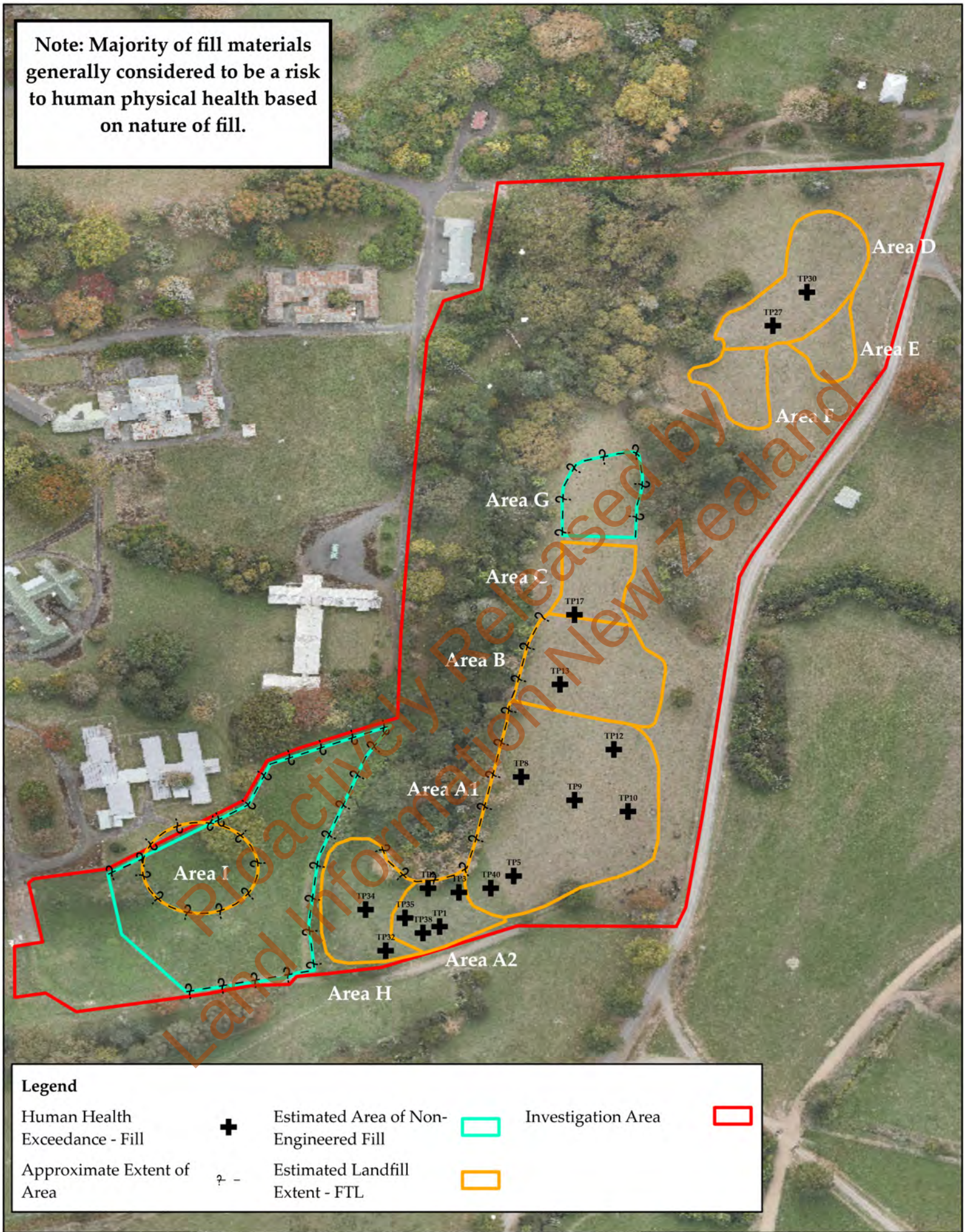

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Figure 11: Human Health Exceedance Plan - Fill

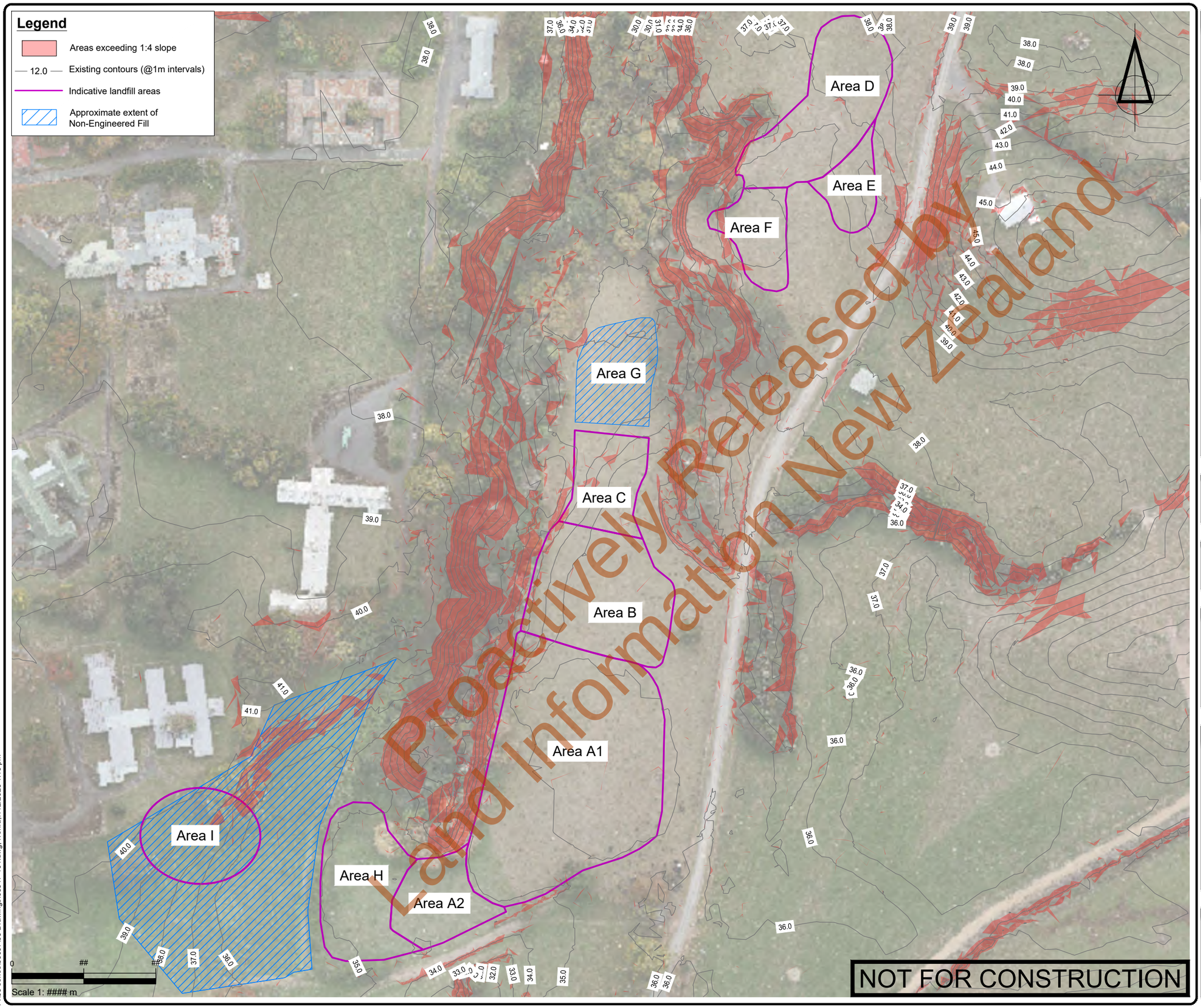
Toitū Te Whenua Land Information New Zealand
Intrusive Investigation
Former Tokanui Hospital Demolition and Remediation Project
Tokanui
Te Awamutu

Date:	24/11/2023
Figure Reference:	33097/011
Drawn by:	EB
Reviewed by:	SF
Job Number:	33097

N

0 27 54 108 162
Meters

Drawings



SURVEYED			APPROVED DATE
DESIGNED			
DRAWN	TB	02/02/23	
CHECKED			

REVISION	CHANGES	CHECKED	DATE
A	MINOR EDITS	FV	31/10/24

NOTES

CLIENT
TOITŪ TE WHENUA
LAND INFORMATION NEW ZEALAND

PROJECT
FORMER TOKANUI HOSPITAL
CLOSED LANDFILL
TOKANUI

TITLE
AREAS POTENTIALLY AFFECTED BY SHALLOW SOIL CREEP

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BLENHEIM 03 428 3292
NELSON 03 222 1132
www.fraserthomas.co.nz

STATUS
FOR INFORMATION
Construction works shall commence only on receipt of and in accordance with the Council or Council organisation stamped approved drawings, unless otherwise indicated.

SCALE 1:1500 (A3)

DRAWING No 65547/101 REVISION A

P:\33 series\33097\03 Drawings\65547-101.dwg, fvohra,7/12/2023 1:16 pm

Appendix A

Historical Aerial Photographs

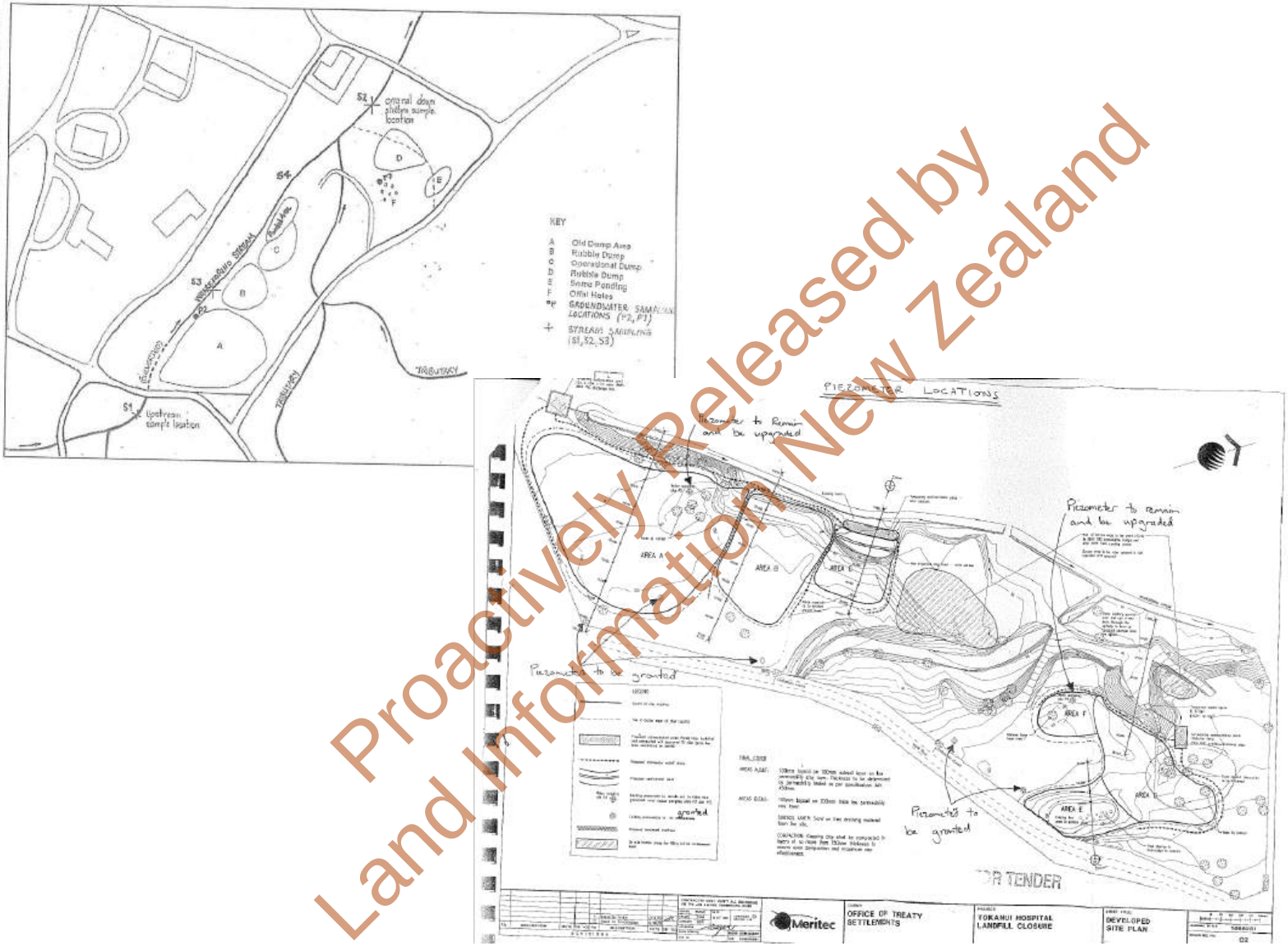
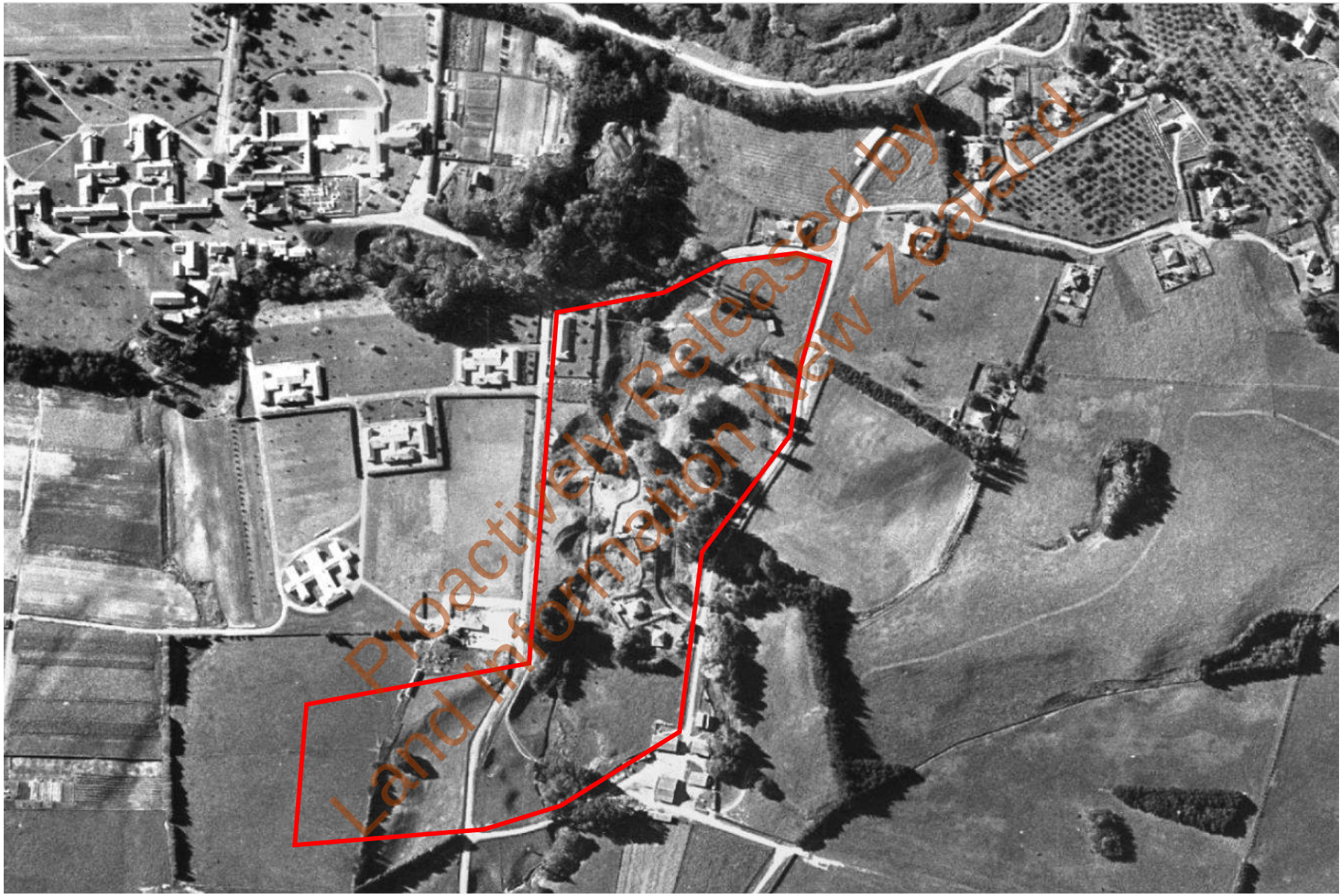


Figure 2: Location of groundwater and surface water quality monitoring sites

1943



Source: Waikato Regional Council

1944

Source: NZ Aerial Imagery: retrolens.co.nz

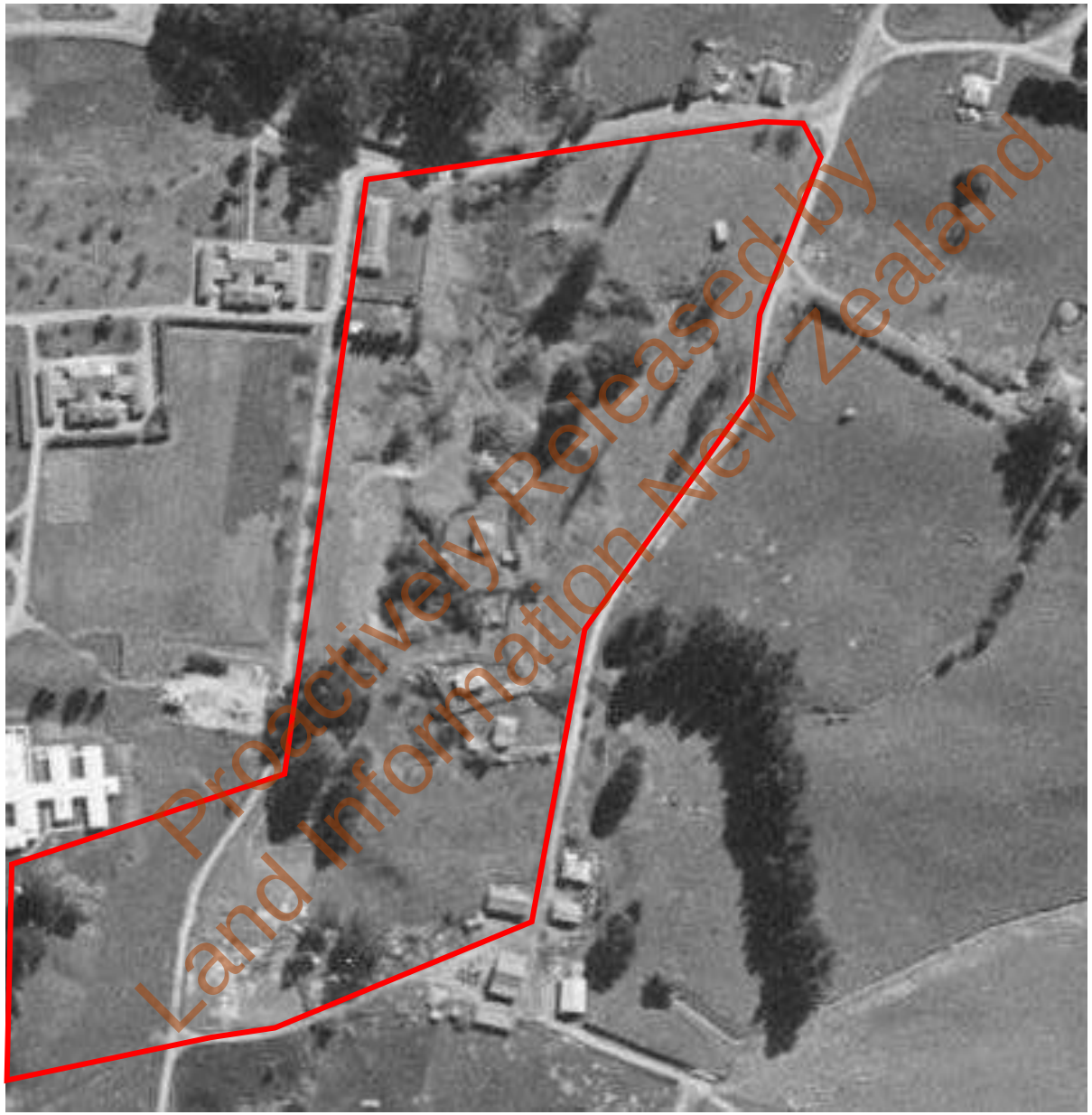
1951

Source: Alexander Turnbill library https://natlib.govt.nz/

1957

Source: Waikato Regional Council

1961



Source: NZ Aerial Imagery: retrolens.co.nz

1966 – East Portion

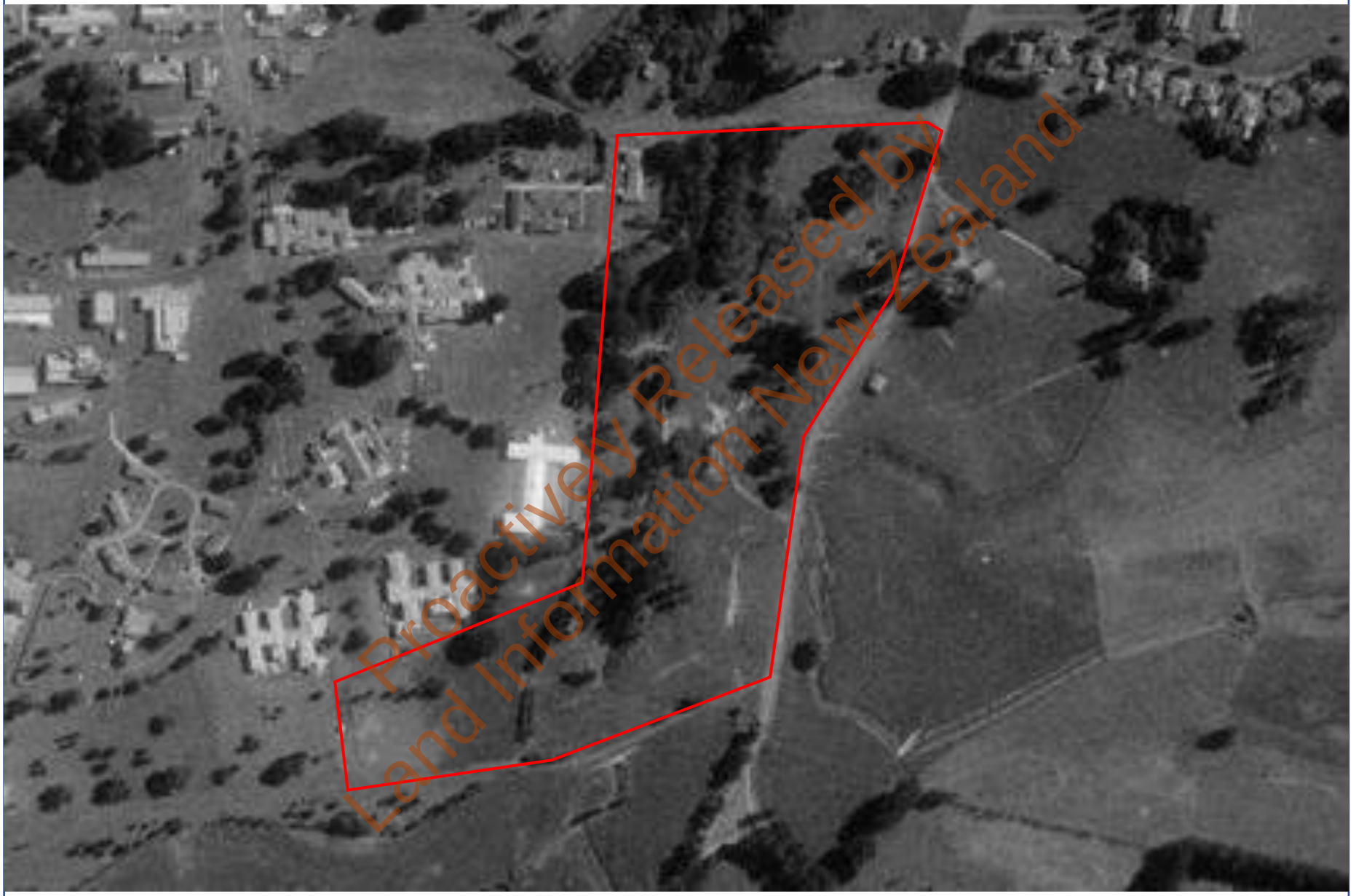
1974

Source: NZ Aerial Imagery: retrolens.co.nz

1979

Source: Waikato Regional Council: retrolens.co.nz

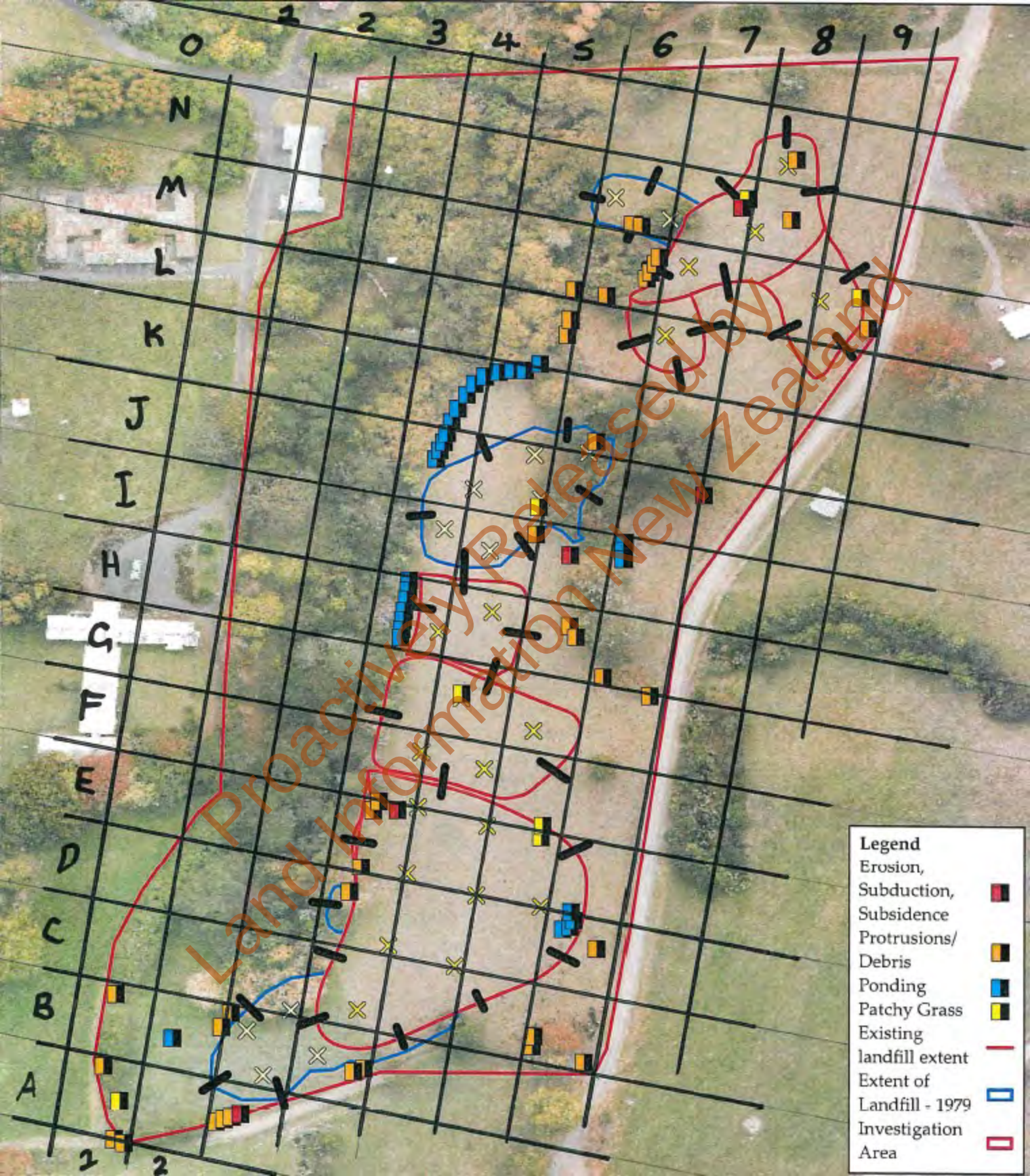
1995



Source: NZ Aerial Imagery: retrolens.co.nz

Appendix B

Landfill Annual (2022) Walkover Survey Findings



Landfill Area	Grid	Description – November 2022
-	A1	Patches of dead grass, cement and wooden post debris
-	A2	-
Extent of A	A3	Large concrete block, small subsidence/erosion near fence, cement protrusion
-	B1	Wooden planks, cement, cement piping debris, patchy grass growth
Extent of A	B2	Previous ponding – lily's growing
Extent of A	B3	2 ceramic pipes protruding
A	B4	Loose rock, brick, cement along fence boundary gully. Single cement block protruding
-	C1	-
-	C2	-
A	C4	-
A	C5	-
A	C6	-
-	C7	Mixed cement blocks, water trough?
A	D4	Concrete block protruding at surface
	D5	-
	D7	Trough, ponding
	E4	Subsidence – ground has sunken, wooden post protruding, rock/concrete protruding, patches of dying pasture, another sunken part, stumps protruding
	E5	
	E6	Patchy pasture
	E7	Patchy pasture
A & B	F4	-
	F5	-
	F6	Patchy pasture throughout
-	F7	
B	G4	
	G5	Patchy vegetation growth
	G6	-
-	G7	-
C	H4	Ponding at fence boundary
	H5	-
-	H6	Bricks, wooden post protruding
-	H7	Cement, wooden post protrusion
Extent of C	I4	-
	I5	Erosion, subduction at boundary fence
-	I7	Minor ponding
Extent of C	J4	-
	J5	Patchy pasture
	J6	-
-	J7	-
-	J8	erosion
-	K4	ponding
Extent of C	K5	ponding
	K6	Small subsidence
-	K7	

-	K8	
-	L5	Concrete, ceramic protrusion
F	L6	
	L7	
E	L8	
D	M6	Rock, concrete blocks, scrap metal, metal piping, wooden posts
	M7	-
E	M8	-
	M9	Patchy pasture
D	N6	Brick, metal pipe protruding
	N7	Subsidence
	N8	
-	O5	-
-	O6	-
D	O8	Old stump protrusion
-	O9	-
-	P7, P8, P9	-

Supplementary notes; based on landfill area

Area A: Area A was largely observed as lush pasture, with some fill protrusion and one instance of ponding and subsidence/erosion.

Patchy pasture was noted within grids B1, B2, and B3 stretching west through the extent of area A, and areas E4, E6, E7 and F6 along the northern boundary of Area A and southern boundary of Area B.

Protrusion of wooden posts and planks were visible at A1 and B1, which is reasonably far from the extent of the landfill in 1979, and at E4 at the edge of area A, which is more likely associated with filling activities. Cement blocks protrude at A1 and B1 which is reasonably far from the extent of Area A1 and likely dumped. They were also found protruding at A3, B4, D4, and E4 along the boundary fenceline and western extent of Area A. 2 Ceramic posts were also noted to protrude at grid B3, at the extent of Area A.

Ponding was observed at Grid D7, surrounding a permanent water trough. Subsidence/Erosion was visible at grid A3 at the fenceline boundary.

Area B: Area B was observed as having no features of note, and some minor localized instances of patchy pasture in grids F6 and G5.

Area C: Area C was observed as mostly lush pasture, with large portions of ponding some visible subduction and subsidence. Grid J5 was the only portion of Area C where patchy pasture was observed, at the extent. Significant ponding was observed at H4 and minor ponding at K5, both located between the extent of area C and the Wharekorino stream. Ponding at both locations has been noted in previous years, and high stream flow is likely a large contributor. Localized subduction is observable at I5 at the extent of area near the fencline. Subsidence was noted at K6 at the north-eastern extent of area C.

Area D: Area D was mostly lush pasture, with very uneven topography including patches of subduction and some instances of protruding debris. Grid M6 contained a large amount of protruding debris including concrete blocks, scrap metal, piping and wooden posts at the boundary of Area D where the land slopes down toward the Wharekorino stream tributary. N6 had similarly exposed debris at the extent of Area D, near M6. Significant subsidence was observed at grid N7

Area E: Area E was primarily in good condition. The only feature of note was general sloping subduction of the land. Previous visits have noted ponding filling this subducted area, but none was observed during 2022.

Area F: No Features of note. Offal pits were located in this area but no visible features related to this.

A1

A1

A1

A1

A1 – Patchy pasture

A1 – Patchy pasture

A2

A2

A2

A2

A3 – large cement block

A3

A3 – Subsidence/erosion

A3

B1

B1 – patchy pasture

B1 – wooden debris

B1 – cement blocks

B1 – cement block/piping debris

B1 – manhole

B1

B1

B2

B2

B2 – previous ponding

B2

B3 – Ceramic pipe protrusion

B3 – Ceramic pipe protrusion

B3

B3

B3

B3

B4

B4

B4 – loose brick debris

B4 – cement block protruding

B4

B4 – cement block protruding

B4

B4

C1

C1

C4

C4

C4

C4

C4

C5

C5

C5

C5

C6

C6

C6

C6

C7

C7

C7

C7

C7

C7 – mixed cement blocks

D4

D4

D4

D4

D4 – concrete block protruding

D5

D5

D5

D5

D5

D7

D7

D7

D7

D7 – ponding

E4 - subsidence

E4 – wooden post protruding

E4 – concrete protrusion

E4 – patchy pasture

E4

E5

E5

E5

E5

E6

E6

E6

E6

E7 – patchy pasture

E7

E7

E7

F4

F4

F4

F4

F4

F5

F5

F5

F5

F6

F6

F6 – patchy pasture

F6

F6

F7

F7

F7

F7

G4

G5 – patchy pasture

G5

G5

G5

G6

G6

G6

G6

G7

G7

G7

G7

G7

H4 – ponding extent

H4

H4 – Ponding at fence boundary

H4

H4

H5

H5

H6

H6

H6

H6 – debris protruding

H6 – debris protruding

H7

H7

H7

H7 – debris protruding

H7

I4

I4

I4

I4

I5

I5 – erosion/subduction

I5

I5

I5

I7

I7 – minor ponding

I7

I7

J4

J4

J4

J4

J5

J5

J5 – patchy pasture

J5

J6

J6

J6

J6

J7

J7

J7

J7

J8 - erosion

J8

J8

J8

J8

K4

K4

K4 - ponding

K4 - ponding

K5

K5

K5 - ponding

K5

K5

K6

K6

K6 – minor subsidence

K7

K7

K8

K8

L5

L5 – concrete/ceramic protrusion

L5

L5 – concrete protrusion

L6

L6

L7

L7

L7

L7

L7

L8

L8

L8

M6 – concrete block, scrap metal, metal piping debris

M6 – concrete debris

M6

M6

M7

M8

M9

M9 – patchy pasture

M9

N6 – metal pipe protruding

N6 – brick protruding

N6

N6

N7

N7 – patchy pasture

N7

N7 - subsidence

O5

O8 – stump protruding

O8

09

O9

O9

P7, P8, P9

P7, P8, P9

Appendix C

Geotechnical Factual Report

Fraser Thomas
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18 July 2023

Project No. 65547

Toitū Te Whenua Land Information New Zealand
Private Bag 4721
Christchurch 8140
New Zealand

Email: kwepasnick@linz.govt.nz

FORMER TOKANUI HOSPITAL CLOSED LANDFILL, TOKANUI – GEOTECHNICAL FACTUAL REPORT

As requested, eleven hand augured boreholes, numbered HA1 to HA11 inclusive, fifty-one machine excavated test pits, numbered TP1 to TP40 inclusive, TP46 to TP52 inclusive and TP54 to TP57 inclusive, forty machine excavated shallow trenches, numbered TR1 to TR40 inclusive and a visual assessment of the overall area reported to encompass the former Tokanui Hospital closed landfill, were undertaken at the locations shown on the appended Fraser Thomas Ltd drawings 33097/007 and 33097/008 in order to investigate the depth/extent of the former Tokanui Hospital closed landfill material and overall condition of the site.

The hand augured borehole and test pit logs are appended to this report.

A site walkover and visual assessment of the subject site was undertaken during the investigation reported herein. The areas where landfill material was encountered were generally observed to comprise grassed, flat lying farm paddocks. Evidence of shallow soil creep, including terracettes and hummocky topography, were observed in areas where the site topography sloped at, or was steeper than 14° to the horizontal (1V:4H), as shown on the appended Fraser Thomas Ltd drawing 65547/101.

The approximate inferred footprint of the landfill area and lateral extent of non-engineered fill, based on the visual appraisal of the site and fill material identified within the trenches, is shown on the appended Fraser Thomas Ltd drawing 33097/008.

In situ undrained shear strength measurements were carried out in the sides and base of the test pits using hand held field shear vane equipment in accordance with the NZ Geotechnical Society 'Test Method for Determining the Vane Shear Strength of a Cohesive Soil using a Hand Held Shear Vane, August 2001'. These tests were carried out in the walls and floor of the test pits at 0.5 m depth intervals, where possible, enabling a strength profile of **cohesive soils** to be obtained from the test pits.

It is noted that in situ undrained shear strength measurements were not generally undertaken in the granular material i.e. landfill refuse.

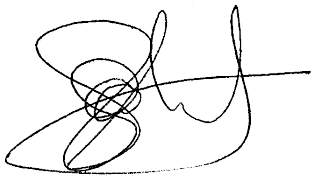
It is also noted that due to instability of the area surrounding the test pits, dynamic cone (Scala) penetrometer (DCP) tests were not undertaken in the landfill refuse. However, a DCP test was conducted in the base of Borehole HA1. The results of the DCP test conducted in the base of Borehole HA1 generally ranged between 2 and 7 blows per 50 mm penetration, corresponding to a loose to medium dense consistency.

In situ undrained shear strength values measured in the landfill capping material were generally greater than 100 kPa, corresponding to a very stiff to hard consistency.

In situ undrained shear strength values measured in the Hamilton Ash and Tauranga Group alluvial sediments ranged between 31 kPa and greater than 200 kPa, corresponding to a firm to hard consistency.

It should be noted that the field investigation data provided is factual only. No liability is accepted by this firm or by any principal, or director, or any servant or agent of this firm, in respect of the use or interpretation of the data by any other person or entity and any liability arising from the use of the appended data is solely that of that person or entity.

Yours sincerely
FRASER THOMAS LIMITED



A G J STUART
Director – Geotechnical Engineering
Chartered Professional Engineering Geologist

HAND AUGERED BOREHOLE AND MACHINE EXCAVATED TEST PIT LOGS

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HAND AUGER LOG

Hole No: HA1

Project No:	Project:	Shear Vane:	Date Drilled:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui		17/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, black, dry, friable	T/S	TS
0.2	[TOPSOIL STOCKPILE/FILL] SILT, sandy (fine), dark brown speckled brown, firm, dry, friable	Fill	
0.6	GRAVEL (fine to medium, sub-angular), minor silt, dark brown mottled light brown, medium dense, moist, poorly graded		
0.8	EOH: 0.70 m TOO DENSE TO AUGER (REFUSAL ON GRAVEL)		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 100 mm)

Depth (m)	Blows / 100 mm
0.6	6
0.8	7
1.0	5
1.2	5
1.4	4
1.6	2
1.8	2
2.0	2
2.2	2
2.4	3
2.6	3
2.8	4
	4

Groundwater: GWNE

Remarks:
1. Groundwater not encountered on 17/04/23.
2. DCP test undertaken in the base of the borehole from 0.6 m to 1.9 m.

Datum:

Coordinates:

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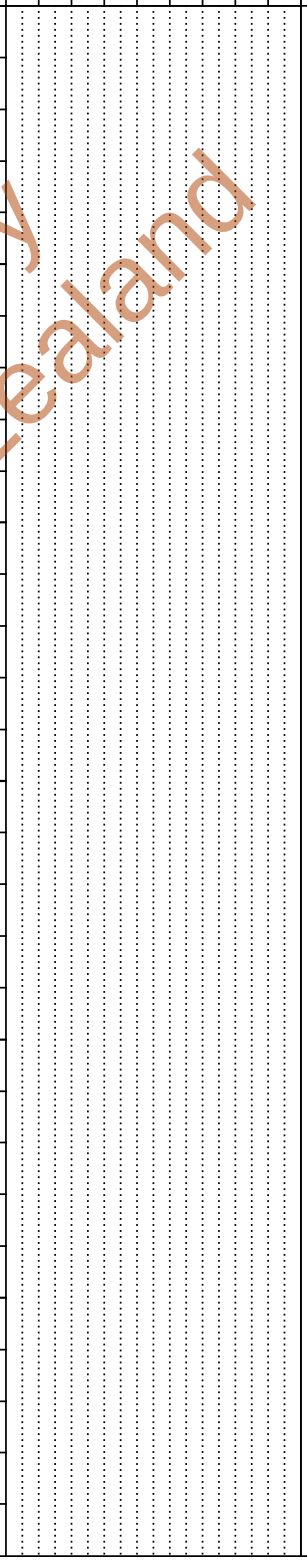
HAND AUGER LOG

Hole No: HA2

Project No:	Project:	Shear Vane:	Date Drilled:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	17/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, black, dry, friable	T/S	TS TS TS TS
0.2	SILT, sandy (fine), light brown, stiff, moist, friable [HAMILTON ASH]	Kauroa-Hamilton Ash	
0.8	0.8 m: becomes light brown/light grey		
1.0	EOH: 1.00 m TARGET DEPTH		



Groundwater: GWNE

Remarks:
1. Groundwater not encountered on 17/04/23.

Datum:

Coordinates:

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HAND AUGER LOG

Hole No: HA3

Project No:	Project:	Shear Vane:	Date Drilled:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	17/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, trace sand (fine), black/dark grey, moist, slightly plastic	T/S	TS
0.4	SILT, sandy (fine), brown, stiff, moist, friable [HAMILTON ASH]	Kauroa-Hamilton Ash	
1.0	EOH: 1.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Values
85 (25)
89 (14)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 100 mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Remarks:
1. Groundwater not encountered on 17/04/23.

Datum:

Coordinates:

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HAND AUGER LOG

Hole No: HA4

Project No:	Project:	Shear Vane:	Date Drilled:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	17/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, trace sand (fine), black/dark grey, moist, slightly plastic	T/S	TS
0.4	SILT, sandy (fine), brown, very stiff, moist, friable [HAMILTON ASH]	Kauroa-Hamilton Ash	
1.0	EOH: 1.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Values
195 (32)
128 (21)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 100 mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Remarks:
1. Groundwater not encountered on 17/04/23.

Datum:

Coordinates:

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HAND AUGER LOG

Hole No: HA5

Project No:	Project:	Shear Vane:	Date Drilled:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	17/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, trace sand (fine), black/dark grey, moist, slightly plastic	T/S	TS
0.2	SILT, some sand (fine), light grey/light brown, hard, moist, friable [HAMILTON ASH]	Kauroa-Hamilton Ash	
0.8	0.8 m: becomes light grey/light orange, very stiff		
1.0	EOH: 1.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values
>200
216 (35)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 100 mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Remarks:
1. Groundwater not encountered on 17/04/23.

Datum:

Coordinates:

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HAND AUGER LOG

Hole No: HA6

Project No:	Project:	Shear Vane:	Date Drilled:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	18/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, black, moist, friable	T/S	TS TS TS TS TS
0.2	SILT, some sand (fine), brown, stiff, moist, friable [HAMILTON ASH]	Kauroa-Hamilton Ash	
0.8	0.8 m: becomes very stiff		
1.0	EOH: 1.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)

Vane readings corrected as per BS 1377

● Shear Vane ○ Residual Shear Vane

50 100 150 200

Values: 89 (21); 110 (25)

Dynamic Cone Penetrometer

Test Method: NZS 4402:1988, Test 6.5.2

(Blows / 100 mm)

2 4 6 8 10 12 14 16

Groundwater: GWNE

Remarks:

1. Groundwater not encountered on 18/04/23.

Datum:

Coordinates:

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HAND AUGER LOG

Hole No: HA7

Project No:	Project:	Shear Vane:	Date Drilled:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	18/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit
0.0	[TOPSOIL] SILT, black, moist, friable	T/S
0.2	SILT, some sand (fine), orange/brown, very stiff, moist, friable [HAMILTON ASH]	Kauroa-Hamilton Ash
0.7	0.7 m: tree root	
0.8	0.8 m: becomes trace sand, slightly plastic	
1.0	EOH: 1.00 m TARGET DEPTH	

Remarks:

1. Groundwater not encountered on 18/04/23.

Datum:

Coordinates:

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HAND AUGER LOG

Hole No: HA8

Project No:	Project:	Shear Vane:	Date Drilled:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	18/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, black, moist, friable	T/S	TS
0.2	SILT, sandy (fine), dark brown, firm, moist, friable [HAMILTON ASH]	Kauroa-Hamilton Ash	
0.6	0.6 m: becomes orange/brown		
1.2	1.2 m: becomes minor sand (fine), stiff, slightly plastic		
1.4	1.4 m: becomes dark orange, very stiff		
2.0	EOH: 2.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Depth (m)	Values
0.4	35 (4)
1.0	43 (7)
1.4	110 (21)
2.0	156 (35)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 100 mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Remarks:
1. Groundwater not encountered on 18/04/23.

Datum:

Coordinates:

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HAND AUGER LOG

Hole No: HA9

Project No:	Project:	Shear Vane:	Date Drilled:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	18/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, black, moist, friable	T/S	TS TS TS TS TS
0.2	SILT, some sand (fine), light brown, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
0.6	0.6 m: tree roots		
1.0	EOH: 1.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values
106 (35)
121 (32)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 100 mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Remarks:
1. Groundwater not encountered on 18/04/23.

Datum:

Coordinates:

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HAND AUGER LOG

Hole No: HA10

Project No:	Project:	Shear Vane:	Date Drilled:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	19/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	[TOPSOIL] SILT, minor gravel (fine, sub-angular), dark brown, moist, friable	T/S	TS
0.4	SILT, minor clay, trace sand (fine), light grey/light brown, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
0.6	0.6 m: becomes some sand (fine), trace clay		
1.0	EOH: 1.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Values
124 (21)
124 (32)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 100 mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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HAND AUGER LOG

Hole No: HA11

Project No:	Project:	Shear Vane:	Date Drilled:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	19/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, minor gravel (fine, sub-angular), dark brown, moist, friable	T/S	TS
0.4	SILT, minor clay, trace sand (fine), light grey/light brown, very stiff, moist, slightly plastic [HAMILTON ASH]		
0.6	0.6 m: becomes brown streaked orange		
1.5	EOH: 1.50 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane

Depth (m)	Values
0.6	145 (25)
1.0	195 (39)
1.5	191 (43)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 100 mm)

Groundwater: GWNE

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP1

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	01/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, minor clay, dark brown, dry, friable	T/S	TS
0.2	[CAPPING MATERIAL] SILT, minor sand (fine), grey mottled orange/black, hard, moist, slightly plastic	LFC	
0.6	[LANDFILL] SILT, some sand (fine to coarse), brown mottled black/orange/grey, stiff, moist, friable, contains abundant (20%) construction/building debris including asphalt, concrete, brick and steel	Fill	
1.7	1.7 m: becomes dark brown mottled orange/black, up to 50% construction debris and general refuse including porcelain, timber, cloth and pipes, minor pit collapse		
2.5	2.5 m: glass bottles noted		
2.7	2.7 m: up to 10% organic material noted including tree stumps and wood fragments		
3.0	EOTP: 3.00 m TEST PIT COLLAPSING - UNSAFE TO PROGRESS		

Undrained Shear Strength (kPa)

Vane readings corrected as per BS 1377

● Shear Vane ○ Residual Shear Vane

Depth (m)	Values
1.6	77 (15)
2.0	141 (15)
0.6	>200

Dynamic Cone Penetrometer

Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm)

Groundwater: GWNE

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 1/11/22

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP2

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	01/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	[ASH/TOPSOIL] SILT, some sand (fine), black speckled white, friable	T/S	TS
0.4	[CAPPING MATERIAL] SILT, some clay, minor gravel (fine, subangular), orange/brown mottled grey/black, very stiff, moist, slightly plastic	LFC	
0.6			
0.8			
1.0	[LANDFILL] SILT, some sand (fine to coarse), black mottled orange/grey, stiff, moist, slightly plastic, contains abundant (20%) general refuse and construction debris including metal, concrete wood and bottles	Fill	
1.2	1.3 m - 1.8 m: CAPPING MATERIAL		
1.4			
1.6			
1.8			
2.0			
2.2	2.2 m - 2.5 m: CAPPING MATERIAL		
2.4			
2.6	2.5 m: contains 50% refuse including steel framing/wires and timber fragments		
2.8	2.8 m: becomes wet (leachate), minor pit collapse occurring		
3.0			
3.2			
3.4	SILT, clayey, grey streak black, stiff, moist, slightly plastic [ALLUVIAL SEDIMENTS]	Tauranga Group	
3.6			
3.8	EOTP: 3.70 m TARGET DEPTH		
4.0			
4.2			
4.4			
4.6			
4.8			

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Depth (m)	Values
0.4	126 (15)
1.0	64 (28)
1.6	80 (31)
2.6	107 (15)
3.8	92 (43)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater
▽ 01/11/2022
▼ 01/11/2022

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater strike recorded at 2.8 m BGL on 1/11/2022.
2. Standing groundwater measured at 3.4 m BGL following completion of excavation on 1/11/2022.
3. Permeability sample of the cap material taken from 0.3 m to 0.4 m below the ground surface.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP3

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	01/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	[TOPSOIL] SILT, minor clay, dark brown, dry, friable	T/S	TS TS
0.4	[CAPPING MATERIAL] SILT, minor gravel (fine, sub angular), brown mottled orange/grey, hard, moist, slightly plastic	LFC	
0.6			
0.8	[LANDFILL] SILT, some sand (fine to coarse), brown mottled black/orange/grey, very stiff, moist, friable, contains abundant (20%) construction/building debris including asphalt, concrete, wood, brick, pipes and steel up to 1 m long	Fill	
1.0			
1.2			
1.4	1.3 m - 1.5 m: CAPPING MATERIAL		
1.6			
1.8			
2.0	2.0 m: contains 30% concrete beams and sheet metal present, trace general refuse including bottles		
2.2			
2.4	2.2 m - 2.4 m: CAPPING MATERIAL		
2.6	2.6 m: 800 mm diameter steel tank		
2.8	2.8 m: 2 m long log		
3.0			
3.2			
3.4			
3.6	3.5 m: becomes wet		
3.8	SILT, clayey, grey streak orange, very stiff, moist, slightly plastic [ALLUVIAL SEDIMENTS]	Alluvium	
4.0	EOTP: 3.70 m TARGET DEPTH		
4.2			
4.4			
4.6			
4.8			

Undrained Shear Strength (kPa)

Vane readings corrected as per BS 1377

● Shear Vane ○ Residual Shear Vane

50 100 150 200

Depth (m)	Values
0.2	
0.4	
0.6	>200
0.8	
1.0	187 (15)
1.2	
1.4	>200
1.6	
1.8	
2.0	
2.2	
2.4	
2.6	
2.8	
3.0	
3.2	
3.4	
3.6	
3.8	135 (34)
4.0	
4.2	
4.4	
4.6	
4.8	

Dynamic Cone Penetrometer

Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm)

2 4 6 8 10 12 14 16

Groundwater

01/11/2022

01/11/2022

Profile:

Excavation Method:

13t Excavator

Remarks:

1. Groundwater strike recorded at 3.5 m BGL on 1/11/2022.
2. Standing groundwater measured at 3.4 m BGL following completion of excavation on 1/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP4

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	01/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS
0.4	[CAPPING MATERIAL] SILT, minor clay, grey/orange mottled black, hard, moist, slightly plastic	LFC	
0.6			
0.8	SILT, minor clay, grey mottled black/orange, hard, moist, slightly plastic 0.7 m: concrete block		
1.0	[LANDFILL] SILT, some sand (fine to coarse), brown mottled black/orange/grey, very stiff, moist, friable, contains abundant (40%) construction/building debris including asphalt, concrete, wood, brick, pipes and steel	Fill	
1.2			
1.4			
1.6			
1.8			
2.0			
2.2			
2.4			
2.6			
2.8			
3.0			
3.2			
3.4			
3.6			
3.8			
4.0	SILT, clayey, grey, stiff, wet, slightly plastic [ALLUVIAL SEDIMENTS]	TG	
4.2	EOTP: 4.10 m TARGET DEPTH		
4.4			
4.6			
4.8			

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Values: >200; 73 (18)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater
01/11/2022

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater strike recorded at 4.0 m BGL on 1/11/2022.
2. Standing groundwater measured at 4.0 m BGL following completion of excavation on 1/11/2022.
3. Permeability sample of the cap material taken from 0.3 m to 0.4 m below the ground surface.
4. TG: Tauranga Group.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP5

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	02/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log	Undrained Shear Strength (kPa)	Values	Depth (m)	Dynamic Cone Penetrometer	Groundwater
				Vane readings corrected as per BS 1377 ● Shear Vane ○ Residual Shear Vane 50 100 150 200			Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm) 2 4 6 8 10 12 14 16	
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS			0.0		
0.2	[CAPPING MATERIAL] SILT, minor clay and gravel (fine, sub angular), orange/brown mottled grey, hard, moist, slightly plastic	LFC				0.2		
0.6	SILT, trace sand (fine), grey mottled orange/brown, very stiff, moist, friable			○ ●	>200	0.6		
1.0	[LANDFILL] SILT, sandy (fine to coarse), black speckled white/orange, stiff, moist, slightly plastic, contains abundant (20%) construction debris including concrete, brick, timber and wire fragments	Fill			135 (15)	1.0		GWNE
1.2	1.2 m - 1.4 m: CAPPING MATERIAL					1.2		
1.6	1.6 m: general refuse and construction debris including glass bottles					1.6		
2.0	2.0 m: pipes, concrete blocks and sheet metal					2.0		
2.5	2.5 m: hole collapsing due to larger (>0.5m) debris of concrete encountered					2.5		
4.2	SILT, some clay, grey, stiff, moist, moderately plastic [ALLUVIAL SEDIMENTS]	T G		○ ●	64 (18)	4.2		
4.3	EOTP: 4.30 m TARGET DEPTH					4.3		

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 2/11/22
2. TG: Tauranga Group.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP6

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	01/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS
0.2	[CAPPING MATERIAL] SILT, minor gravels (fine, sub angular), orange/brown mottled grey, hard, moist, slightly plastic	LFC	
0.6	[ASH/LANDFILL] SILT, sandy (fine to coarse), black speckled orange/white, stiff, moist, friable, trace brick fragments	Fill	
0.8		LFC	
1.0	[CAPPING MATERIAL] SILT, minor clay, trace sand (fine), grey mottled black/orange, very stiff, moist, friable		
1.2			
1.4	[LANDFILL] SILT, minor sand (fine to coarse), black/grey mottled orange, stiff, moist, slightly plastic, contains abundant (20%) construction debris including metal pipes, concrete, fabric, fence posts and wires		
2.0			
2.4	2.4 m: becomes black, inferred boiler ash matrix		
3.0	3.0 m: contains 30% general refuse including glass bottles		
4.0	4.0 m: becomes wet		
4.4	SILT, clayey, grey streaked orange, stiff, moist, slightly plastic [ALLUVIAL SEDIMENTS]	TG	
4.6	EOTP: 4.50 m TARGET DEPTH		

Undrained Shear Strength (kPa)

Vane readings corrected as per BS 1377

● Shear Vane ○ Residual Shear Vane

Depth (m)	Values
1.0	>200
1.0	168 (31)
2.4	64 (15)
4.4	80 (25)

Dynamic Cone Penetrometer

Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm)

Groundwater

01/11/2022

01/11/2022

Profile:

Excavation Method:

13t Excavator

Remarks:

1. Groundwater strike recorded at 4.0 m BGL on 1/11/2022.
2. Standing groundwater measured at 4.3 m BGL following completion of excavation on 1/11/2022.
3. TG: Tauranga Group.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP7

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	02/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS TS
0.2	[CAPPING MATERIAL] SILT, trace gravel (fine, subangular), orange/brown mottled grey, hard, moist, slightly plastic	LFC	
0.4			
0.6			
0.8			
1.0	[LANDFILL] SILT, sandy (fine to coarse), black mottled grey/orange, hard, moist, slightly plastic, contains 20% burnt debris and inferred boiler ash	Fill	
1.2			
1.4			
1.6	1.5 m: contains 20% construction debris including red brick and concrete		
1.8	1.8 m - 2.0 m: CAPPING MATERIAL, very stiff		
2.0	2.0 m: contains 40% general refuse including waste, fence post/wire, metal pipes and concrete		
2.2			
2.4			
2.6			
2.8			
3.0	SILT, clayey, grey streaked orange, stiff, moist, slight plastic [ALLUVIAL SEDIMENTS]	Taura nga Group	
3.2	EOTP: 3.10 m TARGET DEPTH		
3.4			
3.6			
3.8			

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane

Depth (m)	Values
0.4	>200
1.0	>200
1.8	122 (31)
3.0	80 (34)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)

Groundwater: GWNE

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 2/11/2022.
2. Permeability sample of the cap material taken from 0.2 m to 0.3 m below the ground surface.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP8

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	02/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS
0.2	[CAPPING MATERIAL] SILT, some clay, minor gravel (fine, subangular), orange/brown mottled grey, hard, moist, slightly plastic	LFC	
0.6	SILT, minor clay, light grey/light brown mottled orange/black, very stiff, moist, slightly plastic	LFC	
1.4	[LANDFILL] SILT, sandy (fine to coarse), black speckled white/orange, very stiff, moist, slightly plastic, contains minor burnt debris < 150 mm	Fill	
2.3	2.3 m: asbestos tiles present with other construction debris including pipes and general waste	Fill	
3.6	SILT, clayey, grey streaked orange, stiff, moist, moderately plastic [ALLUVIAL SEDIMENTS]	Tauranga Group	
3.9	3.9 m: becomes blueish grey	Tauranga Group	
4.00	EOTP: 4.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane

Depth (m)	Shear Vane	Residual Shear Vane	Values
0.6	○	●	>200
1.0	○	●	135 (34)
1.6	○	●	110 (15)
4.0	○	●	80 (15)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)

Groundwater
▽ 02/11/2022
▼ 02/11/2022

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater strike recorded at 3.6 m BGL on 2/11/2022.
2. Standing groundwater measured at 3.8 m BGL following completion of excavation on 2/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP9

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	02/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log	Undrained Shear Strength (kPa)	Values	Depth (m)	Dynamic Cone Penetrometer	Groundwater
				Vane readings corrected as per BS 1377 ● Shear Vane ○ Residual Shear Vane 50 100 150 200			Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm) 2 4 6 8 10 12 14 16	
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS					
0.2	[CAPPING MATERIAL] SILT, some clay, minor gravel (fine, sub-angular), orange/brown mottled grey, hard, moist, slightly plastic	LFC			>200			
0.8								
1.0	[LANDFILL] SILT, sandy (fine to coarse), black speckled white/orange, very stiff, moist, slightly plastic, contains 20% 50 mm diameter burnt debris	Fill		○ ●	141 (15)			
1.5	1.5 m: contains construction debris							
1.8	1.8 m: contains general refuse							
2.0	2.0 m: contains wooden post/fencing and steel/metal pipes							
2.6	2.6 m: becomes larger debris (>1 m), car axle, 80% refuse							
2.8	2.8 m: becomes wet							▽ 02/11/2022
3.2	SILT, some sand (fine), minor clay, grey streaked orange, very stiff, moist, slightly plastic [ALLUVIAL SEDIMENTS]	Tauranga Group		○ ●	110 (34)			▼ 02/11/2022
3.5	EOTP: 3.50 m TARGET DEPTH							
4.0								
4.8								

Profile:

Excavation Method:

13t Excavator

Remarks:

1. Groundwater strike recorded at 2.8 m BGL on 2/11/2022.
2. Standing groundwater measured at 3.0 m BGL following completion of excavation on 2/11/2022.

Datum:

Coordinates:

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50 Years
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TEST PIT LOG

Hole No: TP10

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	02/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS TS
0.2	[CAPPING MATERIAL] SILT, clayey, trace gravel (fine, subangular), orange/light brown mottled grey, hard, moist, slightly plastic	LFC	
0.8	[LANDFILL] SAND (fine to coarse), silty, black mottled white/orange, loose, moist, poorly graded, contains <100 mm diameter burnt debris	Fill	
1.0	1.1 m: becomes dense		
1.5	1.5 m: 30% general refuse present		
1.8	1.8 m: becomes 80% refuse including bottles, asbestos, newspapers and cans, minor pit collapse		
2.8	2.8 m: becomes wet, pit collapsing		
3.0	SILT, clayey, blueish grey streaked black, stiff, wet, slightly plastic [ALLUVIAL SEDIMENTS]	Tauranga Group	
3.4	EOTP: 3.40 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Depth (m)	Values
0.2	>200
3.4	64 (31)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater
▼ 02/11/2022
▽ 02/11/2022

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater strike recorded at 2.8 m BGL on 2/11/2022.
2. Standing groundwater measured at 2.4 m BGL following completion of excavation 2/11/2022.
3. Permeability sample of the cap material taken from 0.2 m to 0.3 m below the ground surface.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP11

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	02/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S
0.2	[CAPPING MATERIAL] SILT, some clay, minor gravel (fine, subangular), orange/brown mottled grey, hard, moist, slightly plastic	LFC
0.6	SILT, sandy (fine), grey/brown mottled orange/black, very stiff, moist, friable	LFC
1.0	[LANDFILL] SILT, minor sand (fine), black mottled orange/dark red, moist, very stiff, slightly plastic, contains minor refuse debris <100 mm	Fill
1.2	SILT clayey, brown streaked grey/orange, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash
1.8	1.8 m: becomes trace sand (fine)	Kauroa-Hamilton Ash
2.0	2.0 m: becomes sandy (fine), minor clay	Kauroa-Hamilton Ash
2.2	EOTP: 2.20 m TARGET DEPTH	

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane

Depth (m)	Shear Vane	Residual Shear Vane	Values
0.6			>200
1.0	●	○	126 (18)
1.2			
1.6	●	○	110 (43)
2.0	●	○	122 (31)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)

Groundwater: GWNE

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 2/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP12

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	02/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS
0.2	[CAPPING MATERIAL] SILT, minor clay and gravel (fine, subangular), orange/brown, mottled grey, hard, moist, slightly plastic	LFC	
0.6	SILT, clayey, minor sand (fine), grey streaked orange/brown, very stiff, moist, slightly plastic	LFC	
1.2	[LANDFILL] SILT, sandy (fine to coarse), black speckled white/orange, very stiff, moist, slightly plastic, contains general refuse (10%) including glass and plastic	Fill	
2.0	2.0 m: 10% wood and concrete debris present	Fill	
2.8	SILT, some sand (fine), blueish grey, very stiff, moist, slightly plastic [ALLUVIAL SEDIMENTS]	Tauranga Group	
3.10	EOTP: 3.10 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane

Depth (m)	Values
1.0	126 (34)
1.6	>200
2.0	135 (34)
3.0	110 (34)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)

Groundwater
▽ 02/11/2022
▼ 02/11/2022

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater strike recorded at 2.8 m BGL on 2/11/2022.
2. Standing groundwater measured at 3.0 m BGL following completion of excavation on 2/11/2022.
3. Permeability sample of the cap material taken from 0.2 m to 0.3 m below the ground surface.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP13

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	02/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S
0.2	[CAPPING MATERIAL] SILT, minor clay and gravel (fine, subangular), orange/brown mottled grey, hard, moist, slightly plastic	LFC
0.6	[LANDFILL] SILT, sandy (fine to coarse), dark grey mottled black, stiff, moist, slightly plastic, contains 40% plastic, burnt debris, steel debris, concrete, wires and cables	Fill
1.4	1.4 m - 1.6 m: CAPPING MATERIAL	
1.7	1.7 m: contains 50% general demolition debris and rubble including tiles, GIB board and glass	
2.6	2.6 m: contains 30% timber logs, paper and concrete	
3.2	SILT, clayey, minor sand (fine), blueish grey, stiff, wet, slightly plastic [ALLUVIAL SEDIMENTS]	Tauranga Group
3.6	EOTP: 3.60 m TARGET DEPTH	

Graphic Log: TS, TS

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Depth (m)	Values
0.2	>200
0.6	64 (15)
3.6	69 (18)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: ▽ 02/11/2022 ▼ 02/11/2022

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater strike recorded at 3.2 m BGL on 2/11/2022.
2. Standing groundwater measured at 3.4 m BGL following completion of excavation on 2/11/2022.
3. Permeability sample of the cap material taken from 0.2 m to 0.3 m below the ground surface.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP14

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	03/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS
0.2	[CAPPING MATERIAL] SILT, some gravel (fine, subangular), minor clay, orange/brown, hard, moist, slightly plastic	LFC	
0.4			
0.6	SILT, sandy (fine to coarse), trace gravel (fine, subangular), brown mottled orange/grey, very stiff moist, slightly plastic		
0.8			
1.0	[LANDFILL] SILT, trace clay and sand (fine to coarse), black, very stiff, moist, slightly plastic, inferred boiler ash	Fill	
1.2	SILT, clayey, grey/light brown streaked orange, stiff, moist, slightly plastic [ALLUVIAL SEDIMENTS]	Tauranga Group	
1.4			
1.6			
1.8			
2.0	EOTP: 2.00 m TARGET DEPTH		
2.2			
2.4			
2.6			
2.8			

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Depth (m)	Values
0.4	>200
1.0	141 (31)
1.4	92 (31)
2.0	86 (34)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 3/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP15

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	03/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS TS
0.2	[CAPPING MATERIAL] SILT, minor clay and gravel (fine, subangular), orange/brown mottled grey, hard, moist, slightly plastic	LFC	
0.4			
0.6	[LANDFILL] SILT, minor sand (fine), black, very stiff, moist, slightly plastic, contains 20% small tiles, building material and a pipe	Fill	
0.8			
1.0	SILT, minor clay, light brown streaked orange, stiff, moist, slightly plastic [ALLUVIAL SEDIMENTS]	Tauranga Group	
1.2			
1.4			
1.6			
1.7	EOTP: 1.70 m TARGET DEPTH		
1.8			
2.0			
2.2			
2.4			
2.6			
2.8			

Undrained Shear Strength (kPa)

Vane readings corrected as per BS 1377

● Shear Vane ○ Residual Shear Vane

50 100 150 200

Depth (m)	Values
0.4	>200
1.7	73 (31)

Dynamic Cone Penetrometer

Test Method: NZS 4402:1988, Test 6.5.2

(Blows / 0mm)

2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

13t Excavator

Remarks:

1. Groundwater not encountered on 3/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP16

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	03/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS
0.2	[CAPPING MATERIAL] SILT, minor clay and gravel (fine, subangular), orange/brown mottled grey, hard, moist, slightly plastic	LF C	
0.4	[LANDFILL] SILT, minor clay, black mottled orange/dark brown, very stiff, moist, slightly plastic, contains abundant (50%) construction debris including bricks and asbestos	Fill	
0.6	SILT, light brown streaked orange, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
0.8	1.0 m: becomes sandy (fine to coarse), orange, stiff		
1.0	1.2 m: becomes sandy (fine), grey/light brown streaked orange, very stiff		
1.2	EOTP: 1.30 m TARGET DEPTH		
1.4			
1.6			
1.8			
2.0			
2.2			
2.4			
2.6			
2.8			

Undrained Shear Strength (kPa)

Vane readings corrected as per BS 1377

● Shear Vane ○ Residual Shear Vane

50 100 150 200

Values: 126 (58); 92 (28); 126 (34)

Dynamic Cone Penetrometer

Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm)

2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

13t Excavator

Remarks:

1. Groundwater not encountered on 3/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP17

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	03/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS
0.2	[CAPPING MATERIAL] SILT, minor clay and gravel (fine, subangular), orange/brown mottled grey, hard, moist, slightly plastic	LFC	
0.6	0.2 m: some gravel (fine, subangular)		
0.8	[LANDFILL] SILT, sandy (fine to coarse), black speckled white/orange, stiff, moist, slightly plastic, contains 50% general waste and construction debris	Fill	
1.2	1.2 m - 1.5 m: [CAPPING MATERIAL] SILT, clayey, blueish grey		
1.6	1.5 m: large construction debris and general waste including steel and plastic (80%)		
2.0	2.1 m: becomes wet, large wood fragments		
2.6	2.6 m: pit collapsing		
3.6	ORGANIC SILT, some clay and wood fragments, dark grey streaked black/dark brown, firm, moist, slightly plastic [ALLUVIAL SEDIMENTS]	Tauranga Group	
4.0	EOTP: 4.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 | Values
>200
31 (18)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater
03/11/2022
03/11/2022

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater strike recorded at 2.1 m BGL on 3/11/2022.
2. Standing groundwater measured at 2.3 m BGL following completion of excavation on 3/11/2022.
3. Permeability sample of the cap material taken from 0.2 m to 0.3 m below the ground surface.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP18

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	03/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log	Undrained Shear Strength (kPa)	Values	Depth (m)	Dynamic Cone Penetrometer	Groundwater
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS	Vane readings corrected as per BS 1377 ● Shear Vane ○ Residual Shear Vane 50 100 150 200		0.0	Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm) 2 4 6 8 10 12 14 16	GWNE
0.2	[CAPPING MATERIAL] SILT, minor clay and gravel (fine, subangular), orange/brown mottled grey, hard, moist, slightly plastic	LFC			>200	0.2		
0.6	SILT, some clay, light brown streaked orange, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash				0.6		
1.0	0.9 m: becomes light brown/grey streaked orange				110 (34)	1.0		
1.2	1.2 m: becomes minor sand (fine) and clay, stiff					1.2		
1.4					92 (28)	1.4		
1.6	1.6 m: becomes sandy (fine)					1.6		
2.0	EOTP: 2.00 m TARGET DEPTH				67 (31)	2.0		

Profile:

Excavation Method:

13t Excavator

Remarks:

1. Groundwater not encountered on 3/11/2022.
2. Permeability sample of the cap material taken from 0.2 m to 0.3 m below the ground surface.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP19

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	03/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable, contains some refuse debris including nails, plastic, bricks and tiles	T/S	TS
0.2	[CAPPING MATERIAL] SILT, brown/grey mottled orange/dark brown, very stiff, moist, slightly plastic	LFC	
0.4			
0.6	SILT, clayey light brown streaked orange/grey, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
0.8			
1.0			
1.2	1.2 m: becomes minor sand (fine), orange		
1.4			
1.6	CLAY, silty, blueish grey, firm, wet, moderately plastic [ALLUVIAL SEDIMENTS]	TG	
	EOTP: 1.60 m TARGET DEPTH		
1.8			
2.0			
2.2			
2.4			

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane

Depth (m)	Values
0.6	135 (34)
1.0	107 (31)
1.6	31 (15)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)

Groundwater: GWNE

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 3/11/2022.
2. TG: Tauranga Group.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP20

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	03/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable, contains trace refuse debris <50 mm	T/S	TS TS TS
0.2	[NON-ENGINEERED FILL] SILT, minor clay, brown mottled orange/grey/dark brown, stiff, moist, slightly plastic	Fill	
0.4	SILT, minor sand (fine), grey streaked orange/brown, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
0.8	0.8 m: becomes orange streaked light brown/grey, stiff, moderately plastic		
1.2	SILT, sandy (fine), grey, firm, moist, slightly plastic [ALLUVIAL SEDIMENTS]	Tauranga Group	
1.6	1.7 m: becomes stiff		
1.70	EOTP: 1.70 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Depth (m)	Values
0.4	110 (37)
1.0	58 (31)
1.7	52 (28)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 3/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP21

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	03/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable, contains 20% fragments of plate, porcelain and glass	T/S	TS
0.2	[NON-ENGINEERED FILL] SILT, trace gravel (fine, subangular), brown mottled grey/orange/black, very stiff, moist, slightly plastic	Fill	
0.4			
0.6	0.6 m: becomes orange/grey streaked brown, stiff		
0.8	SILT, some sand (fine), dark grey mottled orange, stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
1.0			
1.2	SILT, some sand (fine), light brown streaked orange, stiff, moist, slightly plastic		
1.4			
1.6			
1.8			
2.0	SILT, sandy (fine), minor clay, blueish grey, stiff, moist, slightly plastic [ALLUVIAL SEDIMENTS]	Tauranga Group	
2.2	2.4 m: becomes firm		
2.4	EOTP: 2.40 m TARGET DEPTH		
2.6			
2.8			

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Depth (m)	Values
0.6	150 (46)
1.0	73 (34)
1.4	58 (28)
2.0	58 (31)
2.4	46 (28)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 3/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP22

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	03/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log	Undrained Shear Strength (kPa)	Values	Depth (m)	Dynamic Cone Penetrometer	Groundwater
				Vane readings corrected as per BS 1377 ● Shear Vane ○ Residual Shear Vane 50 100 150 200			Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm) 2 4 6 8 10 12 14 16	
0.0	[TOPSOIL] SILT, dark brown, moist, friable, contains construction debris/glass	T/S	TS TS TS			0.0		
0.2	SILT, some clay, trace sand (fine), grey streaked orange/light brown, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash		○ ●	110 (31)	0.2		
1.0	1.0 m: becomes sandy (fine), orange streaked grey/light brown, stiff			○ ●	104 (37)	1.0		GWNE
1.4	SILT, clayey, trace sand (fine), light blueish grey, firm, moist, highly plastic [ALLUVIAL SEDIMENTS]	Tauranga Group		○ ●	43 (28)	1.4		
1.9	1.9 m: becomes minor sand, blueish grey			○ ●	49 (25)	1.9		
2.3	2.3 m: becomes stiff			○ ●	61 (28)	2.3		
2.4	EOTP: 2.40 m TARGET DEPTH					2.4		

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 3/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP23

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	03/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS
0.2	SILT, trace sand (fine), grey/brown streaked orange, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
0.4	0.3 m: becomes orange/brown streaked grey		
0.6	0.6 m: becomes sandy (fine)		
0.8	0.8 m: becomes stiff		
1.0			
1.2	SILT, clayey, minor sand (fine), grey streaked orange, firm, moist, moderately plastic [ALLUVIAL SEDIMENTS]	TG	
1.4	EOTP: 1.40 m TARGET DEPTH		
1.6			
1.8			
2.0			
2.2			
2.4			
2.6			
2.8			

Undrained Shear Strength (kPa)

Vane readings corrected as per BS 1377

● Shear Vane ○ Residual Shear Vane

50 100 150 200

Values
107 (34)
73 (37)
49 (31)

Dynamic Cone Penetrometer

Test Method: NZS 4402:1988, Test 6.5.2

(Blows / 0mm)

2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

13t Excavator

Remarks:

1. Groundwater not encountered on 3/11/2022.
2. TG: Tauranga Group.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP24

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	03/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log	Undrained Shear Strength (kPa)	Values	Depth (m)	Dynamic Cone Penetrometer	Groundwater
				Vane readings corrected as per BS 1377 ● Shear Vane ○ Residual Shear Vane 50 100 150 200			Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm) 2 4 6 8 10 12 14 16	
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS TS			0.0		
0.2	SILT, minor clay and sand (fine), light brown/grey streaked orange, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash			104 (37)	0.2		
0.4						0.4		
0.6						0.6		
0.8						0.8		
1.0					126 (46)	1.0		
1.2	1.1 m: becomes sandy (fine), stiff					1.2		
1.4						1.4		
1.6	SILT, clayey, trace sand (fine), grey streaked dark grey, stiff, moist, moderately plastic [ALLUVIAL SEDIMENTS]	Tauranga Group			61 (28)	1.6		
1.8						1.8		
2.0					58 (25)	2.0		
2.2	2.5 m: becomes firm					2.2		
2.4	2.6 m: becomes wet, grey, sandy (fine), very stiff, slightly plastic				49 (28)	2.4		
2.6						2.6		03/11/2022
2.7	EOTP: 2.70 m TARGET DEPTH				168 (58)	2.8		03/11/2022

Profile:

Excavation Method:

13t Excavator

Remarks:

1. Groundwater strike recorded at 2.7 m BGL on 3/11/2022.
2. Standing groundwater measured at 2.7 m BGL following completion of excavation on 3/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP25

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	04/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable, minor construction debris present	T/S	TS
0.2	[CAPPING MATERIAL] SILT, gravelly (fine, subangular), orange/brown, very stiff, moist, slightly plastic	LFC	
0.4	SILT, minor clay and sand (fine), light brown streaked orange, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
0.6	0.6 m: becomes grey/light brown streaked orange, stiff		
0.8	0.8 m: becomes sandy (fine)		
1.0			
1.2			
1.4			
1.6			
1.8	1.9 m: becomes clayey, minor sand (fine), very stiff		
2.0			
2.1	EOTP: 2.10 m TARGET DEPTH		
2.2			
2.4			
2.6			
2.8			

Undrained Shear Strength (kPa)

Vane readings corrected as per BS 1377

● Shear Vane ○ Residual Shear Vane

50 100 150 200

Depth (m)	Values
0.6	116 (37)
1.0	89 (28)
1.5	95 (31)
2.0	122 (43)

Dynamic Cone Penetrometer

Test Method: NZS 4402:1988, Test 6.5.2

(Blows / 0mm)

2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

13t Excavator

Remarks:

1. Groundwater not encountered on 4/11/2022.
2. Permeability sample of the cap material taken from 0.2 m to 0.3 m below the ground surface.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP26

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	04/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	[TOPSOIL] SILT, dark brown, moist, friable	T/S	
0.4	[CAPPING MATERIAL] SILT, some gravel (fine, subangular), orange/brown, hard, moist, slightly plastic	LFC	
1.0	[NON-ENGINEERED FILL] SILT, sandy (fine), minor clay, light brown mottled orange/grey, firm, moist, friable, minor pit collapse occurring	Fill	
2.0	[LANDFILL] MEDICAL WASTE including needles, razors and bottles (no soil matrix)	Fill	
4.0	4.0 m: inferred boiler ash noted in 1/4 offal pits	Fill	
4.6	SILT, clayey, grey, stiff, wet, moderately plastic [ALLUVIAL SEDIMENTS]	Tauranga Group	
5.6	EOTP: 5.50 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values
>200

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater
▼ 04/11/2022
▽ 04/11/2022

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater strike recorded at 5.5 m BGL on 4/11/2022.
2. Standing groundwater measured at 5.3 m BGL following completion of excavation on 4/11/2022.
3. Permeability sample of the cap material taken from 0.2 m to 0.3 m below the ground surface.
4. Four 600 mm diameter bored offal pits encountered within the area of the test pit. Log represents the general profile of the offal pits encountered.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP27

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	04/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS
0.2	[CAPPING MATERIAL] SILT, some gravel (fine, subangular), orange/brown, hard, moist, slightly plastic	LFC	
0.4	[LANDFILL] SILT, sandy (fine to coarse), brown speckled white/orange, stiff, moist, slightly plastic, contains 40% construction debris including wood, metal, concrete and bricks	Fill	
1.6	SILT, minor clay and sand (fine), brown streaked orange, stiff, moist, slightly plastic [HAMILTON ASH] 2.0 m: becomes very stiff 2.1 m: becomes grey/light brown streaked orange	Kauroa-Hamilton Ash	
2.6	EOTP: 2.60 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 | Values
101 (34)
104 (31)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 4/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP28

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	04/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log	Undrained Shear Strength (kPa)	Values	Depth (m)	Dynamic Cone Penetrometer	Groundwater
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS	Vane readings corrected as per BS 1377 ● Shear Vane ○ Residual Shear Vane 50 100 150 200		0.0	Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm) 2 4 6 8 10 12 14 16	
0.2	[CAPPING MATERIAL] SILT, gravelly (fine, subangular), orange/brown, hard, moist, slightly plastic	LFC				0.2		
0.4	SILT, sandy (fine), grey/light brown streaked orange, stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash		○ ●	92 (34)	0.4		
0.6						0.6		
0.8	0.8 m: becomes minor clay and sand (fine)			○ ●	89 (28)	0.8		
1.0						1.0		
1.2						1.2		
1.4	1.4 m: becomes orange streaked grey			○ ●	95 (43)	1.4		GWNE
1.6						1.6		
1.8	1.8 m: becomes light brown streaked orange/grey			○ ●	73 (31)	1.8		
2.0						2.0		
2.2						2.2		
2.4				○ ●	77 (34)	2.4		
2.6						2.6		
2.8	2.8 m: becomes sandy (fine)					2.8		
3.0	EOTP: 3.00 m TARGET DEPTH			○ ●	58 (15)	3.0		
3.2						3.2		
3.4						3.4		
3.6						3.6		
3.8						3.8		

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 4/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP29

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	04/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS TS TS
0.2	SILT, sandy (fine), light brown/grey streaked orange, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
0.9	0.9 m: becomes orange/light brown, stiff		
1.2	SILT, clayey, minor sand (fine), grey streaked orange, stiff, moist, moderately plastic [ALLUVIAL SEDIMENTS]	Tauranga Group	
1.50	EOTP: 1.50 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Depth (m)	Values
0.6	110 (40)
1.0	64 (28)
1.4	58 (31)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 4/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP30

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	04/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	[TOPSOIL] SILT, dark brown, moist, friable, minor construction debris	LFC	TS
0.4	[CAPPING MATERIAL] SILT, minor clay and gravels (fine, subangular), orange/brown mottled grey, hard, moist, slightly plastic		
0.6			
0.8	[LANDFILL] SILT, sandy (fine to coarse), dark brown, stiff, moist, slightly plastic, contains 40% construction waste including concrete, bricks, <5 m long pipes and steel	Fill	
1.0	1.0 m: minor pit collapse, construction and building debris present		
1.2			
1.4			
1.6			
1.8			
2.0			
2.2			
2.4			
2.6			
2.8			
3.0			
3.2	SILT, clayey, trace sand (fine), blueish grey streaked black, firm, moist, moderately plastic [ALLUVIAL SEDIMENTS]	Tauranga Group	
3.4			
3.6	EOTP: 3.50 m TARGET DEPTH		
3.8			
4.0			
4.2			
4.4			
4.6			
4.8			

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Values
UTP
46 (34)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 4/11/2022.
2. Permeability sample of the cap material taken from 0.2 m to 0.3 m below the ground surface.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP31

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	04/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S
0.2	SILT, sandy (fine), light brown/grey streaked orange, stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash
1.0	1.0 m: becomes orange streaked light brown	
1.2	SILT, clayey, trace sand (fine), dark grey streaked orange, stiff, moist, moderately plastic [ALLUVIAL SEDIMENTS]	TG
1.4	EOTP: 1.40 m TARGET DEPTH	

Graphic Log: TS, TS

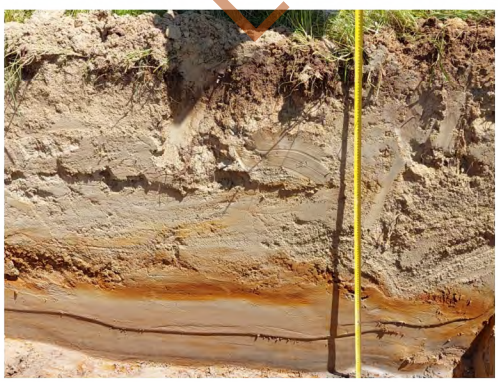
Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Depth (m)	Values
0.2	77 (34)
1.0	64 (37)
1.4	58 (28)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater
04/11/2022
04/11/2022

Profile:



Excavation Method:
13t Excavator

Remarks:
1. Groundwater strike recorded at 1.4 m BGL on 4/11/2022.
2. Standing groundwater measured at 1.4 m BGL following completion of excavation on 4/11/2022.
3. TG: Tauranga Group.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP32

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	09/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log	Undrained Shear Strength (kPa)	Values	Depth (m)	Dynamic Cone Penetrometer	Groundwater
0.2	[TOPSOIL/FILL] GRAVEL (fine, sub-angular), silty, brown mottled grey, medium dense, moist, poorly graded	Fill				0.2		GWNE
0.4	[LANDFILL] SILT, sandy (fine to coarse), black speckled white/orange, stiff, moist, friable, up to 40% general refuse present throughout					0.4		
0.6						0.6		
0.8						0.8		
1.0						1.0		
1.2						1.2		
1.4						1.4		
1.6	CLAY/SILT, minor sand (fine), grey streaked orange, stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash				1.6		
1.8						1.8		
2.0	EOTP: 2.00 m TARGET DEPTH				80 (18)	2.0		
2.2						2.2		
2.4						2.4		
2.6						2.6		
2.8						2.8		

Undrained Shear Strength (kPa): Vane readings corrected as per BS 1377 — Shear Vane ● Residual Shear Vane ○ — 50, 100, 150, 200

Dynamic Cone Penetrometer: Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm) — 2, 4, 6, 8, 10, 12, 14, 16

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 9/11/22.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP33

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	09/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log	Undrained Shear Strength (kPa)	Depth (m)	Dynamic Cone Penetrometer	Groundwater
0.2	[TOPSOIL/FILL] GRAVEL (fine, sub-angular), silty, dark brown mottled grey, medium dense, moist, poorly graded	Fill			0.2		
0.4	SILT, clayey, minor sand (fine), grey/light brown streaked orange, stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash			0.4		GWNE
0.6					0.6		
0.8					0.8		
1.0					1.0		
1.2					1.2		
1.4	EOTP: 1.30 m TARGET DEPTH				1.4		
1.6					1.6		
1.8					1.8		
2.0					2.0		
2.2					2.2		
2.4					2.4		
2.6					2.6		
2.8					2.8		

Undrained Shear Strength (kPa): Vane readings corrected as per BS 1377 — ● Shear Vane ○ Residual Shear Vane; 50, 100, 150, 200; Values: 89 (28)

Dynamic Cone Penetrometer: Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm); 2, 4, 6, 8, 10, 12, 14, 16

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 9/11/22.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP34

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	09/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log	Undrained Shear Strength (kPa)	Depth (m)	Dynamic Cone Penetrometer	Groundwater
0.2	[FILL/TOPSOIL] SILT, gravelly (fine, sub-angular), dark brown speckled grey, stiff, moist, friable, minor construction debris present	Fill		Vane readings corrected as per BS 1377 ● Shear Vane ○ Residual Shear Vane 50 100 150 200 Values	0.2	Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm) 2 4 6 8 10 12 14 16	GWNE
0.4					0.4		
0.6	SILT, clayey, minor sand (fine), grey/light brown streaked orange, stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash			0.6		
0.8					0.8		
1.0					1.0		
1.2					1.2		
1.4	EOTP: 1.30 m TARGET DEPTH			○ ● 86 (18)	1.4		
1.6					1.6		
1.8					1.8		
2.0					2.0		
2.2					2.2		
2.4					2.4		
2.6					2.6		
2.8					2.8		

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 9/11/22.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP35

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	09/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS
0.2	[CAPPING MATERIAL] SILT, clayey, grey mottled brown/black, very stiff, moist, slightly plastic	LFC	
0.6	0.6 m: becomes some gravel (fine, sub-angular)		
0.8	[LANDFILL] SILT, sandy (fine to coarse), black/orange speckled white, stiff, moist, friable, 40% general refuse present including plastic and burnt debris	Fill	
3.0	3.0 m: becomes wet		
3.1	EOTP: 3.10 m TEST PIT COLLAPSING - UNSAFE TO PROGRESS		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 | Values
110 (43)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater
09/11/2022
09/11/2022

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater strike recorded at 3.0 m BGL on 9/11/2022.
2. Standing groundwater measured at 2.9 m BGL following completion of excavation on 9/11/2022.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP36

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO2032	10/11/2022	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	TS TS
0.2	[CAPPING MATERIAL] SILT, minor clay and gravel (fine, subangular), orange/brown mottled grey, hard, moist, slightly plastic	LF C	
0.4	[LANDFILL] SILT, brown/dark brown, stiff, moist, friable, abundant construction debris (60%) including bricks, vinyl, cloth and tiles	Fill	
2.0	SILT, clayey, orange/brown, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
2.2	EOTP: 2.20 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Values
119 (31)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
13t Excavator

Remarks:
1. Groundwater not encountered on 10/11/22.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP37

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	19/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log	Undrained Shear Strength (kPa)	Values	Depth (m)	Dynamic Cone Penetrometer	Groundwater
				Vane readings corrected as per BS 1377 ● Shear Vane ○ Residual Shear Vane 50 100 150 200			Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm) 2 4 6 8 10 12 14 16	
0.2	[FILL] GRAVEL (fine, sub-angular), silty, trace brick fragments and 'burnt' debris, dark brown mottled grey, medium dense, moist, poorly graded	Fill				0.2		
0.4	SILT, minor clay, trace sand (fine), light brown, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash		○ ●	110 (35)	0.4		GWNE
0.6	0.7 m: becomes light grey/light brown, stiff					0.6		
0.8						0.8		
1.0				○ ●	85 (21)	**1.0**		
	EOTP: 1.10 m TARGET DEPTH							
1.2						1.2		
1.4						1.4		
1.6						1.6		
1.8						1.8		

Profile:

Excavation Method:
10t Excavator

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP38

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	19/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, minor gravel (fine, sub-angular), brown, moist, friable	T/S	TS TS
0.2	[CAPPING MATERIAL] GRAVEL (fine to medium, sub-angular), sandy (fine to coarse), grey/dark grey, medium dense, dry, poorly graded	LFC	
0.4	[LANDFILL] SILT, some sand (fine to coarse), orange/brown mottled black/grey, stiff, moist, friable, contains 20% construction/building debris including asphalt and tiles	Fill	
0.6	1.4 m: becomes 'burnt' fill with up to 60% general refuse and up to 40% construction debris including steel, brick and glass		
0.8	2.5 m: pit collapsing		
1.0	SILT, clayey, minor sand (fine), orange/brown, stiff, wet, slightly plastic [HAMILTON ASH]	a' Hamilton	
1.2	EOTP: 3.20 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 | Values
74 (21)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater
▼ 19/04/2023
▽ 19/04/2023

Profile:

Excavation Method:
10t Excavator

Remarks:
1. Groundwater strike recorded at 3.0 m BGL on 19/04/2023.
2. Standing groundwater measured at 2.9 m BGL following completion of excavation on 19/04/2023.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP39

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	19/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	[TOPSOIL] SILT, gravelly (fine, sub-angular), dark brown, dry, friable	T/S	TS
0.4	[CAPPING MATERIAL] SILT, minor gravels (fine, sub-angular), grey/orange mottled black, hard, moist, friable	LFC	
0.6	SILT, minor clay, trace gravel (fine, sub-angular), grey mottled orange/brown, very stiff, moist, slightly plastic		
0.8	[LANDFILL] SILT, sandy (fine to coarse), black/dark brown, stiff, moist, friable, contains up to 50% construction/building debris including concrete, brick and steel	Fill	
1.0	1.1 m - 1.2 m: CAPPING MATERIAL		
1.2	1.3 m: becomes up to 60% construction and 'burnt' debris		
1.4			
1.6	1.6 m: pit collapsing		
1.8			
2.0			
2.2			
2.4	EOTP: 2.30 m TEST PIT COLLAPSING - UNSAFE TO PROGRESS		
2.6			
2.8			

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values
○ 177 (39) ●

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
10t Excavator

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP40

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	19/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, gravelly (fine, sub-angular), dark brown, dry, friable	T/S	TS
0.2	[CAPPING MATERIAL] SILT, minor gravel (fine, sub-angular), grey/orange mottled black, hard, moist, friable	LFC	
0.6	SILT, minor clay, trace gravels (fine, sub-angular), grey mottled orange/brown, stiff, moist, slightly plastic		
0.8	[LANDFILL] SAND (fine to coarse), silty, black/dark brown, loose, moist, poorly graded, contains up to 50% construction/building debris including concrete, brick, roof tiles and steel 1.1 m: minor pit collapse	Fill	
2.0	SILT, some clay, trace sand (fine), light brown/grey streaked orange, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
2.2	EOTP: 2.20 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Depth (m)	Values
0.6	>200
2.0	128 (25)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
10t Excavator

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP46

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	19/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log	Undrained Shear Strength (kPa)	Values	Depth (m)	Dynamic Cone Penetrometer	Groundwater
0.0	[FILL] SILT, minor gravel (fine, sub-angular), dark brown, dry, friable	Fill				0.0		
0.2						0.2		
0.3	[PALAEOSOL] SILT, sandy (fine to coarse), black mottled dark brown, moist, friable	T/S				0.3		
0.4	SILT, minor sand (fine), minor clay, orange/brown, stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash				0.4		
0.6	0.6 m: becomes some sand, friable				60 (21)	0.6		
0.8						0.8		
0.9	0.9 m: becomes grey/brown					0.9		
1.0					78 (28)	1.0		
1.1	EOTP: 1.10 m TARGET DEPTH					1.1		
1.2						1.2		
1.4						1.4		
1.6						1.6		
1.8						1.8		

Undrained Shear Strength (kPa): Vane readings corrected as per BS 1377 — ● Shear Vane ○ Residual Shear Vane; 50, 100, 150, 200

Dynamic Cone Penetrometer: Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm); 2, 4, 6, 8, 10, 12, 14, 16

Groundwater: GWNE

Profile:

Excavation Method:
10t Excavator

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP47

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	19/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, minor sand (fine), black, moist, friable	T/S	TS
0.2	SILT, minor clay, orange/brown, very stiff, moist, slightly plastic [HAMILTON ASH]		
0.4	0.5 m: becomes grey/light brown		
0.6			
0.8	0.9 m: becomes orange/grey		
1.0			
1.2	EOTP: 1.30 m TARGET DEPTH		
1.4			
1.6			
1.8			

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 | Values
110 (21)
113 (18)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
10t Excavator

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP48

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	20/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, minor sand (fine), black, moist, friable	T/S	TS
0.2	SILT, minor clay, trace sand (fine), orange/brown streaked grey, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
0.8	0.8 m: becomes stiff		
1.8	1.8 m: becomes grey/orange, firm		
2.2	EOTP: 2.20 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Depth (m)	Values
0.6	106 (35)
1.0	85 (32)
1.4	89 (39)
2.0	50 (21)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
10t Excavator

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP49

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	20/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[FILL] SILT, minor sand (fine), black, moist, friable	Fill	
0.4	SILT, minor clay, trace sand (fine), orange/brown streaked grey, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
1.4	1.4 m: becomes grey streaked orange		
1.6	EOTP: 1.60 m TARGET DEPTH		

Undrained Shear Strength (kPa)

Vane readings corrected as per BS 1377

● Shear Vane ○ Residual Shear Vane

50 100 150 200

Values
103 (32)
121 (21)
106 (25)

Dynamic Cone Penetrometer

Test Method: NZS 4402:1988, Test 6.5.2

(Blows / 0mm)

2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

10t Excavator

Remarks:

1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP50

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	20/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, minor gravels (fine, sub-angular), brown, moist, friable	T/S	TS
0.2	[LANDFILL] SAND (fine to coarse), minor silt and gravel (fine, sub-angular), black/ brown, loose, moist, poorly graded, contains up to 30% construction/building debris including concrete and bricks	Fill	
0.8	SILT, sandy (fine to coarse), dark brown, stiff, moist, friable, contains up to 10% construction debris		
1.8	1.8 m: burnt timber and steel present in void		
1.8	[PALAEOSOL] SILT, sandy (fine to coarse), black mottled dark brown, moist, friable	T/S	TS
2.0	SILT, minor sand (fine), minor clay, orange/brown, stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
2.20	EOTP: 2.20 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Depth (m)	Values
2.2	85 (21)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
10t Excavator

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP51

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	20/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[FILL] SILT, minor gravel (fine, sub-angular), brown, moist, friable	Fill	
0.4	[PALAEOSOL] SILT, minor sand (fine), black mottled dark brown, moist, friable	T/S	
0.6	SILT, minor clay, orange/brown, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
1.6	1.6 m: becomes grey streaked orange		
1.8	EOTP: 1.80 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200

Depth (m)	Values
0.6	106 (32)
1.0	128 (35)
1.6	103 (21)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
10t Excavator

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP52

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	20/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit
0.0	[TOPSOIL] SILT, minor gravel (fine, sub-angular), brown, moist, friable	T/S
0.2	[LANDFILL] SILT, minor gravel (fine, sub-angular), trace sand (fine to coarse), grey mottled brown, stiff, moist, friable	Fill
0.4	SILT, minor clay, orange/brown, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash
0.6		
0.8		
1.0		
1.2		
1.4	1.5 m: becomes hard	
1.6		
1.8		
1.90	EOTP: 1.90 m TARGET DEPTH	
2.0		
2.2		
2.4		
2.6		
2.8		

Graphic Log: TS, TS, TS

Undrained Shear Strength (kPa)

Vane readings corrected as per BS 1377

● Shear Vane ○ Residual Shear Vane

50 100 150 200

Values: 128 (21); 163 (35); 216 (71)

Dynamic Cone Penetrometer

Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm)

2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

10t Excavator

Remarks:

1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP54

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	19/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log	Undrained Shear Strength (kPa)	Values	Depth (m)	Dynamic Cone Penetrometer	Groundwater
				Vane readings corrected as per BS 1377 ● Shear Vane ○ Residual Shear Vane 50 100 150 200			Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm) 2 4 6 8 10 12 14 16	
0.0	[FILL] SILT, sandy (fine to course), minor gravel (fine, sub-angular), dark brown, moist, friable	Fill				0.0		
	0.1 m: becomes gravelly, trace sand							
0.2	SILT, minor clay, trace sand (fine), orange/brown, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash				0.2		
0.4				○ ●	106 (35)	0.4		
0.6						0.6		GWNE
0.8	0.8 m: becomes grey streaked orange					0.8		
1.0				○ ●	106 (21)	1.0		
1.1	EOTP: 1.10 m TARGET DEPTH					1.2		
1.2						1.4		
1.4						1.6		
1.6						1.8		
1.8								

Profile:

Excavation Method:
10t Excavator

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP55

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	19/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log	Undrained Shear Strength (kPa)	Values	Depth (m)	Dynamic Cone Penetrometer	Groundwater
				Vane readings corrected as per BS 1377 ● Shear Vane ○ Residual Shear Vane 50 100 150 200			Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 0mm) 2 4 6 8 10 12 14 16	
0.0	[FILL] SILT, sandy (fine to course), minor gravel (fine, sub-angular), dark brown, moist, friable	Fill				0.0		
0.1	0.1 m: becomes gravelly, minor sand					0.1		
0.2	SILT, minor clay, trace sand (fine), light brown, stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash				0.2		
0.4				●	89 (21)	0.4		
0.6						0.6		GWNE
0.8	0.8 m: becomes grey streaked orange, very stiff					0.8		
1.0				●	106 (32)	1.0		
1.1	EOTP: 1.10 m TARGET DEPTH					1.1		
1.2						1.2		
1.4						1.4		
1.6						1.6		
1.8						1.8		

Profile:

Excavation Method:
10t Excavator

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP56

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	20/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[LANDFILL] SILT, minor clay and gravel (fine, sub-angular), trace rootlets/organic material, brown mottled black/orange, stiff, moist, friable	Fill	
2.4	[PALAEOSOL] SILT, black mottled dark brown, moist, friable	T/S Kaurora/ Hamilton Ash	TS
2.6	SILT, minor sand (fine), minor clay, orange/brown, hard, moist, slightly plastic [HAMILTON ASH]		
2.70	EOTP: 2.70 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane

Depth (m)	Values
0.6	57 (18)
1.0	92 (21)
2.4	>200

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)

Groundwater: GWNE

Profile:

Excavation Method:
10t Excavator

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP57

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
65547	Toitū Te Whenua Land Information New Zealand Former Tokanui Hospital Closed Landfill, Tokanui	GEO517	20/04/2023	C. Lee	A. Stuart

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	[TOPSOIL] SILT, dark brown, moist, friable	T/S	
0.2	[LANDFILL] SILT, minor sand (fine to coarse) and rootlets/organic material, dark brown mottled black/grey/orange, stiff, moist, friable, contains up to 10% construction debris and general refuse including concrete, brick and plastic bottles	Fill	
1.1	1.1 m: becomes up to 40% construction debris with up to 600 mm diameter concrete blocks and bricks, minor pit collapse		
2.0	[PALAEOSOL] SILT, black mottled dark brown, moist, friable	T/S	
2.2	SILT, minor sand (fine), minor clay, orange/brown, very stiff, moist, slightly plastic [HAMILTON ASH]	Kauroa-Hamilton Ash	
2.35	EOTP: 2.35 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 | Values
○ 181
● (39)

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 0mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:
10t Excavator

Remarks:
1. Groundwater not encountered on 19/04/23.

Datum:

Coordinates:

Appendix D

Sample Results

Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area A Cap Material																						
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			1/11/22-2/11/22			7-Nov-22			20-Apr-23									
Sample Name							TP1 0.6m	TP8 1.0m	TP11 0.6m	TR9 0.2m	TR10 0.5m	TR11 0.3m	TP38 0.3m	TP39 0.5m	TP40 0.6m	TP41 0.2m	TP42 0.2m	TP42 1.0m	TP43 0.3m	TP43 0.7m	TP44 0.4m	TP44 1.0m	TP45 0.2m
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	1.55m-1.65m	0.95m-1.05m	0.55m-0.65m	0.15m-0.25m	0.45m-0.55m	0.25m-0.35m	0.25m-0.35m	0.45m-0.55m	0.55m-0.65m	0.15m-0.25m	0.15m-0.25m	0.95m-1.05m	0.25m-0.35m	0.65m-0.75m	0.35m-0.45m	0.95m-1.05m	0.15m-0.25m
Lab Number							3108552.20	3108552.2	3108552.3	3113975.2	3113975.4	3113975.3	3257173.6	3257173.9	3257173.10	3257173.13	3257173.14	3257173.15	3257173.16	3257173.17	3257173.18	3257173.19	3257173.20
Soil Strata Type																							
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**						2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2
Arsenic	6.8	21	70	17	70	100	5	4	3	2	3	3	5	5	3	3	3	3	4	5	3	3	2
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	32	< 20	< 20	< 20	< 20	26	97	20	47	< 20	< 20	< 20	< 20	159	< 20	< 20	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	0.14	< 0.10	< 0.10	< 0.10	0.1	< 0.10	0.15	0.17	< 0.10	< 0.10	< 0.10	< 0.10	0.15	0.23	< 0.10	0.14	< 0.10
Chromium	30	770	6,300	56	362	100	11	11	7	26	25	8	10	11	10	23	26	8	18	12	26	7	26
Copper	25	NL	>10,000	120	107	200	28	20	10	17	21	16	24	31	16	18	19	16	25	22	17	20	17
Lead	20	250	3,300	78	210	200	61	19.4	16.8	14.9	20	17.8	34	76	17.4	15	15.7	18.2	26	23	16.4	14.7	16.1
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	10	7	3	14	15	5	8	10	8	12	13	4	12	16	13	3	13
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	73	51	25	66	69	40	85	105	46	65	69	33	76	75	65	56	70
PAHs																							
BaP (Eq) NES	ND	11	35	2	35	NL	0.61	< 0.04	< 0.04	< 0.03	< 0.03*	< 0.04*	0.21	0.32	0.049	0.196	< 0.028	< 0.033	0.095*	< 0.034*	< 0.029*	< 0.032	< 0.028
Asbestos (SQ)																							
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	ND	ND	ND	ND	ND	ND	< 0.001*	< 0.001*	< 0.001	ND	ND	ND	ND	ND	ND	ND	ND
% ACM	ND	< 0.01	< 0.05				ND	ND	ND	ND	ND	ND	< 0.01	< 0.01	< 0.01	ND	ND	ND	ND	ND	ND	ND	ND

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.

3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.

4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use

5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use

6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)

7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area A Fill

Sample Date	Background Concentrations [1]	NESCS rural residential/lifestyle block – no produce [2]	NESCS commercial/ industrial outdoor worker (unpaved) [3]	Waste Acceptance Criteria			1/12/22 - 2/12/22															20-Apr-23			
Sample Name							TP1 2.0m	TP2 1.8m	TP2 3.0m	TP3 0.7m	TP3 2.0m	TP4 1.0m	TP5 2.0m	TP5 3.0m	TP6 1.5m	TP6 3.0m	TP7 1.8m	TP8 2.0m	TP9 1.5m	TP9 2.5m	TP10 0.8m	TP10 2.0m	TP12 1.2m	TP35 1.0m	TP35 2.5m	TP38 2.0m	TP40 1.0m
Sample Depth (m)							1.95m-2.05m	1.75m-1.85m	2.95m-3.05m	0.65m-0.75m	1.95m-2.05m	0.95m-1.05m	1.95m-2.05m	2.95m-3.05m	1.45m-1.55m	2.95m-3.05m	1.75m-1.85m	1.95m-2.05m	1.45m-1.55m	2.45m-2.55m	0.75m-0.85m	1.95m-2.05m	1.15m-1.25m	0.95m-1.05m	2.45m-2.55m	1.95m-2.05m	0.95m-1.05m
Lab Number				WRC Cleanfill Criteria	Envirofill South (Managed Fill)	Hampton Downs landfill	3108552.3	3108552.5	3108552.6	3108552.8	3108552.9	3108552.11	3108552.14	3108552.15	3108552.17	3108552.18	3108552.2	3108552.24	3108552.26	3108552.27	3108552.29	3108552.30	3108552.35	3113975.13	3113975.14	3257173.70	3257173.11
Soil Strata Type																											
Heavy Metals (mg/kg dry weight)	95% upper limit for background (mg/kg)						4	4	4	3	4	3	4	4	4	4	4	4	4	4	3	4	3	4	4	4	4
Arsenic	6.8	21	70	17	70	100	22	8	20	< 2	38	4	32	17	11	11	16	17	13	61	7	46	9	15	36	72	7
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	122	64	720	< 20	250	23	820	1040	510	760	290	176	1320	730	1230	1720	1660	590	600	510	950
Cadmium	0.22	110	1,300	0.8	1.2	20	1.22	0.31	9.9	< 0.10	3.3	0.12	0.84	2.7	0.48	1.14	1.05	3.2	0.75	4.1	0.13	11.3	0.21	1.24	7.5	3.2	0.6
Chromium	30	770	6,300	56	362	100	25	16	36	8	37	9	14	20	17	20	22	42	15	40	15	93	13	31	53	38	29
Copper	25	NL	>10,000	120	107	200	99	39	161	15	250	19	46	98	42	47	58	124	61	114	25	157	29	290	430	410	41
Lead	20	250	3,300	78	210	200	179	810	380	18.4	1370	58	690	370	133	121	157	500	31	1030	49	460	34	410	930	360	126
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	23	12	54	4	24	11	15	70	46	37	17	25	14	22	90	127	50	127	91	54	49
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	1010	250	390	55	2200	75	330	720	250	270	780	750	111	2400	128	1860	110	1550	3800	1640	590
PAHs																											
BaP (Eq) NES	ND	11	35	2	35	NL	0.58	0.13	0.82	< 0.03*	0.07	0.24	< 0.04*	0.09	0.36	< 0.04*	0.23	0.2	< 0.04*	< 0.04*	< 0.04*	< 0.04*	1.44	< 0.04	0.48	0.086	0.065
Asbestos (SQ)																											
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	0.003	ND	< 0.001*	< 0.001*	0.001	< 0.001*	< 0.001*	< 0.001*	< 0.001*	< 0.001	< 0.001	< 0.001*	< 0.001*	< 0.001*	ND	0.001	0.005	< 0.001*	0.007	< 0.001	0.008
% ACM	ND	< 0.01	< 0.05				< 0.01	ND	< 0.01	< 0.01	0.12	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	ND	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area A Natural Ground											
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			1/11/22-2/11/22				20-Apr-23
Sample Name							TP4 4.0m	TP7 3.0m	TP11 1.5m	TP12 2.7m	TP40 2.1m
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	3.95m-4.05m	2.95m-3.05m	1.45m-1.55m	2.65m-2.75m	2.05m-2.15m
Lab Number							3108552.12	3108552.21	3108552.33	3108552.36	3257173.12
Soil Strata Type							5	5	6	5	6
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**										
Arsenic	6.8	21	70	17	70	100	3	3	3	2	2
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	21	68	< 20	830	102
Cadmium	0.22	110	1,300	0.8	1.2	20	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chromium	30	770	6,300	56	362	100	6	7	8	9	7
Copper	25	NL	>10,000	120	107	200	10	13	13	14	17
Lead	20	250	3,300	78	210	200	15.6	21	17.6	18	16.4
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	3	3	4	6	4
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	35	54	30	32	39
PAHs											
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.04	< 0.04	< 0.04	< 0.04	< 0.035
Asbestos (SQ)											
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	-	ND	ND	ND	-
% ACM	ND	< 0.01	< 0.05				-	ND	ND	ND	-

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.

3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.

4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use

5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use

6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)

7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area A Topsoil

Sample Date	Background Concentrations [1]	NESCS rural residential/lifestyle block – no produce [2]	NESCS commercial/ industrial outdoor worker (unpaved) [3]	Waste Acceptance Criteria			1/11/22 - 2/11-22												20-Apr-23	
Sample Name							TP1 SUR	TP2 SUR	TP3 SUR	TP4 SUR	TP5 SUR	TP6 SUR	TP7 SUR	TP8 SUR	TP9 SUR	TP10 SUR	TP11 SUR	TP12 SUR	TP35 SUR	TP38 SUR	TP39 SUR
Sample Depth (m)							0-0.15	0-0.15	0-0.15	0-0.15	0-0.15	0-0.15	0-0.15	0-0.15	0-0.15	0-0.15	0-0.15	0-0.15	0-0.15	0-0.15	0-0.15
Lab Number							3108552.1	3108552.4	3108552.7	3108552.1	3108552.1	3108552.2	3108552.2	3108552.2	3108552.3	3108552.3	3108552.3	3108552.3	3113975.12	3257173.5	3257173.8
Soil Strata Type							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Heavy Metals (mg/kg dry weight)	95% upper limit for background (mg/kg)			WRC Cleanfill Criteria	Envirofill South (Managed Fill)	Hampton Downs landfill															
Arsenic	6.8	21	70	17	70	100	4	9	5	5	4	5	5	5	4	5	5	9	5	5	8
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	27	480	25	< 20	300	< 20	21	< 20	< 20	45	< 20	960	50	97	41
Cadmium	0.22	110	1,300	0.8	1.2	20	0.22	0.22	0.18	0.19	< 0.10	0.18	0.31	0.25	0.12	0.19	0.31	0.25	0.13	0.15	0.5
Chromium	30	770	6,300	56	362	100	11	12	9	10	10	9	11	9	11	16	9	14	9	10	13
Copper	25	NL	>10,000	120	107	200	27	30	23	24	26	24	37	34	22	28	22	31	24	24	40
Lead	20	250	3,300	78	210	200	83	47	36	43	24	35	36	37	30	39	51	30	29	34	79
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	33	40	9	7	19	8	9	9	6	12	5	55	8	8	12
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	84	119	68	73	47	82	180	161	67	94	76	143	66	85	191
PAHs																					
BaP (Eq) NES	ND	11	35	2	35	NL	0.24	0.1	0.3	0.5	0.04	0.23	0.19	0.29	0.15	0.14	< 0.04	1.7	0.12	0.21	1.83
Asbestos (SQ)																					
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	< 0.001	ND	ND	ND	0.001	< 0.001	ND	ND	ND	ND	ND	0.002	< 0.001*	< 0.001*	< 0.001
% ACM	ND	< 0.01	< 0.05				< 0.01	ND	ND	ND	< 0.01	< 0.01	ND	ND	ND	ND	ND	< 0.01	< 0.01	< 0.01	< 0.01

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area B Fill

Sample Date	Background Concentrations [1]	NESCS rural residential/lifestyle block – no produce [2]	NESCS commercial/ industrial outdoor worker (unpaved) [3]	Waste Acceptance Criteria			2/11/22 - 3/11/22				
Sample Name							TP 13 1.0m	TP14 0.8m	TP15 0.5m	TP15 0.8m	TP16 0.3m
Sample Depth (m)							0.95m-	0.75m-0.85m	0.45m-0.55m	0.75m-0.85m	0.25m-0.35m
Lab Number							3108552.38	3113975.7	3113975.24	3113975.25	3113975.27
Soil Strata Type											
Heavy Metals (mg/kg dry weight)	95% upper limit for background (mg/kg)			WRC Cleanfill Criteria	Envirofill South (Managed Fill)	Hampton Downs landfill	4	4	3	3	4
Arsenic	6.8	21	70	17	70	100	10	5	3	3	*14*
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	75	154	< 20	< 20	360
Cadmium	0.22	110	1,300	0.8	1.2	20	*4.6*	0.26	0.11	0.11	0.32
Chromium	30	770	6,300	56	362	100	43	9	9	7	12
Copper	25	NL	>10,000	120	107	200	49	27	16	15	25
Lead	20	250	3,300	78	210	200	*350*	*138*	29	24	*200*
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	11	6	4	3	47
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	*250*	98	83	65	158
PAHs											
BaP (Eq) NES	ND	11	35	2	35	NL	0.43	0.12	< 0.04	< 0.04	0.14
Asbestos (SQ)											
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	ND	ND	ND	ND	< 0.001*
% ACM	ND	< 0.01	< 0.05				ND	ND	ND	ND	< 0.01

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area B Natural Ground									
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			2/11/22 - 3/11/22		
Sample Name							TP13 3.2m	TP14 1.2m	TP16 0.5m
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	3.15m-3.25m	1.15m-1.25m	0.45m-0.55m
Lab Number							3108552.39	3113975.7	3113975.28
Soil Strata Type							5	5	5
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**								
Arsenic	6.8	21	70	17	70	100	16	2	6
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	89	28	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	0.68	< 0.10	0.33
Chromium	30	770	6,300	56	362	100	18	8	10
Copper	25	NL	>10,000	120	107	200	63	15	18
Lead	20	250	3,300	78	210	200	*189*	20	*107*
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	14	5	9
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	*380*	31	127
PAHs									
BaP (Eq) NES	ND	11	35	2	35	NL	0.45	< 0.04	0.13
Asbestos (SQ)									
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	< 0.001*	ND	< 0.001*
% ACM	ND	< 0.01	< 0.05				< 0.01	ND	< 0.01

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area B Topsoil										
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			2/11/22 - 3/11-22			
Sample Name							TP13 SUR	TP14 SUR	TP15 SUR	TP16 SUR
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	0-0.15	0-0.15	0-0.15	0-0.15
Lab Number							3108552.4	3113975.2	3113975.2	3113975.3
Soil Strata Type							1	1	1	1
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**									
Arsenic	6.8	21	70	17	70	100	5	5	4	4
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20	50	< 20	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	0.24	0.14	0.21	0.11
Chromium	30	770	6,300	56	362	100	11	12	8	24
Copper	25	NL	>10,000	120	107	200	24	24	31	21
Lead	20	250	3,300	78	210	200	73	33	26	22
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	8	9	5	14
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	115	68	139	79
PAHs										
BaP (Eq) NES	ND	11	35	2	35	NL	0.06	1.11	0.66	0.09
Asbestos (SQ)										
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	ND	ND	ND	ND
% ACM	ND	< 0.01	< 0.05				ND	ND	ND	ND

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area C Cap							
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			3-Nov-22
Sample Name							TR16 0.4m
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	0.35m-0.45m
Lab Number							3113975.10
Soil Strata Type							3
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**						
Arsenic	6.8	21	70	17	70	100	3
Boron	6.7	4,500 [5]	300,000 [6]	15	260	500	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	< 0.10
Chromium	30	770	6,300	56	362	100	12
Copper	25	NL	>10,000	120	107	200	18
Lead	20	250	3,300	78	210	200	31
Nickel	7.6	400 [5]	6,000 [6]	33	320	200	9
Zinc	53	7,400 [5]	400,000 [6]	175	1,160	500	54
PAHs							
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.03*
Asbestos (SQ)							
AF/FA	ND	< 0.001	< 0.001	ND	Soils only	Soils & ACM	ND
% ACM	ND	< 0.01	< 0.05				ND

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Pr Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Pr Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area C Fill								
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			3-Nov-22	
Sample Name							TP17 0.7m	TP17 3.7m
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	0.65m-0.75m	3.65m-3.75m
Lab Number							3113975.30	3113975.31
Soil Strata Type							4	5
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**							
Arsenic	6.8	21	70	17	70	100	5	*34*
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20	210
Cadmium	0.22	110	1,300	0.8	1.2	20	0.32	*2.9*
Chromium	30	770	6,300	56	362	100	12	27
Copper	25	NL	>10,000	120	107	200	32	*89*
Lead	20	250	3,300	78	210	200	*250*	*270*
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	9	31
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	175	*960*
PAHs								
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.04*	0.46
Asbestos (SQ)								
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	ND	**0.009**
% ACM	ND	< 0.01	< 0.05				ND	< 0.01

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.

3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.

4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 fo Low Density Residential land use

5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 fo Commercial/Industrial land use

6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)

7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area C Natural Ground							
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			3-Nov-22
Sample Name							TP18 1.2m
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	1.15m-1.25m
Lab Number							3113975.33
Soil Strata Type							6
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**						
Arsenic	6.8	21	70	17	70	100	2
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	< 0.10
Chromium	30	770	6,300	56	362	100	8
Copper	25	NL	>10,000	120	107	200	13
Lead	20	250	3,300	78	210	200	21
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	4
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	31
PAHs							
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.04
Asbestos (SQ)				ND	AF/FA Only	AF/FA & ACM	
AF/FA	ND	< 0.001	< 0.001				ND
% ACM	ND	< 0.01	< 0.05				ND

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area C Topsoil								
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			3-Nov-22	
Sample Name							TP17 SUR	TP18 SUR
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	0.0m-0.15m	0.0m-0.15m
Lab Number							3113975.29	3113975.32
Soil Strata Type							1	1
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**							
Arsenic	6.8	21	70	17	70	100	4	6
Boron	6.7	4,500 [5]	300,000 [6]	15	260	500	< 20	84
Cadmium	0.22	110	1,300	0.8	1.2	20	< 0.10	0.26
Chromium	30	770	6,300	56	362	100	6	11
Copper	25	NL	>10,000	120	107	200	13	32
Lead	20	250	3,300	78	210	200	20	73
Nickel	7.6	400 [5]	6,000 [6]	33	320	200	5	17
Zinc	53	7,400 [5]	400,000 [6]	175	1,160	500	44	110
PAHs								
BaP (Eq) NES	ND	11	35	2	35	NL	0.21	0.04
Asbestos (SQ)								
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	ND	**0.002**
% ACM	ND	< 0.01	< 0.05				ND	< 0.01

Note:

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.

3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.

5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use

6. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use

7. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)

8. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area D Fill								
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			4-Nov-22	
Sample Name							TP27 1.0m	TP30 1.5m
Sample Depth (m)							0.95m-1.05m	1.45m-1.55m
Lab Number							3113975.52	3113975.59
Soil Strata Type				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	4	4
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**							
Arsenic	6.8	21	70	17	70	100	5	6
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	0.24	0.32
Chromium	30	770	6,300	56	362	100	13	15
Copper	25	NL	>10,000	120	107	200	29	37
Lead	20	250	3,300	78	210	200	*220*	*470*
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	6	8
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	139	*250*
PAHs								
BaP (Eq) NES	ND	11	35	2	35	NL	1.24	0.25
Asbestos (SQ)								
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	**0.004**	ND
% ACM	ND	< 0.01	< 0.05				< 0.01	ND

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area D Natural Grounc												
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			4-Nov-22					9-Nov-22
Sample Name							TP27 1.7m	TP28 0.5m	TP29 0.3m	TP30 3.5m	TP31 1.0m	TR29 2.9m
Sample Depth (m)							1.65m-1.75m	0.45m-0.55m	0.25m-0.35m	3.45m-3.55m	1.45m-1.55m	2.85m-2.95m
Lab Number							3113975.53	3113975.55	3113975.57	3113975.59	3113975.62	3113975.70
Soil Strata Type				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**						
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**						6	6	6	5	6	6
Arsenic	6.8	21	70	17	70	100	2	2	< 2	6	2	2
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20	< 20	< 20	< 20	< 20	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	< 0.10	< 0.10	< 0.10	0.32	< 0.10	< 0.10
Chromium	30	770	6,300	56	362	100	8	6	7	15	6	7
Copper	25	NL	>10,000	120	107	200	12	13	11	37	10	9
Lead	20	250	3,300	78	210	200	25	14.7	15.7	*470*	15.5	25
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	4	4	4	8	3	3
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	34	36	41	*250*	32	36
PAHs												
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.04	< 0.05	< 0.04	< 0.04	< 0.04	< 0.04
Asbestos (SQ)												
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	ND	ND	ND	ND	ND	ND
% ACM	ND	< 0.01	< 0.05				ND	ND	ND	ND	ND	ND

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area D Topsoil											
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			4-Nov-22				
Sample Name							TP27 SUR	TP28 SUR	TP29 SUR	TP30 SUR	TP31 SUR
Sample Depth (m)							0.0m-0.15m	0.0m-0.15m	0.0m-0.15m	0.0m-0.15m	0.0m-0.15m
Lab Number				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	3113975.51	3113975.54	3113975.56	3113975.58	3113975.61
Soil Strata Type							1	1	1	1	1
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**										
Arsenic	6.8	21	70	17	70	100	4	3	3	4	4
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20	< 20	< 20	< 20	35
Cadmium	0.22	110	1,300	0.8	1.2	20	0.26	0.12	< 0.10	0.27	0.22
Chromium	30	770	6,300	56	362	100	13	17	9	18	11
Copper	25	NL	>10,000	120	107	200	34	17	15	23	25
Lead	20	250	3,300	78	210	200	48	22	19.1	32	25
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	10	9	4	10	8
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	118	68	52	95	85
PAHs											
BaP (Eq) NES	ND	11	35	2	35	NL	0.32	< 0.03	0.11	0.09	0.07
Asbestos (SQ)											
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	ND	ND	ND	ND	ND
% ACM	ND	< 0.01	< 0.05				ND	ND	ND	ND	ND

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.

3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.

4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use

5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use

6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)

7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area E Natural Ground							
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			4-Nov-22
Sample Name							TP25 2.0m
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	1.95m-2.05m
Lab Number							3113975.47
Soil Strata Type							6
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**						
Arsenic	6.8	21	70	17	70	100	2
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	< 0.10
Chromium	30	770	6,300	56	362	100	7
Copper	25	NL	>10,000	120	107	200	13
Lead	20	250	3,300	78	210	200	17.9
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	4
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	27
PAHs							
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.04
Asbestos (SQ)				ND	AF/FA Only	AF/FA & ACM	
AF/FA	ND	< 0.001	< 0.001				ND
% ACM	ND	< 0.01	< 0.05				ND

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.

3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.

4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use

5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use

6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)

7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area E Topsoil							
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			4-Nov-22
Sample Name							TP25 SUR
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	0.0m-0.15m
Lab Number							3113975.46
Soil Strata Type							1
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**						
Arsenic	6.8	21	70	17	70	100	3
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	0.14
Chromium	30	770	6,300	56	362	100	24
Copper	25	NL	>10,000	120	107	200	18
Lead	20	250	3,300	78	210	200	17.8
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	12
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	79
PAHs							
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.03
Asbestos (SQ)				ND	AF/FA Only	AF/FA & ACM	
AF/FA	ND	< 0.001	< 0.001				ND
% ACM	ND	< 0.01	< 0.05				ND

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

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Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

Fraser Thomas

Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area F Cap							
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			9-Nov-22
Sample Name							TR27 0.3m
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	0.25m-0.35m
Lab Number							3113975.50
Soil Strata Type							2
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**						
Arsenic	6.8	21	70	17	70	100	4
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	0.11
Chromium	30	770	6,300	56	362	100	23
Copper	25	NL	>10,000	120	107	200	19
Lead	20	250	3,300	78	210	200	18.5
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	13
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	68
PAHs							
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.03*
Asbestos (SQ)				ND	Soils only	Soils & ACM	
AF/FA	ND	< 0.001	< 0.001				ND
% ACM	ND	< 0.01	< 0.05				ND

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area F Fill								
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			4-Nov-22	
Sample Name							TP26 0.8m	TP26 1.5m
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	0.75m-0.85m	1.45m-1.55m
Lab Number							3113975.49	3113975.50
Soil Strata Type							4 (Mainly Medical Waste)	4 (Mainly Medical Waste)
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**							
Arsenic	6.8	21	70	17	70	100	2	< 2
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	0.22	< 0.10
Chromium	30	770	6,300	56	362	100	9	5
Copper	25	NL	>10,000	120	107	200	14	13
Lead	20	250	3,300	78	210	200	21	13.9
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	5	3
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	91	47
PAHs								
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.04	< 0.04
Asbestos (SQ)				ND	Soils only	Soils & ACM		
AF/FA	ND	< 0.001	< 0.001				ND	ND
% ACM	ND	< 0.01	< 0.05				ND	ND

Note:

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area F Natural Ground							
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			9-Nov-22
Sample Name							TR27 4.8m
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	4.75m-4.85m
Lab Number							3113975.60
Soil Strata Type							6
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**						
Arsenic	6.8	21	70	17	70	100	2
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	< 0.10
Chromium	30	770	6,300	56	362	100	5
Copper	25	NL	>10,000	120	107	200	10
Lead	20	250	3,300	78	210	200	11.9
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	3
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	33
PAHs							
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.04
Asbestos (SQ)				ND	Soils only	Soils & ACM	
AF/FA	ND	< 0.001	< 0.001				ND
% ACM	ND	< 0.01	< 0.05				ND

Note:

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area F Topsoil							
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			4-Nov-22
Sample Name							TP26 SUR
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	0.0m-0.15m
Lab Number							3113975.48
Soil Strata Type							1
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**						
Arsenic	6.8	21	70	17	70	100	3
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	0.11
Chromium	30	770	6,300	56	362	100	18
Copper	25	NL	>10,000	120	107	200	17
Lead	20	250	3,300	78	210	200	19.1
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	10
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	61
PAHs							
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.03
Asbestos (SQ)				ND	Soils only	Soils & ACM	
AF/FA	ND	< 0.001	< 0.001				ND
% ACM	ND	< 0.01	< 0.05				ND

Note:

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area G Fill							
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			3-Nov-22
Sample Name							TR22 1.0m
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	0.95m-1.05m
Lab Number							3113975.80
Soil Strata Type							4 (Reworked Natural)
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**						
Arsenic	6.8	21	70	17	70	100	4
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	< 0.10
Chromium	30	770	6,300	56	362	100	8
Copper	25	NL	>10,000	120	107	200	19
Lead	20	250	3,300	78	210	200	21
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	4
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	55
PAHs							
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.04*
Asbestos (SQ)				ND	AF/FA Only	AF/FA & ACM	
AF/FA	ND	< 0.001	< 0.001				ND
% ACM	ND	< 0.01	< 0.05				ND

Note:

* - Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.

3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.

4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 –

5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use

6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)

7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area G Natural Ground												
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			3-Nov-22					
Sample Name							TP19 0.8m	TP20 1.5m	TP21 1.0m	TP22 1.0m	TP23 1.2m	TP24 1.5m
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	0.75m-0.85m	1.45m-1.55m	0.95m-1.05m	0.95m-1.05m	1.15m-1.25m	1.45m-1.55m
Lab Number							3113975.35	3113975.37	3113975.39	3113975.41	3113975.43	3113975.45
Soil Strata Type							6	6	5	6	6	6
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**											
Arsenic	6.8	21	70	17	70	100	2	< 2	3	2	3	2
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20	< 20	< 20	< 20	< 20	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	< 0.10	< 0.10	0.11	< 0.10	< 0.10	< 0.10
Chromium	30	770	6,300	56	362	100	4	4	6	4	7	6
Copper	25	NL	>10,000	120	107	200	10	10	10	10	15	12
Lead	20	250	3,300	78	210	200	9.7	10.8	24	10	14.3	11
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	2	2	4	2	4	3
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	34	34	340	36	41	39
PAHs												
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Asbestos (SQ)												
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	ND	ND	ND	ND	ND	ND
% ACM	ND	< 0.01	< 0.05				ND	ND	ND	ND	ND	ND

Note:

* = Residual concentrations of other PAHs detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.

3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.

4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use

5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use

6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)

7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area G Topsoil												
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			3-Nov-22					
Sample Name							TP19 SUR	TP20 SUR	TP21 SUR	TP22 SUR	TP23 SUR	TP24 SUR
Sample Depth (m)							0.0m-0.15m	0.0m-0.15m	0.0m-0.15m	0.0m-0.15m	0.0m-0.15m	0.0m-0.15m
Lab Number							3113975.34	3113975.36	3113975.38	3113975.40	3113975.42	3113975.44
Soil Strata Type				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	1	1	1	1	1	1
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**											
Arsenic	6.8	21	70	17	70	100	6	5	3	4	4	3
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	60	26	< 20	22	25	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	0.34	0.25	0.11	0.22	0.19	< 0.10
Chromium	30	770	6,300	56	362	100	12	11	7	8	7	7
Copper	25	NL	>10,000	120	107	200	40	31	14	26	18	13
Lead	20	250	3,300	78	210	200	56	65	39	33	26	21
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	16	11	5	8	14	4
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	112	107	55	136	89	74
PAHs												
BaP (Eq) NES	ND	11	35	2	35	NL	0.54	0.13	0.1	0.08	0.07	< 0.04
Asbestos (SQ)												
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	< 0.001*	ND	ND	ND	ND	ND
% ACM	ND	< 0.01	< 0.05				< 0.01	ND	ND	ND	ND	ND

Note:

* - Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area H Fill								
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			9-Nov-22	
Sample Name							TP32 0.5m	TP34 SUR
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	0.45m-0.55m	0.0m-0.15m
Lab Number							3113975.20	3113975.15
Soil Strata Type							4	4
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**							
Arsenic	6.8	21	70	17	70	100	*95*	*16*
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	240	98
Cadmium	0.22	110	1,300	0.8	1.2	20	*2.3*	0.46
Chromium	30	770	6,300	56	362	100	51	19
Copper	25	NL	>10,000	120	107	200	*300*	*69*
Lead	20	250	3,300	78	210	200	*550*	*940*
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	47	15
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	*2700*	*320*
PAHs								
BaP (Eq) NES	ND	11	35	2	35	NL	0.04	0.04
Asbestos (SQ)								
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	< 0.001*	**0.003**
% ACM	ND	< 0.01	< 0.05				< 0.01	< 0.01

Note:

* - Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.

3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.

4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use

5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use

6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)

7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area H Natural Ground									
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			9-Nov-22		
Sample Name							TP32 1.5m	TP33 0.5m	TP34 0.5
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	1.45m-1.55m	0.45m-0.55m	0.45m-0.55m
Lab Number							3113975.21	3113975.18	3113975.16
Soil Strata Type							5	6	5
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**								
Arsenic	6.8	21	70	17	70	100	2	3	3
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20	< 20	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	< 0.10	< 0.10	< 0.10
Chromium	30	770	6,300	56	362	100	7	8	8
Copper	25	NL	>10,000	120	107	200	17	15	16
Lead	20	250	3,300	78	210	200	21	18.2	17.9
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	4	4	4
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	43	39	33
PAHs									
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.04	< 0.04	< 0.04
Asbestos (SQ)									
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	ND	ND	ND
% ACM	ND	< 0.01	< 0.05				ND	ND	ND

Note:

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
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-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type	
1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area H Topsoil											
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			9-Nov-22		20-Apr-23		
Sample Name							TP32 SUR	TP33 SUR	TP37 SUR	TP54 SUR	TP55 SUR
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	0.0m-0.15m	0.0m-0.15m	0.15m-0.25m	0.05m-0.15m	0.05m-0.15m
Lab Number							3113975.19	3113975.17	3257173.40	3257173.32	3257173.33
Soil Strata Type							1	1	1	1	1
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**										
Arsenic	6.8	21	70	17	70	100	5	5	7	6	7
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20	< 20	< 20	< 20	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	0.19	0.24	0.27	0.23	< 0.10
Chromium	30	770	6,300	56	362	100	16	13	14	13	17
Copper	25	NL	>10,000	120	107	200	44	28	44	39	37
Lead	20	250	3,300	78	210	200	25	68	47	76	28
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	10	8	23	8	10
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	85	164	110	112	70
PAHs											
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.04*	0.05	0.31	< 0.031	< 0.025
Asbestos (SQ)											
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	ND	ND	< 0.001	0.004	< 0.001
% ACM	ND	< 0.01	< 0.05				ND	ND	ND	ND	ND

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.

3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.

4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental

5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use

6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)

7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area I Fill													
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			20-Apr-23						
Sample Name							HA01	TP46	TP50	TP50	TP51	TP57	TP57
Sample Depth (m)							0.2-0.6m	0.25-0.35m	0.25-0.35m	0.45-0.55m	0.20-0.30m	0.75-0.85m	1.45-1.55m
Lab Number							3257173.10	3257173.22	3257173.27	3257173.28	3257173.30	3257173.36	3257173.37
Soil Strata Type				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	4	4	4	4	4	4	4
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**												
Arsenic	6.8	21	70	17	70	100	5	5	5	5	5	6	5
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20	< 20	< 20	30	< 20	< 20	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	0.19	0.36	0.14	0.18	0.51	0.23	0.13
Chromium	30	770	6,300	56	362	100	14	14	15	13	10	18	14
Copper	25	NL	>10,000	120	107	200	48	47	35	36	49	141	40
Lead	20	250	3,300	78	210	200	96	19.6	34	57	20	66	47
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	8	7	8	13	5	8	6
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	116	87	78	83	115	86	74
PAHs													
BaP (Eq) NES	ND	11	35	2	35	NL	0.67	< 0.038	0.33	0.58	< 0.038	0.193	0.98
Asbestos (SQ)													
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	ND	ND	< 0.001*	< 0.001*	ND	ND	ND
% ACM	ND	< 0.01	< 0.05				ND	ND	ND	ND	ND	ND	ND

Note:

* - Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/
2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.
3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.
4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use
5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use
6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)
7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
BOLD:	Exceeded NES:CS Commercial/Industrial Outdoor Worker
ND:	Not detected
NL:	No limit
NS:	Not stated
-	Not tested for
	Above cleanfill acceptance criteria
	Above managed fill acceptance criteria
	Above Class 1 landfill acceptance criteria

Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
6	Natural ground

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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area I Natural Ground							
Sample Date	**Background Concentrations [1]**	**NESCS rural residential/lifestyle block – no produce [2]**	**NESCS commercial/ industrial outdoor worker (unpaved) [3]**	**Waste Acceptance Criteria**			20-Apr-23
Sample Name							TP56
Sample Depth (m)				**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**	2.25-2.35m
Lab Number							3257173.35
Soil Strata Type							5
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**						
Arsenic	6.8	21	70	17	70	100	6
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	0.57
Chromium	30	770	6,300	56	362	100	11
Copper	25	NL	>10,000	120	107	200	46
Lead	20	250	3,300	78	210	200	24
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	6
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	155
PAHs							
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.043
Asbestos (SQ)				ND	AF/FA Only	AF/FA & ACM	
AF/FA	ND	< 0.001	< 0.001				ND
% ACM	ND	< 0.01	< 0.05				ND

Note:

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.

3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.

4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use

5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use

6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)

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Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
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Former Tokanui Psychiatric Hospital Closed Landfill: Soil Results Area I Topsoil

Sample Date	Background Concentrations [1]	NESCS rural residential/lifestyle block – no produce [2]	NESCS commercial/ industrial outdoor worker (unpaved) [3]	Waste Acceptance Criteria			20-Apr-23							
Sample Name							TP46	TP47	TP48	TP49	TP50	TP51	TP52	TP56
Sample Depth (m)				WRC Cleanfill Criteria	Envirofill South (Managed Fill)	Hampton Downs landfill	0.0m-0.1m	0.0m-0.1m	0.0m-0.1m	0.0m-0.1m	0.0m-0.1m	0.0m-0.1m	0.0m-0.1m	0.0m-0.1m
Lab Number							3257173.21	3257173.23	3257173.24	3257173.25	3257173.26	3257173.29	3257173.31	3257173.34
Soil Strata Type							1	1	1	1	1	1	1	1
Heavy Metals (mg/kg dry weight)	95% upper limit for background (mg/kg)													
Arsenic	6.8	21	70	17	70	100	6	6	5	4	5	6	5	8
Boron	6.7	4,500 [4]	300,000 [5]	15	260	500	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cadmium	0.22	110	1,300	0.8	1.2	20	0.24	0.54	0.44	0.35	0.14	0.23	0.1	0.4
Chromium	30	770	6,300	56	362	100	17	12	9	9	12	15	13	13
Copper	25	NL	>10,000	120	107	200	47	47	37	31	33	57	30	42
Lead	20	250	3,300	78	210	200	21	26	25	21	34	47	21	27
Nickel	7.6	400 [4]	6,000 [5]	33	320	200	8	6	5	5	8	9	9	6
Zinc	53	7,400 [4]	400,000 [5]	175	1,160	500	72	104	122	113	55	92	47	97
PAHs														
BaP (Eq) NES	ND	11	35	2	35	NL	< 0.037	< 0.040	< 0.036*	< 0.035*	0.48	0.29	0.09	< 0.035*
Asbestos (SQ)														
AF/FA	ND	< 0.001	< 0.001	ND	AF/FA Only	AF/FA & ACM	ND	ND	ND	ND	ND	ND	ND	0.003
% ACM	ND	< 0.01	< 0.05				ND	ND	ND	ND	ND	ND	ND	ND

Note:

* = Residual concentrations detected

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to rural residential/lifestyle block - no produce (unpublished) land use have been selected.

3. Resource Management (National Environmental Standard for Assessing and managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to Commercial/Industrial outdoor worker (unpaved) land use have been selected.

4. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Low Density Residential land use

5. No Soil Contaminant Standards for health (SCSs (health)) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 2013 for Commercial/Industrial land use

6. BRANZ 2017 Asbestos in Soil guidelines of 0.01% w/w % ACM or 0.001% w/w for % FA & AF fraction for Residential sites (Residential guidelines applied to assess risk to Remedial workers)

7. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction for Commercial/Industrial sites.

Underlined:	Above background concentrations
RED:	Exceeded NES:CS Residential/Lifestyle Block/BRANZ guidleine
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Soil Strata Type

1	Topsoil
2	Landfill cap
3	Interface of landfill cap and mixed fill
4	Mixed Fill
5	Interface of mixed fill and natural ground
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Tokonui Landfill Monitoring: Stream Sediment Results									
Sample Date	**Background Concentrations[1]**		**Waste Acceptance Criteria**			17-Apr-23			
Sample Name						S1	S3	S4	S2
Lab Number						3247082.60	3247082.80	3247082.90	3247082.70
Heavy Metals (mg/kg dry weight)	**95% upper limit for background (mg/kg)**	**ISQG-Low (Trigger Value)[2]**	**WRC Cleanfill Criteria**	**Envirofill South (Managed Fill)**	**Hampton Downs landfill**				
Arsenic	6.8	60	17	70	100	5	6	4	8
Boron	6.7	-	15	260	500	< 20	31	< 20	< 20
Cadmium	0.22	4.5	0.8	1.2	20	< 0.10	0.52	0.27	0.7
Chromium	30	240	56	362	100	7	12	9	12
Copper	25	195	120	107	200	14	24	15	22
Lead	20	150	78	210	200	10.2	18.9	14	15.5
Nickel	7.6	63	33	320	200	4	6	4	7
Zinc	53	600	175	1,160	500	28	129	68	151
PAHs									
Bap Eq	ND	-	2	35	1	< 0.058*	< 0.061	< 0.058*	< 0.14
Asbestos						ND	ND	ND	ND
AF/FA	ND	-	NA	AF/FA Only	AF/FA & ACM	-	-	-	-
ACM %	ND	-				-	-	-	-

Notes: * perylene detected in these samples at just above lab detection limits

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. ANZECC ISQG-Low (Trigger Value) recommended sediment quality guidelines with 3x dilution factor, as recommended by Ecan for considering potential environmental effects

Underlined: Above background concentrations

Bold above ANZECC ISQG-Low guidelines

\- Not tested for

Above cleanfill acceptance criteria

Above managed fill acceptance criteria

Above Class A landfill acceptance criteria

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
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W www.hill-laboratories.com

Certificate of Analysis

Client:	Fraser Thomas Limited	**Lab No:**	3108552	SPv3
Contact:	Elliot Bish	**Date Received:**	02-Nov-2022	
	C/- Fraser Thomas Limited	**Date Reported:**	23-Feb-2023	**(Amended)**
	PO Box 204006	**Quote No:**	118001	
	Highbrook	**Order No:**	PO000796	
	Auckland 2161	**Client Reference:**	33097	
		Submitted By:	Elliot Bish	

Sample Type: Soil

Sample Name:		TP1 Sur	TP1 0.6m	TP1 2.0m	TP2 Sur	TP2 1.8m
Lab Number:		3108552.1	3108552.2	3108552.3	3108552.4	3108552.5
Individual Tests						
Dry Matter	g/100g as rcvd	79	72	76	71	78
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	4	5	22	9	8
Total Recoverable Boron	mg/kg dry wt	27	32	122	480	64
Total Recoverable Cadmium	mg/kg dry wt	0.22	0.14	1.22	0.22	0.31
Total Recoverable Chromium	mg/kg dry wt	11	11	25	12	16
Total Recoverable Copper	mg/kg dry wt	27	28	99	30	39
Total Recoverable Lead	mg/kg dry wt	83	61	179	47	810
Total Recoverable Nickel	mg/kg dry wt	33	10	23	40	12
Total Recoverable Zinc	mg/kg dry wt	84	73	1,010	119	250
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	1.7	4.2	4.4	0.8	0.8
1-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.014	< 0.013	< 0.014	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.014	< 0.013	< 0.014	< 0.013
Acenaphthylene	mg/kg dry wt	< 0.013	0.018	< 0.013	< 0.014	< 0.013
Acenaphthene	mg/kg dry wt	< 0.013	< 0.014	0.013	< 0.014	< 0.013
Anthracene	mg/kg dry wt	0.023	0.050	0.071	0.019	< 0.013
Benzo[a]anthracene	mg/kg dry wt	0.137	0.37	0.35	0.058	0.056
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.170	0.42	0.40	0.070	0.096
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.24	0.61	0.58	0.095	0.134
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.24	0.61	0.57	0.094	0.134
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.193	0.49	0.46	0.077	0.112
Benzo[e]pyrene	mg/kg dry wt	0.097	0.23	0.22	0.041	0.069
Benzo[g,h,i]perylene	mg/kg dry wt	0.103	0.24	0.23	0.037	0.083
Benzo[k]fluoranthene	mg/kg dry wt	0.076	0.195	0.195	0.031	0.040
Chrysene	mg/kg dry wt	0.138	0.39	0.35	0.055	0.056
Dibenzo[a,h]anthracene	mg/kg dry wt	0.018	0.050	0.047	< 0.014	< 0.013
Fluoranthene	mg/kg dry wt	0.27	0.66	0.77	0.130	0.076
Fluorene	mg/kg dry wt	< 0.013	< 0.014	< 0.013	< 0.014	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.101	0.25	0.26	0.035	0.059
Naphthalene	mg/kg dry wt	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07
Perylene	mg/kg dry wt	0.043	0.101	0.102	0.019	0.025
Phenanthrene	mg/kg dry wt	0.069	0.107	0.20	0.069	0.020
Pyrene	mg/kg dry wt	0.25	0.64	0.67	0.108	0.087

Sample Type: Soil						
Sample Name:		TP2 3.0m	TP3 Sur	TP3 0.7m	TP3 2.0m	TP4 Sur
Lab Number:		3108552.6	3108552.7	3108552.8	3108552.9	3108552.10
Individual Tests						
Dry Matter	g/100g as rcvd	62	74	88	76	75
TCLP Weight of Sample Taken	g	-	-	-	50	-
TCLP Initial Sample pH	pH Units	-	-	-	9.3	-
TCLP Acid Adjusted Sample pH	pH Units	-	-	-	2.1	-
TCLP Extractant Type*		-	-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-
TCLP Extraction Fluid pH	pH Units	-	-	-	5.0	-
TCLP Post Extraction Sample pH	pH Units	-	-	-	5.9	-
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	20	5	< 2	38	5
Total Recoverable Boron	mg/kg dry wt	720	25	< 20	250	< 20
Total Recoverable Cadmium	mg/kg dry wt	9.9	0.18	< 0.10	3.3	0.19
Total Recoverable Chromium	mg/kg dry wt	36	9	8	37	10
Total Recoverable Copper	mg/kg dry wt	161	23	15	250	24
Total Recoverable Lead	mg/kg dry wt	380	36	18.4	1,370	43
Total Recoverable Nickel	mg/kg dry wt	54	9	4	24	7
Total Recoverable Zinc	mg/kg dry wt	390	68	55	2,200	73
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	6.0	2.2	< 0.3	0.4	3.3
1-Methylnaphthalene	mg/kg dry wt	< 0.016	< 0.014	< 0.012	< 0.014	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.016	< 0.014	< 0.012	< 0.014	< 0.013
Acenaphthylene	mg/kg dry wt	< 0.016	< 0.014	< 0.012	< 0.014	0.015
Acenaphthene	mg/kg dry wt	< 0.016	< 0.014	< 0.012	< 0.014	0.015
Anthracene	mg/kg dry wt	0.074	0.035	< 0.012	< 0.014	0.045
Benzo[a]anthracene	mg/kg dry wt	0.48	0.159	< 0.012	0.033	0.23
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.55	0.21	0.013	0.051	0.34
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.82	0.30	< 0.027	0.070	0.50
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.81	0.30	< 0.027	0.069	0.50
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.70	0.24	0.013	0.059	0.40
Benzo[e]pyrene	mg/kg dry wt	0.32	0.119	0.012	0.035	0.21
Benzo[g,h,i]perylene	mg/kg dry wt	0.32	0.131	0.021	0.043	0.25
Benzo[k]fluoranthene	mg/kg dry wt	0.29	0.096	< 0.012	0.021	0.152
Chrysene	mg/kg dry wt	0.54	0.164	< 0.012	0.032	0.24
Dibenzo[a,h]anthracene	mg/kg dry wt	0.073	0.023	< 0.012	< 0.014	0.049
Fluoranthene	mg/kg dry wt	0.99	0.34	0.014	0.046	0.46
Fluorene	mg/kg dry wt	< 0.016	< 0.014	< 0.012	< 0.014	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.36	0.131	0.012	0.028	0.26
Naphthalene	mg/kg dry wt	< 0.08	< 0.07	< 0.06	< 0.07	< 0.07
Perylene	mg/kg dry wt	0.139	0.051	< 0.012	< 0.014	0.092
Phenanthrene	mg/kg dry wt	0.26	0.121	< 0.012	0.013	0.158
Pyrene	mg/kg dry wt	0.89	0.32	0.013	0.044	0.42

Sample Name:		TP4 1.0m	TP4 4.0m	TP5 Sur	TP5 2.0m	TP5 3.0m
Lab Number:		3108552.11	3108552.12	3108552.13	3108552.14	3108552.15
Individual Tests						
Dry Matter	g/100g as rcvd	80	73	75	66	68
TCLP Weight of Sample Taken	g	-	-	-	-	50
TCLP Initial Sample pH	pH Units	-	-	-	-	9.2
TCLP Acid Adjusted Sample pH	pH Units	-	-	-	-	2.3
TCLP Extractant Type*		-	-	-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05
TCLP Extraction Fluid pH	pH Units	-	-	-	-	5.0
TCLP Post Extraction Sample pH	pH Units	-	-	-	-	6.7

Sample Type: Soil						
Sample Name:		TP4 1.0m	TP4 4.0m	TP5 Sur	TP5 2.0m	TP5 3.0m
Lab Number:		3108552.11	3108552.12	3108552.13	3108552.14	3108552.15
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	4	3	4	32	17
Total Recoverable Boron	mg/kg dry wt	23	21	300	820	1,040
Total Recoverable Cadmium	mg/kg dry wt	0.12	< 0.10	< 0.10	0.84	2.7
Total Recoverable Chromium	mg/kg dry wt	9	6	10	14	20
Total Recoverable Copper	mg/kg dry wt	19	10	26	46	98
Total Recoverable Lead	mg/kg dry wt	58	15.6	24	690	370
Total Recoverable Nickel	mg/kg dry wt	11	3	19	15	70
Total Recoverable Zinc	mg/kg dry wt	75	35	47	330	720
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	1.7	< 0.4	0.3	< 0.4	0.8
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.014	< 0.013	< 0.015	< 0.015
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.014	< 0.013	< 0.015	< 0.015
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.014	< 0.013	< 0.015	< 0.015
Acenaphthene	mg/kg dry wt	< 0.012	< 0.014	< 0.013	< 0.015	< 0.015
Anthracene	mg/kg dry wt	0.022	< 0.014	< 0.013	< 0.015	< 0.015
Benzo[a]anthracene	mg/kg dry wt	0.133	< 0.014	0.026	< 0.015	0.045
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.170	< 0.014	0.032	0.016	0.066
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.24	< 0.033	0.043	< 0.035	0.093
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.24	< 0.033	0.042	< 0.035	0.092
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.183	< 0.014	0.037	0.019	0.082
Benzo[e]pyrene	mg/kg dry wt	0.094	< 0.014	0.018	< 0.015	0.048
Benzo[g,h,i]perylene	mg/kg dry wt	0.114	< 0.014	0.014	< 0.015	0.053
Benzo[k]fluoranthene	mg/kg dry wt	0.077	< 0.014	0.015	< 0.015	0.032
Chrysene	mg/kg dry wt	0.134	< 0.014	0.025	< 0.015	0.048
Dibenzo[a,h]anthracene	mg/kg dry wt	0.015	< 0.014	< 0.013	< 0.015	< 0.015
Fluoranthene	mg/kg dry wt	0.26	< 0.014	0.054	< 0.015	0.102
Fluorene	mg/kg dry wt	< 0.012	< 0.014	< 0.013	< 0.015	< 0.015
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.110	< 0.014	0.015	< 0.015	0.043
Naphthalene	mg/kg dry wt	< 0.06	< 0.07	< 0.07	< 0.08	< 0.08
Perylene	mg/kg dry wt	0.046	< 0.014	< 0.013	< 0.015	0.021
Phenanthrene	mg/kg dry wt	0.069	< 0.014	0.016	< 0.015	0.042
Pyrene	mg/kg dry wt	0.26	< 0.014	0.050	< 0.015	0.099

Sample Name:		TP6 Sur	TP6 1.5m	TP6 3.0m	TP7 Sur	TP7 1.8m
Lab Number:		3108552.16	3108552.17	3108552.18	3108552.19	3108552.20
Individual Tests						
Dry Matter	g/100g as rcvd	74	74	69	65	76
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	5	11	11	5	16
Total Recoverable Boron	mg/kg dry wt	< 20	510	760	21	290
Total Recoverable Cadmium	mg/kg dry wt	0.18	0.48	1.14	0.31	1.05
Total Recoverable Chromium	mg/kg dry wt	9	17	20	11	22
Total Recoverable Copper	mg/kg dry wt	24	42	47	37	58
Total Recoverable Lead	mg/kg dry wt	35	133	121	36	157
Total Recoverable Nickel	mg/kg dry wt	8	46	37	9	17
Total Recoverable Zinc	mg/kg dry wt	82	250	270	180	780
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	2.0	2.5	< 0.4	1.3	1.5
1-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.014	< 0.014	< 0.016	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.014	< 0.014	< 0.016	< 0.013
Acenaphthylene	mg/kg dry wt	< 0.014	< 0.014	< 0.014	< 0.016	< 0.013
Acenaphthene	mg/kg dry wt	< 0.014	< 0.014	< 0.014	< 0.016	< 0.013
Anthracene	mg/kg dry wt	0.028	0.042	< 0.014	< 0.016	0.015
Benzo[a]anthracene	mg/kg dry wt	0.142	0.198	< 0.014	0.098	0.108

Sample Type: Soil						
Sample Name:		TP6 Sur	TP6 1.5m	TP6 3.0m	TP7 Sur	TP7 1.8m
Lab Number:		3108552.16	3108552.17	3108552.18	3108552.19	3108552.20
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.162	0.26	0.016	0.141	0.159
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.23	0.36	< 0.034	0.193	0.23
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.23	0.36	< 0.034	0.191	0.23
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.195	0.27	0.019	0.153	0.21
Benzo[e]pyrene	mg/kg dry wt	0.092	0.148	< 0.014	0.080	0.113
Benzo[g,h,i]perylene	mg/kg dry wt	0.094	0.166	< 0.014	0.078	0.129
Benzo[k]fluoranthene	mg/kg dry wt	0.076	0.107	< 0.014	0.063	0.080
Chrysene	mg/kg dry wt	0.145	0.194	< 0.014	0.101	0.112
Dibenzo[a,h]anthracene	mg/kg dry wt	0.017	0.026	< 0.014	< 0.016	0.019
Fluoranthene	mg/kg dry wt	0.36	0.36	0.024	0.20	0.178
Fluorene	mg/kg dry wt	< 0.014	< 0.014	< 0.014	< 0.016	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.097	0.152	< 0.014	0.081	0.121
Naphthalene	mg/kg dry wt	< 0.07	< 0.07	< 0.07	< 0.08	< 0.07
Perylene	mg/kg dry wt	0.036	0.064	< 0.014	0.033	0.049
Phenanthrene	mg/kg dry wt	0.166	0.124	< 0.014	0.054	0.058
Pyrene	mg/kg dry wt	0.31	0.40	0.022	0.192	0.155

Sample Name:		TP7 3.0m	TP8 Sur	TP8 1.0m	TP8 2.0m	TP9 Sur
Lab Number:		3108552.21	3108552.22	3108552.23	3108552.24	3108552.25
Individual Tests						
Dry Matter	g/100g as rcvd	72	62	73	71	74
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	3	5	4	17	4
Total Recoverable Boron	mg/kg dry wt	68	< 20	< 20	176	< 20
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.25	< 0.10	3.2	0.12
Total Recoverable Chromium	mg/kg dry wt	7	9	11	42	11
Total Recoverable Copper	mg/kg dry wt	13	34	20	124	22
Total Recoverable Lead	mg/kg dry wt	21	37	19.4	500	30
Total Recoverable Nickel	mg/kg dry wt	3	9	7	25	6
Total Recoverable Zinc	mg/kg dry wt	54	161	51	750	67
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	2.1	< 0.4	1.3	1.0
1-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.016	< 0.014	< 0.014	< 0.014
2-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.016	< 0.014	< 0.014	< 0.014
Acenaphthylene	mg/kg dry wt	< 0.014	< 0.016	< 0.014	< 0.014	< 0.014
Acenaphthene	mg/kg dry wt	< 0.014	< 0.016	< 0.014	< 0.014	< 0.014
Anthracene	mg/kg dry wt	< 0.014	0.030	< 0.014	0.015	< 0.014
Benzo[a]anthracene	mg/kg dry wt	< 0.014	0.159	< 0.014	0.097	0.072
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.014	0.20	< 0.014	0.138	0.102
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.033	0.29	< 0.033	0.196	0.146
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.033	0.29	< 0.033	0.194	0.145
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.014	0.24	< 0.014	0.159	0.125
Benzo[e]pyrene	mg/kg dry wt	< 0.014	0.121	< 0.014	0.088	0.068
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.014	0.130	< 0.014	0.107	0.070
Benzo[k]fluoranthene	mg/kg dry wt	< 0.014	0.095	< 0.014	0.063	0.052
Chrysene	mg/kg dry wt	< 0.014	0.157	< 0.014	0.102	0.077
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.014	0.024	< 0.014	< 0.014	< 0.014
Fluoranthene	mg/kg dry wt	< 0.014	0.33	< 0.014	0.169	0.145
Fluorene	mg/kg dry wt	< 0.014	< 0.016	< 0.014	< 0.014	< 0.014
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.014	0.133	< 0.014	0.094	0.069
Naphthalene	mg/kg dry wt	< 0.07	< 0.08	< 0.07	< 0.07	< 0.07
Perylene	mg/kg dry wt	< 0.014	0.051	< 0.014	0.033	0.027

Sample Type: Soil						
Sample Name:		TP7 3.0m	TP8 Sur	TP8 1.0m	TP8 2.0m	TP9 Sur
Lab Number:		3108552.21	3108552.22	3108552.23	3108552.24	3108552.25
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Phenanthrene	mg/kg dry wt	< 0.014	0.095	< 0.014	0.044	0.042
Pyrene	mg/kg dry wt	< 0.014	0.30	< 0.014	0.165	0.132

Sample Name:		TP9 1.5m	TP9 2.5m	TP10 Sur	TP10 0.8m	TP10 2.0m
Lab Number:		3108552.26	3108552.27	3108552.28	3108552.29	3108552.30
Individual Tests						
Dry Matter	g/100g as rcvd	72	69	77	67	61
TCLP Weight of Sample Taken	g	-	50	-	-	50
TCLP Initial Sample pH	pH Units	-	8.9	-	-	9.0
TCLP Acid Adjusted Sample pH	pH Units	-	2.7	-	-	3.1
TCLP Extractant Type*		-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05
TCLP Extraction Fluid pH	pH Units	-	5.0	-	-	5.0
TCLP Post Extraction Sample pH	pH Units	-	6.6	-	-	6.6
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	13	61	5	7	46
Total Recoverable Boron	mg/kg dry wt	1,320	730	45	1,230	1,720
Total Recoverable Cadmium	mg/kg dry wt	0.75	4.1	0.19	0.13	11.3
Total Recoverable Chromium	mg/kg dry wt	15	40	16	15	93
Total Recoverable Copper	mg/kg dry wt	61	114	28	25	157
Total Recoverable Lead	mg/kg dry wt	31	1,030	39	49	460
Total Recoverable Nickel	mg/kg dry wt	14	22	12	90	127
Total Recoverable Zinc	mg/kg dry wt	111	2,400	94	128	1,860
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	< 0.4	1.0	< 0.4	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.015	< 0.013	< 0.015	< 0.016
2-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.015	< 0.013	0.015	0.018
Acenaphthylene	mg/kg dry wt	< 0.014	< 0.015	< 0.013	< 0.015	< 0.016
Acenaphthene	mg/kg dry wt	< 0.014	< 0.015	< 0.013	< 0.015	< 0.016
Anthracene	mg/kg dry wt	< 0.014	< 0.015	0.013	< 0.015	< 0.016
Benzo[a]anthracene	mg/kg dry wt	0.021	< 0.015	0.077	< 0.015	< 0.016
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.024	< 0.015	0.096	< 0.015	< 0.016
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.033	< 0.035	0.135	< 0.035	< 0.039
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.033	< 0.035	0.134	< 0.035	< 0.039
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.033	0.023	0.120	< 0.015	< 0.016
Benzo[e]pyrene	mg/kg dry wt	0.017	< 0.015	0.060	< 0.015	< 0.016
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.014	< 0.015	0.058	< 0.015	< 0.016
Benzo[k]fluoranthene	mg/kg dry wt	< 0.014	< 0.015	0.050	< 0.015	< 0.016
Chrysene	mg/kg dry wt	0.020	< 0.015	0.078	0.015	< 0.016
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.014	< 0.015	< 0.013	< 0.015	< 0.016
Fluoranthene	mg/kg dry wt	0.039	0.024	0.150	< 0.015	0.017
Fluorene	mg/kg dry wt	< 0.014	< 0.015	< 0.013	< 0.015	< 0.016
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.014	< 0.015	0.052	< 0.015	< 0.016
Naphthalene	mg/kg dry wt	< 0.07	< 0.08	< 0.07	< 0.08	< 0.08
Perylene	mg/kg dry wt	0.017	< 0.015	0.025	0.031	< 0.016
Phenanthrene	mg/kg dry wt	< 0.014	0.017	0.038	0.016	< 0.016
Pyrene	mg/kg dry wt	0.037	0.019	0.138	< 0.015	< 0.016

Sample Name:		TP11 Sur	TP11 0.6m	TP11 1.5m	TP12 Sur	TP12 1.2m
Lab Number:		3108552.31	3108552.32	3108552.33	3108552.34	3108552.35
Individual Tests						
Dry Matter	g/100g as rcvd	66	72	67	71	70
TCLP Weight of Sample Taken	g	-	-	-	50	-
TCLP Initial Sample pH	pH Units	-	-	-	9.2	-
TCLP Acid Adjusted Sample pH	pH Units	-	-	-	2.9	-

Sample Type: Soil						
Sample Name:		TP11 Sur	TP11 0.6m	TP11 1.5m	TP12 Sur	TP12 1.2m
Lab Number:		3108552.31	3108552.32	3108552.33	3108552.34	3108552.35
Individual Tests						
TCLP Extractant Type*		-	-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-
TCLP Extraction Fluid pH	pH Units	-	-	-	5.0	-
TCLP Post Extraction Sample pH	pH Units	-	-	-	6.6	-
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	5	3	3	9	9
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	< 20	960	1,660
Total Recoverable Cadmium	mg/kg dry wt	0.31	< 0.10	< 0.10	0.25	0.21
Total Recoverable Chromium	mg/kg dry wt	9	7	8	14	13
Total Recoverable Copper	mg/kg dry wt	22	10	13	31	29
Total Recoverable Lead	mg/kg dry wt	51	16.8	17.6	30	34
Total Recoverable Nickel	mg/kg dry wt	5	3	4	55	50
Total Recoverable Zinc	mg/kg dry wt	76	25	30	143	110
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	< 0.4	< 0.4	15.1	11.5
1-Methylnaphthalene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	< 0.014	< 0.015
2-Methylnaphthalene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	< 0.014	< 0.015
Acenaphthylene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	0.014	0.014
Acenaphthene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	0.033	0.036
Anthracene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	0.37	0.28
Benzo[a]anthracene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	1.23	0.90
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.015	< 0.014	< 0.015	1.13	0.97
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.036	< 0.034	< 0.035	1.70	1.44
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.036	< 0.033	< 0.035	1.67	1.42
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	1.40	1.17
Benzo[e]pyrene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	0.63	0.55
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	0.57	0.53
Benzo[k]fluoranthene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	0.55	0.48
Chrysene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	1.23	0.89
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	0.144	0.128
Fluoranthene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	3.0	2.0
Fluorene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	0.036	0.036
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	0.66	0.58
Naphthalene	mg/kg dry wt	< 0.08	< 0.07	< 0.08	< 0.07	< 0.08
Perylene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	0.29	0.25
Phenanthrene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	1.18	0.76
Pyrene	mg/kg dry wt	< 0.015	< 0.014	< 0.015	2.6	1.86

Sample Name:		TP12 2.7m	TP13 Sur	TP13 1.0m	TP13 3.2m
Lab Number:		3108552.36	3108552.37	3108552.38	3108552.39
Individual Tests					
Dry Matter	g/100g as rcvd	65	72	72	78
TCLP Weight of Sample Taken	g	-	-	50	-
TCLP Initial Sample pH	pH Units	-	-	9.0	-
TCLP Acid Adjusted Sample pH	pH Units	-	-	3.1	-
TCLP Extractant Type*		-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-
TCLP Extraction Fluid pH	pH Units	-	-	4.9	-
TCLP Post Extraction Sample pH	pH Units	-	-	6.1	-
7 Heavy metals plus Boron					
Total Recoverable Arsenic	mg/kg dry wt	2	5	10	16
Total Recoverable Boron	mg/kg dry wt	830	< 20	75	89
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.24	4.6	0.68
Total Recoverable Chromium	mg/kg dry wt	9	11	43	18

Sample Type: Soil					
Sample Name:		TP12 2.7m	TP13 Sur	TP13 1.0m	TP13 3.2m
Lab Number:		3108552.36	3108552.37	3108552.38	3108552.39
7 Heavy metals plus Boron					
Total Recoverable Copper	mg/kg dry wt	14	24	49	63
Total Recoverable Lead	mg/kg dry wt	18.0	73	350	189
Total Recoverable Nickel	mg/kg dry wt	6	8	11	14
Total Recoverable Zinc	mg/kg dry wt	32	115	250	380
Polycyclic Aromatic Hydrocarbons Screening in Soil*					
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	0.4	2.6	2.8
1-Methylnaphthalene	mg/kg dry wt	< 0.015	< 0.014	< 0.014	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.015	< 0.014	< 0.014	< 0.013
Acenaphthylene	mg/kg dry wt	< 0.015	< 0.014	< 0.014	< 0.013
Acenaphthene	mg/kg dry wt	< 0.015	< 0.014	< 0.014	< 0.013
Anthracene	mg/kg dry wt	< 0.015	< 0.014	0.019	0.020
Benzo[a]anthracene	mg/kg dry wt	< 0.015	0.033	0.167	0.190
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.015	0.047	0.29	0.30
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.037	0.061	0.43	0.45
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.037	0.060	0.43	0.45
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.015	0.052	0.37	0.39
Benzo[e]pyrene	mg/kg dry wt	< 0.015	0.029	0.21	0.22
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.015	0.027	0.29	0.29
Benzo[k]fluoranthene	mg/kg dry wt	< 0.015	0.022	0.139	0.152
Chrysene	mg/kg dry wt	< 0.015	0.033	0.165	0.21
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.015	< 0.014	0.043	0.044
Fluoranthene	mg/kg dry wt	< 0.015	0.070	0.23	0.30
Fluorene	mg/kg dry wt	< 0.015	< 0.014	< 0.014	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.015	0.022	0.26	0.27
Naphthalene	mg/kg dry wt	< 0.08	< 0.07	< 0.07	< 0.07
Perylene	mg/kg dry wt	< 0.015	< 0.014	0.094	0.093
Phenanthrene	mg/kg dry wt	< 0.015	0.025	0.037	0.040
Pyrene	mg/kg dry wt	< 0.015	0.060	0.23	0.27

Sample Type: Aqueous						
Sample Name:		TP3 2.0m [TCLP Extract]	TP5 3.0m [TCLP Extract]	TP9 2.5m [TCLP Extract]	TP10 2.0m [TCLP Extract]	TP12 Sur [TCLP Extract]
Lab Number:		3108552.40	3108552.41	3108552.42	3108552.43	3108552.44
Individual Tests						
Total Boron	g/m³	-	5.8	-	17.9	4.1
Total Copper	g/m³	0.029	-	-	-	-
Total Lead	g/m³	0.28	-	0.037	-	-
Total Zinc	g/m³	2.4	-	6.4	-	-

Sample Name:		TP13 1.0m [TCLP Extract]
Lab Number:		3108552.45
Individual Tests		
Total Lead	g/m³	0.0070

Analyst's Comments

Amended Report: This certificate of analysis replaces report '3108552-SPv2' issued on 17-Nov-2022 at 3:31 pm.
Reason for amendment: TCLP metals added to 6 samples.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-39
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-39
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-39
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.024 mg/kg dry wt	1-39
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.024 mg/kg dry wt	1-39
7 Heavy metals plus Boron	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 20 mg/kg dry wt	1-39
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, GC-MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.010 - 0.05 mg/kg dry wt	1-39
TCLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1311.	-	9, 15, 27, 30, 34, 38
TCLP Profile			
TCLP Weight of Sample Taken	Gravimetric. US EPA 1311.	0.1 g	9, 15, 27, 30, 34, 38
TCLP Initial Sample pH	pH meter. US EPA 1311.	0.1 pH Units	9, 15, 27, 30, 34, 38
TCLP Acid Adjusted Sample pH	pH meter. US EPA 1311.	0.1 pH Units	9, 15, 27, 30, 34, 38
TCLP Extractant Type*	US EPA 1311.	-	9, 15, 27, 30, 34, 38
TCLP Extraction Fluid pH	pH meter. US EPA 1311.	0.1 pH Units	9, 15, 27, 30, 34, 38
TCLP Post Extraction Sample pH	pH meter. US EPA 1311.	0.1 pH Units	9, 15, 27, 30, 34, 38

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	40-45
Total Boron	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23rd ed. 2017.	0.11 g/m^3	41, 43-44
Total Copper	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23rd ed. 2017.	0.011 g/m^3	40
Total Lead	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23rd ed. 2017.	0.0021 g/m^3	40, 42, 45
Total Zinc	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23rd ed. 2017.	0.021 g/m^3	40, 42

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 14-Nov-2022 and 23-Feb-2023. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Fraser Thomas Limited	**Lab No:**	3113975	SPv2
Contact:	Elliot Bish	**Date Received:**	10-Nov-2022	
	C/- Fraser Thomas Limited	**Date Reported:**	23-Feb-2023	**(Amended)**
	PO Box 204006	**Quote No:**	118001	
	Highbrook	**Order No:**	PO000796	
	Auckland 2161	**Client Reference:**	33097	
		Submitted By:	Ben Laing-McConnell	

Sample Type: Soil

Sample Name:		TR16 0.4m 10-Nov-2022	TR9 0.2m 10-Nov-2022	TR11 0.3m 10-Nov-2022	TR10 0.5m 10-Nov-2022	TR27 0.3m 10-Nov-2022
Lab Number:		3113975.1	3113975.2	3113975.3	3113975.4	3113975.5
Individual Tests						
Dry Matter	g/100g as rcvd	81	88	73	86	83
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	3	2	3	3	4
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	26	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	0.10	0.11
Total Recoverable Chromium	mg/kg dry wt	12	26	8	25	23
Total Recoverable Copper	mg/kg dry wt	18	17	16	21	19
Total Recoverable Lead	mg/kg dry wt	31	14.9	17.8	20	18.5
Total Recoverable Nickel	mg/kg dry wt	9	14	5	15	13
Total Recoverable Zinc	mg/kg dry wt	54	66	40	69	68
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	< 0.4	< 0.3	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.011	< 0.014	< 0.012	< 0.012
2-Methylnaphthalene	mg/kg dry wt	< 0.018	< 0.011	< 0.014	< 0.017	< 0.018
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.011	< 0.014	< 0.012	< 0.012
Acenaphthene	mg/kg dry wt	< 0.012	< 0.011	< 0.014	< 0.012	< 0.012
Anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.014	< 0.012	< 0.012
Benzo[a]anthracene	mg/kg dry wt	0.017	< 0.011	< 0.014	0.017	0.015
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.021	< 0.011	0.015	0.019	0.018
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.029	< 0.027	< 0.033	< 0.027	< 0.029
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.029	< 0.027	< 0.033	< 0.027	< 0.029
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.022	< 0.011	0.016	0.022	0.023
Benzo[e]pyrene	mg/kg dry wt	0.013	< 0.011	< 0.014	0.011	0.012
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.012	< 0.011	< 0.014	< 0.012	< 0.012
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.014	< 0.012	< 0.012
Chrysene	mg/kg dry wt	0.014	< 0.011	< 0.014	0.013	0.015
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.014	< 0.012	< 0.012
Fluoranthene	mg/kg dry wt	0.026	< 0.011	0.019	0.027	0.030
Fluorene	mg/kg dry wt	< 0.012	< 0.011	< 0.014	< 0.012	< 0.012
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.012	< 0.011	< 0.014	0.011	< 0.012
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.07	< 0.06	< 0.06
Perylene	mg/kg dry wt	< 0.012	< 0.011	< 0.014	< 0.012	< 0.012
Phenanthrene	mg/kg dry wt	0.016	< 0.011	< 0.014	0.013	0.018
Pyrene	mg/kg dry wt	0.026	< 0.011	0.017	0.029	0.029

Sample Type: Soil						
Sample Name:		TR27 OFFAL 4.8m 10-Nov-2022	TR29 2.9m 10-Nov-2022	TR22 1.0 10-Nov-2022	Dup07 10-Nov-2022	Dup08 10-Nov-2022
Lab Number:		3113975.6	3113975.7	3113975.8	3113975.9	3113975.10
Individual Tests						
Dry Matter	g/100g as rcvd	62	69	60	-	-
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	2	2	4	5	4
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	0.29	0.28
Total Recoverable Chromium	mg/kg dry wt	5	7	8	13	9
Total Recoverable Copper	mg/kg dry wt	10	9	19	28	37
Total Recoverable Lead	mg/kg dry wt	11.9	25	21	46	37
Total Recoverable Nickel	mg/kg dry wt	3	3	4	11	8
Total Recoverable Zinc	mg/kg dry wt	33	36	55	144	191
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	< 0.4	< 0.4	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Acenaphthylene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Acenaphthene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Anthracene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.038	< 0.034	< 0.039	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.038	< 0.034	< 0.039	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Chrysene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Fluoranthene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Fluorene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Naphthalene	mg/kg dry wt	< 0.08	< 0.08	< 0.09	-	-
Perylene	mg/kg dry wt	< 0.016	< 0.015	0.071	-	-
Phenanthrene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-
Pyrene	mg/kg dry wt	< 0.016	< 0.015	< 0.017	-	-

Sample Name:		Dup09 10-Nov-2022	TP35 SUR 10-Nov-2022	TP35 1.0m 10-Nov-2022	TP35 2.5m 10-Nov-2022	TP34 SUR 10-Nov-2022
Lab Number:		3113975.11	3113975.12	3113975.13	3113975.14	3113975.15
Individual Tests						
Dry Matter	g/100g as rcvd	-	74	66	53	87
TCLP Weight of Sample Taken	g	-	-	-	50	-
TCLP Initial Sample pH	pH Units	-	-	-	9.1	-
TCLP Acid Adjusted Sample pH	pH Units	-	-	-	2.8	-
TCLP Extractant Type*		-	-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-
TCLP Extraction Fluid pH	pH Units	-	-	-	4.9	-
TCLP Post Extraction Sample pH	pH Units	-	-	-	6.3	-
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	8	5	15	36	16
Total Recoverable Boron	mg/kg dry wt	65	50	590	600	98
Total Recoverable Cadmium	mg/kg dry wt	1.16	0.13	1.24	7.5	0.46
Total Recoverable Chromium	mg/kg dry wt	14	9	31	53	19
Total Recoverable Copper	mg/kg dry wt	54	24	290	430	69

Sample Type: Soil						
Sample Name:		Dup09 10-Nov-2022	TP35 SUR 10-Nov-2022	TP35 1.0m 10-Nov-2022	TP35 2.5m 10-Nov-2022	TP34 SUR 10-Nov-2022
Lab Number:		3113975.11	3113975.12	3113975.13	3113975.14	3113975.15
7 Heavy metals plus Boron						
Total Recoverable Lead	mg/kg dry wt	87	29	410	930	940
Total Recoverable Nickel	mg/kg dry wt	13	8	127	91	15
Total Recoverable Zinc	mg/kg dry wt	290	66	1,550	3,800	320
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	-	0.8	< 0.4	2.8	0.3
1-Methylnaphthalene	mg/kg dry wt	-	< 0.013	< 0.015	< 0.019	< 0.012
2-Methylnaphthalene	mg/kg dry wt	-	< 0.013	< 0.03	< 0.019	< 0.017
Acenaphthylene	mg/kg dry wt	-	< 0.013	< 0.015	< 0.019	< 0.012
Acenaphthene	mg/kg dry wt	-	< 0.013	< 0.015	< 0.019	< 0.012
Anthracene	mg/kg dry wt	-	< 0.013	< 0.015	< 0.019	< 0.012
Benzo[a]anthracene	mg/kg dry wt	-	0.062	< 0.015	0.21	0.021
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	0.076	< 0.015	0.33	0.032
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	-	0.115	< 0.036	0.48	0.042
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	-	0.114	< 0.036	0.48	0.042
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	0.089	< 0.015	0.36	0.040
Benzo[e]pyrene	mg/kg dry wt	-	0.040	< 0.015	0.190	0.025
Benzo[g,h,i]perylene	mg/kg dry wt	-	0.046	< 0.015	0.20	0.022
Benzo[k]fluoranthene	mg/kg dry wt	-	0.041	< 0.015	0.158	0.015
Chrysene	mg/kg dry wt	-	0.065	< 0.015	0.22	0.025
Dibenzo[a,h]anthracene	mg/kg dry wt	-	< 0.013	< 0.015	0.050	< 0.012
Fluoranthene	mg/kg dry wt	-	0.140	< 0.015	0.33	0.028
Fluorene	mg/kg dry wt	-	< 0.013	< 0.015	< 0.019	< 0.012
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	0.048	< 0.015	0.21	0.019
Naphthalene	mg/kg dry wt	-	< 0.07	< 0.08	< 0.10	< 0.06
Perylene	mg/kg dry wt	-	0.021	< 0.015	0.083	< 0.012
Phenanthrene	mg/kg dry wt	-	0.041	< 0.015	0.038	0.016
Pyrene	mg/kg dry wt	-	0.122	< 0.015	0.38	0.028

Sample Name:		TP34 0.5m 10-Nov-2022	TP33 SUR 10-Nov-2022	TP33 0.5m 10-Nov-2022	TP32 SUR 10-Nov-2022	TP32 0.5m 10-Nov-2022
Lab Number:		3113975.16	3113975.17	3113975.18	3113975.19	3113975.20
Individual Tests						
Dry Matter	g/100g as rcvd	65	77	75	70	61
TCLP Weight of Sample Taken	g	-	-	-	-	50
TCLP Initial Sample pH	pH Units	-	-	-	-	8.9
TCLP Acid Adjusted Sample pH	pH Units	-	-	-	-	3.6
TCLP Extractant Type*		-	-	-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05
TCLP Extraction Fluid pH	pH Units	-	-	-	-	4.9
TCLP Post Extraction Sample pH	pH Units	-	-	-	-	6.4
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	3	5	3	5	95
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	< 20	< 20	240
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.24	< 0.10	0.19	2.3
Total Recoverable Chromium	mg/kg dry wt	8	13	8	16	51
Total Recoverable Copper	mg/kg dry wt	16	28	15	44	300
Total Recoverable Lead	mg/kg dry wt	17.9	68	18.2	25	550
Total Recoverable Nickel	mg/kg dry wt	4	8	4	10	47
Total Recoverable Zinc	mg/kg dry wt	33	164	39	85	2,700
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	0.4	< 0.4	< 0.4	< 0.5
1-Methylnaphthalene	mg/kg dry wt	< 0.016	< 0.013	< 0.014	< 0.014	< 0.017
2-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.019	< 0.02	< 0.014	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.016	< 0.013	< 0.014	< 0.014	< 0.017

Sample Type: Soil						
Sample Name:		TP34 0.5m 10-Nov-2022	TP33 SUR 10-Nov-2022	TP33 0.5m 10-Nov-2022	TP32 SUR 10-Nov-2022	TP32 0.5m 10-Nov-2022
Lab Number:		3113975.16	3113975.17	3113975.18	3113975.19	3113975.20
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Acenaphthene	mg/kg dry wt	< 0.016	< 0.013	< 0.014	< 0.014	< 0.017
Anthracene	mg/kg dry wt	< 0.016	< 0.013	< 0.014	< 0.014	< 0.017
Benzo[a]anthracene	mg/kg dry wt	< 0.016	0.027	< 0.014	< 0.014	< 0.017
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.016	0.040	< 0.014	< 0.014	< 0.017
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.037	0.053	< 0.033	< 0.034	< 0.040
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.037	0.053	< 0.033	< 0.034	< 0.040
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.016	0.049	< 0.014	0.015	< 0.017
Benzo[e]pyrene	mg/kg dry wt	< 0.016	0.030	< 0.014	< 0.014	< 0.017
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.016	0.028	< 0.014	< 0.014	< 0.017
Benzo[k]fluoranthene	mg/kg dry wt	< 0.016	0.019	< 0.014	< 0.014	< 0.017
Chrysene	mg/kg dry wt	< 0.016	0.033	< 0.014	< 0.014	< 0.017
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.016	< 0.013	< 0.014	< 0.014	< 0.017
Fluoranthene	mg/kg dry wt	< 0.016	0.041	< 0.014	0.017	< 0.017
Fluorene	mg/kg dry wt	< 0.016	< 0.013	< 0.014	< 0.014	< 0.017
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.016	0.025	< 0.014	< 0.014	< 0.017
Naphthalene	mg/kg dry wt	< 0.08	< 0.07	< 0.07	< 0.07	< 0.09
Perylene	mg/kg dry wt	< 0.016	< 0.013	< 0.014	< 0.014	< 0.017
Phenanthrene	mg/kg dry wt	< 0.016	0.017	< 0.014	< 0.014	< 0.017
Pyrene	mg/kg dry wt	< 0.016	0.044	< 0.014	0.015	< 0.017

Sample Name:		TP32 1.5m 10-Nov-2022	TP14 SUR	TP15 SUR	TP15 0.5m	TP15 0.8m
Lab Number:		3113975.21	3113975.22	3113975.23	3113975.24	3113975.25
Individual Tests						
Dry Matter	g/100g as rcvd	67	77	72	72	71
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	2	5	4	3	3
Total Recoverable Boron	mg/kg dry wt	< 20	50	< 20	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.14	0.21	0.11	0.11
Total Recoverable Chromium	mg/kg dry wt	7	12	8	9	7
Total Recoverable Copper	mg/kg dry wt	17	24	31	16	15
Total Recoverable Lead	mg/kg dry wt	21	33	26	29	24
Total Recoverable Nickel	mg/kg dry wt	4	9	5	4	3
Total Recoverable Zinc	mg/kg dry wt	43	68	139	83	65
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	7.1	4.7	< 0.4	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.015	< 0.013	< 0.014	< 0.014	< 0.014
2-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.02	< 0.03	< 0.03	< 0.014
Acenaphthylene	mg/kg dry wt	< 0.015	0.026	0.016	< 0.014	< 0.014
Acenaphthene	mg/kg dry wt	< 0.015	0.035	0.039	< 0.014	< 0.014
Anthracene	mg/kg dry wt	< 0.015	0.113	0.137	< 0.014	< 0.014
Benzo[a]anthracene	mg/kg dry wt	< 0.015	0.51	0.34	< 0.014	< 0.014
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.015	0.76	0.45	< 0.014	< 0.014
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.036	1.11	0.66	< 0.033	< 0.033
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.036	1.11	0.66	< 0.033	< 0.033
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.015	0.83	0.48	< 0.014	< 0.014
Benzo[e]pyrene	mg/kg dry wt	< 0.015	0.45	0.27	< 0.014	< 0.014
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.015	0.55	0.28	< 0.014	< 0.014
Benzo[k]fluoranthene	mg/kg dry wt	< 0.015	0.30	0.196	< 0.014	< 0.014
Chrysene	mg/kg dry wt	< 0.015	0.48	0.32	< 0.014	< 0.014
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.015	0.116	0.072	< 0.014	< 0.014

Sample Type: Soil						
Sample Name:		TP32 1.5m 10-Nov-2022	TP14 SUR	TP15 SUR	TP15 0.5m	TP15 0.8m
Lab Number:		3113975.21	3113975.22	3113975.23	3113975.24	3113975.25
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Fluoranthene	mg/kg dry wt	< 0.015	0.92	0.68	< 0.014	< 0.014
Fluorene	mg/kg dry wt	< 0.015	0.027	0.040	< 0.014	< 0.014
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.015	0.59	0.31	< 0.014	< 0.014
Naphthalene	mg/kg dry wt	< 0.08	< 0.07	< 0.07	< 0.07	< 0.07
Perylene	mg/kg dry wt	< 0.015	0.22	0.114	< 0.014	< 0.014
Phenanthrene	mg/kg dry wt	< 0.015	0.29	0.38	< 0.014	< 0.014
Pyrene	mg/kg dry wt	< 0.015	0.91	0.57	< 0.014	< 0.014

Sample Name:		TP16 SUR	TP16 0.3m	TP16 0.5m	TP17 SUR	TP17 0.7m
Lab Number:		3113975.26	3113975.27	3113975.28	3113975.29	3113975.30
Individual Tests						
Dry Matter	g/100g as rcvd	85	76	75	80	71
TCLP Weight of Sample Taken	g	-	-	-	-	50
TCLP Initial Sample pH	pH Units	-	-	-	-	7.4
TCLP Acid Adjusted Sample pH	pH Units	-	-	-	-	1.6
TCLP Extractant Type*		-	-	-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05
TCLP Extraction Fluid pH	pH Units	-	-	-	-	4.9
TCLP Post Extraction Sample pH	pH Units	-	-	-	-	4.9
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	4	14	6	4	5
Total Recoverable Boron	mg/kg dry wt	< 20	360	< 20	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	0.11	0.32	0.33	< 0.10	0.32
Total Recoverable Chromium	mg/kg dry wt	24	12	10	6	12
Total Recoverable Copper	mg/kg dry wt	21	25	18	13	32
Total Recoverable Lead	mg/kg dry wt	22	200	107	20	250
Total Recoverable Nickel	mg/kg dry wt	14	47	9	5	9
Total Recoverable Zinc	mg/kg dry wt	79	158	127	44	175
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	0.6	1.0	0.9	1.4	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.013	< 0.013	< 0.013	< 0.014
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.013	< 0.02	< 0.013	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.013	< 0.013	< 0.013	< 0.014
Acenaphthene	mg/kg dry wt	< 0.012	< 0.013	< 0.013	< 0.013	< 0.014
Anthracene	mg/kg dry wt	< 0.012	< 0.013	0.016	0.019	< 0.014
Benzo[a]anthracene	mg/kg dry wt	0.047	0.070	0.069	0.095	< 0.014
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.055	0.086	0.082	0.142	< 0.014
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.087	0.138	0.127	0.21	< 0.033
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.086	0.136	0.125	0.21	< 0.033
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.065	0.122	0.116	0.162	0.016
Benzo[e]pyrene	mg/kg dry wt	0.029	0.060	0.057	0.084	< 0.014
Benzo[g,h,i]perylene	mg/kg dry wt	0.036	0.068	0.066	0.102	< 0.014
Benzo[k]fluoranthene	mg/kg dry wt	0.030	0.049	0.044	0.069	< 0.014
Chrysene	mg/kg dry wt	0.049	0.081	0.083	0.105	< 0.014
Dibenzo[a,h]anthracene	mg/kg dry wt	0.012	0.018	0.013	0.022	< 0.014
Fluoranthene	mg/kg dry wt	0.108	0.142	0.135	0.20	< 0.014
Fluorene	mg/kg dry wt	< 0.012	< 0.013	< 0.013	< 0.013	< 0.014
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.037	0.072	0.071	0.098	< 0.014
Naphthalene	mg/kg dry wt	< 0.06	< 0.07	< 0.07	< 0.07	< 0.07
Perylene	mg/kg dry wt	0.015	0.020	0.020	0.036	< 0.014
Phenanthrene	mg/kg dry wt	0.022	0.034	0.041	0.067	0.014
Pyrene	mg/kg dry wt	0.091	0.131	0.132	0.179	< 0.014

Sample Type: Soil						
Sample Name:		TP17 3.7m	TP18 SUR	TP18 1.2m	TP19 SUR	TP19 0.8m
Lab Number:		3113975.31	3113975.32	3113975.33	3113975.34	3113975.35
Individual Tests						
Dry Matter	g/100g as rcvd	72	75	71	70	63
TCLP Weight of Sample Taken	g	50	-	-	-	-
TCLP Initial Sample pH	pH Units	8.0	-	-	-	-
TCLP Acid Adjusted Sample pH	pH Units	1.7	-	-	-	-
TCLP Extractant Type*		NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-	-	-
TCLP Extraction Fluid pH	pH Units	4.9	-	-	-	-
TCLP Post Extraction Sample pH	pH Units	5.1	-	-	-	-
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	34	6	2	6	2
Total Recoverable Boron	mg/kg dry wt	210	84	< 20	60	< 20
Total Recoverable Cadmium	mg/kg dry wt	2.9	0.26	< 0.10	0.34	< 0.10
Total Recoverable Chromium	mg/kg dry wt	27	11	8	12	4
Total Recoverable Copper	mg/kg dry wt	89	32	13	40	10
Total Recoverable Lead	mg/kg dry wt	270	73	21	56	9.7
Total Recoverable Nickel	mg/kg dry wt	31	17	4	16	2
Total Recoverable Zinc	mg/kg dry wt	960	110	31	112	34
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	2.5	< 0.4	< 0.4	4.0	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.013	< 0.014	< 0.014	< 0.016
2-Methylnaphthalene	mg/kg dry wt	< 0.02	< 0.02	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.014	< 0.013	< 0.014	0.017	< 0.016
Acenaphthene	mg/kg dry wt	< 0.014	< 0.013	< 0.014	0.018	< 0.016
Anthracene	mg/kg dry wt	0.014	< 0.013	< 0.014	0.087	< 0.016
Benzo[a]anthracene	mg/kg dry wt	0.24	0.019	< 0.014	0.32	< 0.016
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.32	0.026	< 0.014	0.36	< 0.016
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.46	0.036	< 0.034	0.54	< 0.037
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.46	0.035	< 0.034	0.53	< 0.037
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.35	0.034	< 0.014	0.41	< 0.016
Benzo[e]pyrene	mg/kg dry wt	0.172	0.018	< 0.014	0.21	< 0.016
Benzo[g,h,i]perylene	mg/kg dry wt	0.165	0.017	< 0.014	0.21	< 0.016
Benzo[k]fluoranthene	mg/kg dry wt	0.139	0.015	< 0.014	0.172	< 0.016
Chrysene	mg/kg dry wt	0.21	0.018	< 0.014	0.29	< 0.016
Dibenzo[a,h]anthracene	mg/kg dry wt	0.043	< 0.013	< 0.014	0.050	< 0.016
Fluoranthene	mg/kg dry wt	0.21	0.033	< 0.014	0.65	< 0.016
Fluorene	mg/kg dry wt	< 0.014	< 0.013	< 0.014	0.015	< 0.016
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.184	0.019	< 0.014	0.22	< 0.016
Naphthalene	mg/kg dry wt	< 0.07	< 0.07	< 0.07	< 0.07	< 0.08
Perylene	mg/kg dry wt	0.082	< 0.013	< 0.014	0.093	< 0.016
Phenanthrene	mg/kg dry wt	0.021	0.015	< 0.014	0.21	< 0.016
Pyrene	mg/kg dry wt	0.37	0.034	< 0.014	0.60	< 0.016

Sample Name:		TP20 SUR	TP20 1.5m	TP21 SUR	TP21 1.0m	TP22 SUR
Lab Number:		3113975.36	3113975.37	3113975.38	3113975.39	3113975.40
Individual Tests						
Dry Matter	g/100g as rcvd	69	63	76	71	65
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	5	< 2	3	3	4
Total Recoverable Boron	mg/kg dry wt	26	< 20	< 20	< 20	22
Total Recoverable Cadmium	mg/kg dry wt	0.25	< 0.10	0.11	0.11	0.22
Total Recoverable Chromium	mg/kg dry wt	11	4	7	6	8
Total Recoverable Copper	mg/kg dry wt	31	10	14	10	26
Total Recoverable Lead	mg/kg dry wt	65	10.8	39	24	33
Total Recoverable Nickel	mg/kg dry wt	11	2	5	4	8

Sample Type: Soil						
Sample Name:		TP20 SUR	TP20 1.5m	TP21 SUR	TP21 1.0m	TP22 SUR
Lab Number:		3113975.36	3113975.37	3113975.38	3113975.39	3113975.40
7 Heavy metals plus Boron						
Total Recoverable Zinc	mg/kg dry wt	107	34	55	340	136
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	0.9	< 0.4	0.7	< 0.4	0.6
1-Methylnaphthalene	mg/kg dry wt	< 0.015	< 0.016	< 0.013	< 0.014	< 0.015
2-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.03	< 0.02	< 0.014	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.015	< 0.016	< 0.013	< 0.014	< 0.015
Acenaphthene	mg/kg dry wt	< 0.015	< 0.016	< 0.013	< 0.014	< 0.015
Anthracene	mg/kg dry wt	< 0.015	< 0.016	< 0.013	< 0.014	< 0.015
Benzo[a]anthracene	mg/kg dry wt	0.068	< 0.016	0.052	< 0.014	0.048
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.091	< 0.016	0.076	< 0.014	0.066
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.131	< 0.039	0.100	< 0.034	0.085
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.129	< 0.039	0.099	< 0.034	0.084
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.102	< 0.016	0.085	< 0.014	0.068
Benzo[e]pyrene	mg/kg dry wt	0.053	< 0.016	0.044	< 0.014	0.036
Benzo[g,h,i]perylene	mg/kg dry wt	0.057	< 0.016	0.047	< 0.014	0.034
Benzo[k]fluoranthene	mg/kg dry wt	0.042	< 0.016	0.034	< 0.014	0.027
Chrysene	mg/kg dry wt	0.074	< 0.016	0.051	< 0.014	0.048
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.015	< 0.016	< 0.013	< 0.014	< 0.015
Fluoranthene	mg/kg dry wt	0.115	< 0.016	0.092	< 0.014	0.083
Fluorene	mg/kg dry wt	< 0.015	< 0.016	< 0.013	< 0.014	< 0.015
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.053	< 0.016	0.048	< 0.014	0.034
Naphthalene	mg/kg dry wt	< 0.08	< 0.08	< 0.07	< 0.07	< 0.08
Perylene	mg/kg dry wt	0.095	< 0.016	0.021	< 0.014	0.016
Phenanthrene	mg/kg dry wt	0.032	< 0.016	0.023	< 0.014	0.020
Pyrene	mg/kg dry wt	0.127	< 0.016	0.099	< 0.014	0.080

Sample Name:		TP22 1.0m	TP23 SUR	TP23 1.2m	TP24 SUR	TP24 1.5m
Lab Number:		3113975.41	3113975.42	3113975.43	3113975.44	3113975.45
Individual Tests						
Dry Matter	g/100g as rcvd	60	67	63	77	64
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	2	4	3	3	2
Total Recoverable Boron	mg/kg dry wt	< 20	25	< 20	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.19	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	4	7	7	7	6
Total Recoverable Copper	mg/kg dry wt	10	18	15	13	12
Total Recoverable Lead	mg/kg dry wt	10.0	26	14.3	21	11.0
Total Recoverable Nickel	mg/kg dry wt	2	14	4	4	3
Total Recoverable Zinc	mg/kg dry wt	36	89	41	74	39
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	0.5	< 0.4	< 0.4	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.016	< 0.015	< 0.016	< 0.013	< 0.016
2-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.019	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.016	< 0.015	< 0.016	< 0.013	< 0.016
Acenaphthene	mg/kg dry wt	< 0.016	< 0.015	< 0.016	< 0.013	< 0.016
Anthracene	mg/kg dry wt	< 0.016	< 0.015	< 0.016	< 0.013	< 0.016
Benzo[a]anthracene	mg/kg dry wt	< 0.016	0.041	< 0.016	< 0.013	< 0.016
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.016	0.055	< 0.016	< 0.013	< 0.016
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.039	0.072	< 0.039	< 0.031	< 0.038
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.039	0.072	< 0.039	< 0.031	< 0.037
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.016	0.061	< 0.016	< 0.013	< 0.016

Sample Type: Soil						
Sample Name:		TP22 1.0m	TP23 SUR	TP23 1.2m	TP24 SUR	TP24 1.5m
Lab Number:		3113975.41	3113975.42	3113975.43	3113975.44	3113975.45
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Benzo[e]pyrene	mg/kg dry wt	< 0.016	0.033	< 0.016	< 0.013	< 0.016
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.016	0.038	< 0.016	< 0.013	< 0.016
Benzo[k]fluoranthene	mg/kg dry wt	< 0.016	0.025	< 0.016	< 0.013	< 0.016
Chrysene	mg/kg dry wt	< 0.016	0.043	< 0.016	< 0.013	< 0.016
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.016	< 0.015	< 0.016	< 0.013	< 0.016
Fluoranthene	mg/kg dry wt	< 0.016	0.083	< 0.016	< 0.013	< 0.016
Fluorene	mg/kg dry wt	< 0.016	< 0.015	< 0.016	< 0.013	< 0.016
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.016	0.033	< 0.016	< 0.013	< 0.016
Naphthalene	mg/kg dry wt	< 0.08	< 0.08	< 0.08	< 0.07	< 0.08
Perylene	mg/kg dry wt	< 0.016	0.015	< 0.016	< 0.013	< 0.016
Phenanthrene	mg/kg dry wt	< 0.016	0.032	< 0.016	< 0.013	< 0.016
Pyrene	mg/kg dry wt	< 0.016	0.082	< 0.016	< 0.013	< 0.016

Sample Name:		TP25 SUR	TP25 2.0m	TP26 SUR	TP26 0.8m	TP26 1.5m
Lab Number:		3113975.46	3113975.47	3113975.48	3113975.49	3113975.50
Individual Tests						
Dry Matter	g/100g as rcvd	87	67	83	77	77
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	3	2	3	2	< 2
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	0.14	< 0.10	0.11	0.22	< 0.10
Total Recoverable Chromium	mg/kg dry wt	24	7	18	9	5
Total Recoverable Copper	mg/kg dry wt	18	13	17	14	13
Total Recoverable Lead	mg/kg dry wt	17.8	17.9	19.1	21	13.9
Total Recoverable Nickel	mg/kg dry wt	12	4	10	5	3
Total Recoverable Zinc	mg/kg dry wt	79	27	61	91	47
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.4	< 0.3	< 0.4	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.017	< 0.03	< 0.012	< 0.013	< 0.013
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Acenaphthene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Anthracene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Benzo[a]anthracene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.028	< 0.035	< 0.029	< 0.032	< 0.032
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.028	< 0.035	< 0.029	< 0.032	< 0.031
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Benzo[e]pyrene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Chrysene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Fluoranthene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Fluorene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Naphthalene	mg/kg dry wt	< 0.06	< 0.08	< 0.06	< 0.07	< 0.07
Perylene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Phenanthrene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013
Pyrene	mg/kg dry wt	< 0.012	< 0.015	< 0.012	< 0.013	< 0.013

Sample Type: Soil						
Sample Name:		TP27 SUR	TP27 1.0m	TP27 1.7m	TP28 SUR	TP28 0.5m
Lab Number:		3113975.51	3113975.52	3113975.53	3113975.54	3113975.55
Individual Tests						
Dry Matter	g/100g as rcvd	77	81	72	83	57
TCLP Weight of Sample Taken	g	-	50	-	-	-
TCLP Initial Sample pH	pH Units	-	9.3	-	-	-
TCLP Acid Adjusted Sample pH	pH Units	-	1.8	-	-	-
TCLP Extractant Type*		-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-	-
TCLP Extraction Fluid pH	pH Units	-	4.9	-	-	-
TCLP Post Extraction Sample pH	pH Units	-	5.4	-	-	-
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	4	5	2	3	2
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	0.26	0.24	< 0.10	0.12	< 0.10
Total Recoverable Chromium	mg/kg dry wt	13	13	8	17	6
Total Recoverable Copper	mg/kg dry wt	34	29	12	17	13
Total Recoverable Lead	mg/kg dry wt	48	220	25	22	14.7
Total Recoverable Nickel	mg/kg dry wt	10	6	4	9	4
Total Recoverable Zinc	mg/kg dry wt	118	139	34	68	36
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	2.0	8.8	< 0.4	< 0.3	< 0.5
1-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.012	< 0.014	< 0.012	< 0.018
2-Methylnaphthalene	mg/kg dry wt	< 0.02	< 0.018	< 0.03	< 0.018	< 0.018
Acenaphthylene	mg/kg dry wt	0.018	0.026	< 0.014	< 0.012	< 0.018
Acenaphthene	mg/kg dry wt	< 0.014	< 0.012	< 0.014	< 0.012	< 0.018
Anthracene	mg/kg dry wt	0.018	0.092	< 0.014	< 0.012	< 0.018
Benzo[a]anthracene	mg/kg dry wt	0.160	0.78	< 0.014	< 0.012	< 0.018
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.22	0.83	< 0.014	< 0.012	< 0.018
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.32	1.24	< 0.033	< 0.030	< 0.043
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.32	1.23	< 0.033	< 0.029	< 0.043
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.25	0.98	< 0.014	< 0.012	< 0.018
Benzo[e]pyrene	mg/kg dry wt	0.129	0.50	< 0.014	< 0.012	< 0.018
Benzo[g,h,i]perylene	mg/kg dry wt	0.144	0.52	< 0.014	< 0.012	< 0.018
Benzo[k]fluoranthene	mg/kg dry wt	0.095	0.38	< 0.014	< 0.012	< 0.018
Chrysene	mg/kg dry wt	0.152	0.71	< 0.014	< 0.012	< 0.018
Dibenzo[a,h]anthracene	mg/kg dry wt	0.031	0.123	< 0.014	< 0.012	< 0.018
Fluoranthene	mg/kg dry wt	0.28	1.43	< 0.014	< 0.012	< 0.018
Fluorene	mg/kg dry wt	< 0.014	< 0.012	< 0.014	< 0.012	< 0.018
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.150	0.55	< 0.014	< 0.012	< 0.018
Naphthalene	mg/kg dry wt	< 0.07	< 0.06	< 0.07	< 0.06	< 0.09
Perylene	mg/kg dry wt	0.058	0.21	< 0.014	< 0.012	< 0.018
Phenanthrene	mg/kg dry wt	0.049	0.34	< 0.014	< 0.012	< 0.018
Pyrene	mg/kg dry wt	0.29	1.32	< 0.014	< 0.012	< 0.018

Sample Name:		TP29 SUR	TP29 0.3m	TP30 SUR	TP30 1.5m	TP30 3.5m
Lab Number:		3113975.56	3113975.57	3113975.58	3113975.59	3113975.60
Individual Tests						
Dry Matter	g/100g as rcvd	74	71	78	77	72
TCLP Weight of Sample Taken	g	-	-	-	50	50
TCLP Initial Sample pH	pH Units	-	-	-	9.1	7.2
TCLP Acid Adjusted Sample pH	pH Units	-	-	-	1.7	1.6
TCLP Extractant Type*		-	-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05	NaOH/Acetic acid at pH 4.93 +/- 0.05
TCLP Extraction Fluid pH	pH Units	-	-	-	4.9	4.9
TCLP Post Extraction Sample pH	pH Units	-	-	-	5.1	4.9

Sample Type: Soil						
Sample Name:		TP29 SUR	TP29 0.3m	TP30 SUR	TP30 1.5m	TP30 3.5m
Lab Number:		3113975.56	3113975.57	3113975.58	3113975.59	3113975.60
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	3	< 2	4	6	4
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	0.27	0.32	0.13
Total Recoverable Chromium	mg/kg dry wt	9	7	18	15	15
Total Recoverable Copper	mg/kg dry wt	15	11	23	37	28
Total Recoverable Lead	mg/kg dry wt	19.1	15.7	32	470	83
Total Recoverable Nickel	mg/kg dry wt	4	4	10	8	8
Total Recoverable Zinc	mg/kg dry wt	52	41	95	250	160
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	0.7	< 0.4	0.8	2.3	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.014	< 0.013	< 0.013	< 0.014
2-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.03	< 0.013	0.015	< 0.014
Acenaphthylene	mg/kg dry wt	< 0.014	< 0.014	< 0.013	0.028	< 0.014
Acenaphthene	mg/kg dry wt	< 0.014	< 0.014	< 0.013	0.015	< 0.014
Anthracene	mg/kg dry wt	< 0.014	< 0.014	0.017	0.055	< 0.014
Benzo[a]anthracene	mg/kg dry wt	0.047	< 0.014	0.050	0.127	< 0.014
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.075	< 0.014	0.058	0.176	< 0.014
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.115	< 0.033	0.091	0.25	< 0.034
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.114	< 0.033	0.090	0.25	< 0.034
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.087	< 0.014	0.072	0.183	< 0.014
Benzo[e]pyrene	mg/kg dry wt	0.042	< 0.014	0.033	0.104	< 0.014
Benzo[g,h,i]perylene	mg/kg dry wt	0.059	< 0.014	0.041	0.141	< 0.014
Benzo[k]fluoranthene	mg/kg dry wt	0.036	< 0.014	0.032	0.077	< 0.014
Chrysene	mg/kg dry wt	0.048	< 0.014	0.061	0.145	< 0.014
Dibenzo[a,h]anthracene	mg/kg dry wt	0.016	< 0.014	< 0.013	0.024	< 0.014
Fluoranthene	mg/kg dry wt	0.088	< 0.014	0.147	0.34	< 0.014
Fluorene	mg/kg dry wt	< 0.014	< 0.014	< 0.013	0.016	< 0.014
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.059	< 0.014	0.040	0.118	< 0.014
Naphthalene	mg/kg dry wt	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07
Perylene	mg/kg dry wt	0.020	< 0.014	0.015	0.045	< 0.014
Phenanthrene	mg/kg dry wt	0.021	< 0.014	0.098	0.28	< 0.014
Pyrene	mg/kg dry wt	0.082	< 0.014	0.119	0.32	< 0.014

Sample Name:		TP31 SUR	TP31 1.0m	DUP01	DUP02	DUP03
Lab Number:		3113975.61	3113975.62	3113975.63	3113975.64	3113975.65
Individual Tests						
Dry Matter	g/100g as rcvd	74	66	-	-	-
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	4	2	3	3	3
Total Recoverable Boron	mg/kg dry wt	35	< 20	< 20	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	0.22	< 0.10	0.11	< 0.10	0.15
Total Recoverable Chromium	mg/kg dry wt	11	6	7	7	23
Total Recoverable Copper	mg/kg dry wt	25	10	15	13	17
Total Recoverable Lead	mg/kg dry wt	25	15.5	41	12.3	17.9
Total Recoverable Nickel	mg/kg dry wt	8	3	5	3	12
Total Recoverable Zinc	mg/kg dry wt	85	32	57	38	77
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	0.4	< 0.4	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.015	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.03	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.013	< 0.015	-	-	-
Acenaphthene	mg/kg dry wt	< 0.013	< 0.015	-	-	-
Anthracene	mg/kg dry wt	< 0.013	< 0.015	-	-	-
Benzo[a]anthracene	mg/kg dry wt	0.032	< 0.015	-	-	-

Sample Type: Soil						
Sample Name:		TP31 SUR	TP31 1.0m	DUP01	DUP02	DUP03
Lab Number:		3113975.61	3113975.62	3113975.63	3113975.64	3113975.65
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.043	< 0.015	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.066	< 0.036	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.065	< 0.036	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.048	< 0.015	-	-	-
Benzo[e]pyrene	mg/kg dry wt	0.021	< 0.015	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.029	< 0.015	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	0.024	< 0.015	-	-	-
Chrysene	mg/kg dry wt	0.034	< 0.015	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.013	< 0.015	-	-	-
Fluoranthene	mg/kg dry wt	0.071	< 0.015	-	-	-
Fluorene	mg/kg dry wt	< 0.013	< 0.015	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.031	< 0.015	-	-	-
Naphthalene	mg/kg dry wt	< 0.07	< 0.08	-	-	-
Perylene	mg/kg dry wt	< 0.013	< 0.015	-	-	-
Phenanthrene	mg/kg dry wt	0.019	< 0.015	-	-	-
Pyrene	mg/kg dry wt	0.061	< 0.015	-	-	-

Sample Name:		DUP04	DUP05	DUP06	TP14 0.8m	TP14 1.2m
Lab Number:		3113975.66	3113975.67	3113975.68	3113975.69	3113975.70
Individual Tests						
Dry Matter	g/100g as rcvd	-	-	-	74	69
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	7	3	< 2	5	2
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	< 20	154	28
Total Recoverable Cadmium	mg/kg dry wt	0.20	< 0.10	< 0.10	0.26	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	9	6	9	8
Total Recoverable Copper	mg/kg dry wt	26	14	11	27	15
Total Recoverable Lead	mg/kg dry wt	27.0	18.0	15.2	138	20
Total Recoverable Nickel	mg/kg dry wt	6	4	3	6	5
Total Recoverable Zinc	mg/kg dry wt	134	48	34	98	31
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	-	-	-	0.7	< 0.4
1-Methylnaphthalene	mg/kg dry wt	-	-	-	< 0.014	< 0.015
2-Methylnaphthalene	mg/kg dry wt	-	-	-	< 0.014	< 0.03
Acenaphthylene	mg/kg dry wt	-	-	-	< 0.014	< 0.015
Acenaphthene	mg/kg dry wt	-	-	-	< 0.014	< 0.015
Anthracene	mg/kg dry wt	-	-	-	< 0.014	< 0.015
Benzo[a]anthracene	mg/kg dry wt	-	-	-	0.053	< 0.015
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	-	0.081	< 0.015
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	-	-	-	0.120	< 0.035
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	-	-	-	0.119	< 0.035
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	-	0.091	< 0.015
Benzo[e]pyrene	mg/kg dry wt	-	-	-	0.043	< 0.015
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	-	0.056	< 0.015
Benzo[k]fluoranthene	mg/kg dry wt	-	-	-	0.040	< 0.015
Chrysene	mg/kg dry wt	-	-	-	0.052	< 0.015
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	-	0.014	< 0.015
Fluoranthene	mg/kg dry wt	-	-	-	0.089	< 0.015
Fluorene	mg/kg dry wt	-	-	-	< 0.014	< 0.015
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	-	0.054	< 0.015
Naphthalene	mg/kg dry wt	-	-	-	< 0.07	< 0.08
Perylene	mg/kg dry wt	-	-	-	0.021	< 0.015

Sample Type: Soil						
Sample Name:		DUP04	DUP05	DUP06	TP14 0.8m	TP14 1.2m
Lab Number:		3113975.66	3113975.67	3113975.68	3113975.69	3113975.70
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Phenanthrene	mg/kg dry wt	-	-	-	0.016	< 0.015
Pyrene	mg/kg dry wt	-	-	-	0.091	< 0.015

Sample Type: Aqueous						
Sample Name:		TP17 0.7m [TCLP Extract]	TP17 3.7m [TCLP Extract]	TP27 1.0m [TCLP Extract]	TP30 1.5m [TCLP Extract]	TP30 3.5m [TCLP Extract]
Lab Number:		3113975.71	3113975.72	3113975.73	3113975.74	3113975.75
Individual Tests						
Total Lead	g/m³	0.080	0.031	0.042	0.122	0.0049
Total Zinc	g/m³	-	2.6	-	-	-

Sample Name:		TP35 2.5m [TCLP Extract]	TP32 0.5m [TCLP Extract]
Lab Number:		3113975.76	3113975.77
Individual Tests			
Total Boron	g/m³	1.65	-
Total Copper	g/m³	0.014	< 0.011
Total Lead	g/m³	0.032	0.0025
Total Zinc	g/m³	2.1	3.9

Analyst's Comments

Amended Report: This certificate of analysis replaces report '3113975-SPv1' issued on 17-Nov-2022 at 7:50 am.
Reason for amendment: At the client's request, TCLPs have been added.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-70
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-8, 12-62, 69-70
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-8, 12-62, 69-70
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.024 mg/kg dry wt	1-8, 12-62, 69-70
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.024 mg/kg dry wt	1-8, 12-62, 69-70
7 Heavy metals plus Boron	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 20 mg/kg dry wt	1-70
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, GC-MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.010 - 0.05 mg/kg dry wt	1-8, 12-62, 69-70
TCLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1311.	-	14, 20, 30-31, 52, 59-60
TCLP Profile			

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
TCLP Weight of Sample Taken	Gravimetric. US EPA 1311.	0.1 g	14, 20, 30-31, 52, 59-60
TCLP Initial Sample pH	pH meter. US EPA 1311.	0.1 pH Units	14, 20, 30-31, 52, 59-60
TCLP Acid Adjusted Sample pH	pH meter. US EPA 1311.	0.1 pH Units	14, 20, 30-31, 52, 59-60
TCLP Extractant Type*	US EPA 1311.	-	14, 20, 30-31, 52, 59-60
TCLP Extraction Fluid pH	pH meter. US EPA 1311.	0.1 pH Units	14, 20, 30-31, 52, 59-60
TCLP Post Extraction Sample pH	pH meter. US EPA 1311.	0.1 pH Units	14, 20, 30-31, 52, 59-60

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	71-77
Total Boron	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23rd ed. 2017.	0.11 g/m³	76
Total Copper	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23rd ed. 2017.	0.011 g/m³	76-77
Total Lead	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23rd ed. 2017.	0.0021 g/m³	71-77
Total Zinc	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23rd ed. 2017.	0.021 g/m³	72, 76-77

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 14-Nov-2022 and 23-Feb-2023. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Fraser Thomas Limited	**Lab No:**	3257173	SPv1
Contact:	Elliot Bish	**Date Received:**	27-Apr-2023	
	C/- Fraser Thomas Limited	**Date Reported:**	02-May-2023	
	PO Box 204006	**Quote No:**	92882	
	Highbrook	**Order No:**	PO000883	
	Auckland 2161	**Client Reference:**	33097	
		Submitted By:	Ben Laing-McConnell	

Sample Type: Soil

Sample Name:		HA1 0.2-0.6m 20-Apr-2023	Dup01 20-Apr-2023	Dup02 20-Apr-2023	TP37 0.2m 20-Apr-2023	TP38 0.1m 20-Apr-2023
Lab Number:		3257173.1	3257173.2	3257173.3	3257173.4	3257173.5
Individual Tests						
Dry Matter	g/100g as rcvd	73	-	-	72	75
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	5	5	6	7	5
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	< 20	< 20	28
Total Recoverable Cadmium	mg/kg dry wt	0.19	0.56	< 0.10	0.27	0.18
Total Recoverable Chromium	mg/kg dry wt	14	12	13	14	9
Total Recoverable Copper	mg/kg dry wt	48	48	28	44	26
Total Recoverable Lead	mg/kg dry wt	96	27	18.5	47	37
Total Recoverable Nickel	mg/kg dry wt	8	5	7	23	8
Total Recoverable Zinc	mg/kg dry wt	116	101	45	110	270
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	4.0	-	-	2.1	1.7
1-Methylnaphthalene	mg/kg dry wt	< 0.014	-	-	< 0.014	< 0.014
2-Methylnaphthalene	mg/kg dry wt	< 0.014	-	-	< 0.014	< 0.014
Acenaphthylene	mg/kg dry wt	0.016	-	-	< 0.014	< 0.014
Acenaphthene	mg/kg dry wt	< 0.014	-	-	< 0.014	< 0.014
Anthracene	mg/kg dry wt	0.036	-	-	0.021	0.016
Benzo[a]anthracene	mg/kg dry wt	0.26	-	-	0.186	0.123
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.44	-	-	0.21	0.179
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.67	-	-	0.31	0.26
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.66	-	-	0.31	0.26
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.53	-	-	0.25	0.21
Benzo[e]pyrene	mg/kg dry wt	0.29	-	-	0.126	0.103
Benzo[g,h,i]perylene	mg/kg dry wt	0.35	-	-	0.123	0.111
Benzo[k]fluoranthene	mg/kg dry wt	0.193	-	-	0.097	0.072
Chrysene	mg/kg dry wt	0.29	-	-	0.183	0.121
Dibenzo[a,h]anthracene	mg/kg dry wt	0.082	-	-	0.033	0.027
Fluoranthene	mg/kg dry wt	0.46	-	-	0.32	0.25
Fluorene	mg/kg dry wt	< 0.014	-	-	< 0.014	< 0.014
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.38	-	-	0.124	0.111
Naphthalene	mg/kg dry wt	< 0.07	-	-	< 0.07	< 0.07
Perylene	mg/kg dry wt	0.117	-	-	0.044	0.043
Phenanthrene	mg/kg dry wt	0.096	-	-	0.056	0.041
Pyrene	mg/kg dry wt	0.44	-	-	0.31	0.26

Sample Type: Soil						
Sample Name:		TP38 0.3m 20-Apr-2023	TP38 2.0m 20-Apr-2023	TP39 0.2m 20-Apr-2023	TP39 0.5m 20-Apr-2023	TP40 0.6m 20-Apr-2023
Lab Number:		3257173.6	3257173.7	3257173.8	3257173.9	3257173.10
Individual Tests						
Dry Matter	g/100g as rcvd	77	73	72	78	76
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	5	72	8	5	3
Total Recoverable Boron	mg/kg dry wt	97	510	41	20	47
Total Recoverable Cadmium	mg/kg dry wt	0.15	3.2	0.50	0.17	< 0.10
Total Recoverable Chromium	mg/kg dry wt	10	38	13	11	10
Total Recoverable Copper	mg/kg dry wt	24	410	40	31	16
Total Recoverable Lead	mg/kg dry wt	34	360	79	76	17.4
Total Recoverable Nickel	mg/kg dry wt	8	54	12	10	8
Total Recoverable Zinc	mg/kg dry wt	85	1,640	191	105	46
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	1.4	0.7	14.6	2.4	0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.014	< 0.014	< 0.013	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.014	< 0.014	< 0.013	< 0.013
Acenaphthylene	mg/kg dry wt	< 0.013	< 0.014	0.018	< 0.013	< 0.013
Acenaphthene	mg/kg dry wt	< 0.013	< 0.014	0.129	0.019	< 0.013
Anthracene	mg/kg dry wt	0.016	< 0.014	0.43	0.051	< 0.013
Benzo[a]anthracene	mg/kg dry wt	0.091	0.046	1.00	0.168	0.026
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.143	0.058	1.27	0.22	0.033
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.21	0.086	1.83	0.32	0.049
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.21	0.085	1.81	0.32	0.048
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.160	0.074	1.26	0.25	0.037
Benzo[e]pyrene	mg/kg dry wt	0.081	0.037	0.72	0.135	0.021
Benzo[g,h,i]perylene	mg/kg dry wt	0.099	0.035	0.77	0.141	0.023
Benzo[k]fluoranthene	mg/kg dry wt	0.064	0.026	0.46	0.078	0.016
Chrysene	mg/kg dry wt	0.102	0.049	0.98	0.164	0.027
Dibenzo[a,h]anthracene	mg/kg dry wt	0.023	< 0.014	0.179	0.029	< 0.013
Fluoranthene	mg/kg dry wt	0.194	0.111	2.6	0.37	0.063
Fluorene	mg/kg dry wt	< 0.013	< 0.014	0.087	0.014	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.104	0.036	0.75	0.146	0.021
Naphthalene	mg/kg dry wt	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07
Perylene	mg/kg dry wt	0.040	0.014	0.28	0.050	< 0.013
Phenanthrene	mg/kg dry wt	0.045	0.046	1.28	0.180	0.030
Pyrene	mg/kg dry wt	0.21	0.097	2.5	0.37	0.068

Sample Name:		TP40 1.0m 20-Apr-2023	TP40 2.1m 20-Apr-2023	TP41 cap 0.2m 20-Apr-2023	TP42 cap 0.2m 20-Apr-2023	TP42 cap 1.0m 20-Apr-2023
Lab Number:		3257173.11	3257173.12	3257173.13	3257173.14	3257173.15
Individual Tests						
Dry Matter	g/100g as rcvd	78	69	86	87	72
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	7	2	3	3	3
Total Recoverable Boron	mg/kg dry wt	950	102	< 20	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	0.60	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	29	7	23	26	8
Total Recoverable Copper	mg/kg dry wt	41	17	18	19	16
Total Recoverable Lead	mg/kg dry wt	126	16.4	15.0	15.7	18.2
Total Recoverable Nickel	mg/kg dry wt	49	4	12	13	4
Total Recoverable Zinc	mg/kg dry wt	590	39	65	69	33
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	0.5	< 0.4	1.2	< 0.3	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.015	< 0.012	< 0.012	< 0.014
2-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.015	< 0.012	< 0.012	< 0.014

Sample Type: Soil						
Sample Name:		TP40 1.0m 20-Apr-2023	TP40 2.1m 20-Apr-2023	TP41 cap 0.2m 20-Apr-2023	TP42 cap 0.2m 20-Apr-2023	TP42 cap 1.0m 20-Apr-2023
Lab Number:		3257173.11	3257173.12	3257173.13	3257173.14	3257173.15
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Acenaphthylene	mg/kg dry wt	< 0.013	< 0.015	0.015	< 0.012	< 0.014
Acenaphthene	mg/kg dry wt	< 0.013	< 0.015	< 0.012	< 0.012	< 0.014
Anthracene	mg/kg dry wt	< 0.013	< 0.015	0.027	< 0.012	< 0.014
Benzo[a]anthracene	mg/kg dry wt	0.036	< 0.015	0.062	< 0.012	< 0.014
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.045	< 0.015	0.115	< 0.012	< 0.014
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.065	< 0.035	0.196	< 0.028	< 0.033
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.064	< 0.035	0.195	< 0.027	< 0.033
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.051	< 0.015	0.141	< 0.012	< 0.014
Benzo[e]pyrene	mg/kg dry wt	0.026	< 0.015	0.109	< 0.012	< 0.014
Benzo[g,h,i]perylene	mg/kg dry wt	0.027	< 0.015	0.169	< 0.012	< 0.014
Benzo[k]fluoranthene	mg/kg dry wt	0.021	< 0.015	0.043	< 0.012	< 0.014
Chrysene	mg/kg dry wt	0.035	< 0.015	0.060	< 0.012	< 0.014
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.013	< 0.015	0.037	< 0.012	< 0.014
Fluoranthene	mg/kg dry wt	0.070	< 0.015	0.113	< 0.012	< 0.014
Fluorene	mg/kg dry wt	< 0.013	< 0.015	< 0.012	< 0.012	< 0.014
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.027	< 0.015	0.176	< 0.012	< 0.014
Naphthalene	mg/kg dry wt	< 0.07	< 0.08	< 0.06	< 0.06	< 0.07
Perylene	mg/kg dry wt	0.018	< 0.015	0.032	< 0.012	< 0.014
Phenanthrene	mg/kg dry wt	0.016	< 0.015	0.038	< 0.012	< 0.014
Pyrene	mg/kg dry wt	0.069	< 0.015	0.098	< 0.012	< 0.014

Sample Name:		TP43 cap 0.3m 20-Apr-2023	TP43 cap 0.7m 20-Apr-2023	TP44 cap 0.4m 20-Apr-2023	TP44 IF 1.0m 20-Apr-2023	TP45 0.2m 20-Apr-2023
Lab Number:		3257173.16	3257173.17	3257173.18	3257173.19	3257173.20
Individual Tests						
Dry Matter	g/100g as rcvd	82	71	86	74	87
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	4	5	3	3	2
Total Recoverable Boron	mg/kg dry wt	< 20	159	< 20	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	0.15	0.23	< 0.10	0.14	< 0.10
Total Recoverable Chromium	mg/kg dry wt	18	12	26	7	26
Total Recoverable Copper	mg/kg dry wt	25	22	17	20	17
Total Recoverable Lead	mg/kg dry wt	26	23	16.4	14.7	16.1
Total Recoverable Nickel	mg/kg dry wt	12	16	13	3	13
Total Recoverable Zinc	mg/kg dry wt	76	75	65	56	70
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	0.7	< 0.4	< 0.3	< 0.4	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.014	< 0.012	< 0.013	< 0.012
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.014	< 0.012	< 0.013	< 0.012
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.014	< 0.012	< 0.013	< 0.012
Acenaphthene	mg/kg dry wt	< 0.012	< 0.014	< 0.012	< 0.013	< 0.012
Anthracene	mg/kg dry wt	< 0.012	< 0.014	< 0.012	< 0.013	< 0.012
Benzo[a]anthracene	mg/kg dry wt	0.049	< 0.014	< 0.012	< 0.013	< 0.012
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.063	< 0.014	0.013	< 0.013	< 0.012
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.095	< 0.034	< 0.029	< 0.032	< 0.028
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.094	< 0.034	< 0.029	< 0.032	< 0.028
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.076	< 0.014	0.018	< 0.013	< 0.012
Benzo[e]pyrene	mg/kg dry wt	0.038	< 0.014	< 0.012	< 0.013	< 0.012
Benzo[g,h,i]perylene	mg/kg dry wt	0.039	< 0.014	< 0.012	< 0.013	< 0.012
Benzo[k]fluoranthene	mg/kg dry wt	0.033	< 0.014	< 0.012	< 0.013	< 0.012
Chrysene	mg/kg dry wt	0.050	< 0.014	0.012	< 0.013	< 0.012

Sample Type: Soil						
Sample Name:		TP43 cap 0.3m 20-Apr-2023	TP43 cap 0.7m 20-Apr-2023	TP44 cap 0.4m 20-Apr-2023	TP44 IF 1.0m 20-Apr-2023	TP45 0.2m 20-Apr-2023
Lab Number:		3257173.16	3257173.17	3257173.18	3257173.19	3257173.20
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.014	< 0.012	< 0.013	< 0.012
Fluoranthene	mg/kg dry wt	0.114	< 0.014	0.019	< 0.013	< 0.012
Fluorene	mg/kg dry wt	< 0.012	< 0.014	< 0.012	< 0.013	< 0.012
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.043	< 0.014	< 0.012	< 0.013	< 0.012
Naphthalene	mg/kg dry wt	< 0.06	< 0.07	< 0.06	< 0.07	< 0.06
Perylene	mg/kg dry wt	0.014	< 0.014	< 0.012	< 0.013	< 0.012
Phenanthrene	mg/kg dry wt	0.030	< 0.014	< 0.012	< 0.013	< 0.012
Pyrene	mg/kg dry wt	0.105	< 0.014	0.019	< 0.013	< 0.012

Sample Name:		TP46 0.1m 20-Apr-2023	TP46 0.3m 20-Apr-2023	TP47 0.1m 20-Apr-2023	TP48 0.1m 20-Apr-2023	TP49 0.1m 20-Apr-2023
Lab Number:		3257173.21	3257173.22	3257173.23	3257173.24	3257173.25
Individual Tests						
Dry Matter	g/100g as rcvd	66	65	60	66	69
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	6	5	6	5	4
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	0.24	0.36	0.54	0.44	0.35
Total Recoverable Chromium	mg/kg dry wt	17	14	12	9	9
Total Recoverable Copper	mg/kg dry wt	47	47	47	37	31
Total Recoverable Lead	mg/kg dry wt	21	19.6	26	25	21
Total Recoverable Nickel	mg/kg dry wt	8	7	6	5	5
Total Recoverable Zinc	mg/kg dry wt	72	87	104	122	113
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
2-Methylnaphthalene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Acenaphthylene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Acenaphthene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Anthracene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Benzo[a]anthracene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.016	< 0.016	< 0.017	0.017	< 0.015
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.037	< 0.038	< 0.040	< 0.036	< 0.035
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.037	< 0.038	< 0.040	< 0.036	< 0.035
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	0.020	0.017
Benzo[e]pyrene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Benzo[k]fluoranthene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Chrysene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Fluoranthene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	0.023	0.016
Fluorene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Naphthalene	mg/kg dry wt	< 0.08	< 0.08	< 0.09	< 0.08	< 0.08
Perylene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Phenanthrene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	< 0.015	< 0.015
Pyrene	mg/kg dry wt	< 0.016	< 0.016	< 0.017	0.023	0.018

Sample Name:		TP50 0.1m 20-Apr-2023	TP50 0.3m 20-Apr-2023	TP50 0.5m 20-Apr-2023	TP51 0.1m 20-Apr-2023	TP51 0.25m 20-Apr-2023
Lab Number:		3257173.26	3257173.27	3257173.28	3257173.29	3257173.30
Individual Tests						
Dry Matter	g/100g as rcvd	77	69	76	74	62

Sample Type: Soil						
Sample Name:		TP50 0.1m 20-Apr-2023	TP50 0.3m 20-Apr-2023	TP50 0.5m 20-Apr-2023	TP51 0.1m 20-Apr-2023	TP51 0.25m 20-Apr-2023
Lab Number:		3257173.26	3257173.27	3257173.28	3257173.29	3257173.30
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	5	5	5	6	5
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	30	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	0.14	0.14	0.18	0.23	0.51
Total Recoverable Chromium	mg/kg dry wt	12	15	13	15	10
Total Recoverable Copper	mg/kg dry wt	33	35	36	57	49
Total Recoverable Lead	mg/kg dry wt	34	34	57	47	20
Total Recoverable Nickel	mg/kg dry wt	8	8	13	9	5
Total Recoverable Zinc	mg/kg dry wt	55	78	83	92	115
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	3.1	2.3	3.8	1.9	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.014	< 0.013	< 0.014	< 0.016
2-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.014	< 0.013	< 0.014	< 0.016
Acenaphthylene	mg/kg dry wt	< 0.014	< 0.014	0.017	< 0.014	< 0.016
Acenaphthene	mg/kg dry wt	< 0.014	< 0.014	< 0.013	< 0.014	< 0.016
Anthracene	mg/kg dry wt	0.028	0.037	0.042	0.019	< 0.016
Benzo[a]anthracene	mg/kg dry wt	0.26	0.172	0.27	0.140	< 0.016
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.32	0.22	0.40	0.20	< 0.016
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.48	0.33	0.58	0.29	< 0.038
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.48	0.33	0.57	0.29	< 0.038
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.39	0.23	0.42	0.23	< 0.016
Benzo[e]pyrene	mg/kg dry wt	0.194	0.138	0.25	0.131	< 0.016
Benzo[g,h,i]perylene	mg/kg dry wt	0.189	0.170	0.28	0.150	< 0.016
Benzo[k]fluoranthene	mg/kg dry wt	0.157	0.103	0.165	0.083	< 0.016
Chrysene	mg/kg dry wt	0.25	0.161	0.26	0.138	< 0.016
Dibenzo[a,h]anthracene	mg/kg dry wt	0.051	0.035	0.061	0.031	< 0.016
Fluoranthene	mg/kg dry wt	0.48	0.36	0.54	0.27	< 0.016
Fluorene	mg/kg dry wt	< 0.014	< 0.014	< 0.013	< 0.014	< 0.016
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.21	0.168	0.28	0.148	< 0.016
Naphthalene	mg/kg dry wt	< 0.07	< 0.07	< 0.07	< 0.07	< 0.08
Perylene	mg/kg dry wt	0.076	0.053	0.093	0.048	< 0.016
Phenanthrene	mg/kg dry wt	0.076	0.115	0.124	0.061	< 0.016
Pyrene	mg/kg dry wt	0.44	0.36	0.58	0.28	< 0.016

Sample Name:		TP52 0.1m 20-Apr-2023	TP54 0.1m 20-Apr-2023	TP55 0.1m 20-Apr-2023	TP56 0.1m 20-Apr-2023	TP56 2.3m 20-Apr-2023
Lab Number:		3257173.31	3257173.32	3257173.33	3257173.34	3257173.35
Individual Tests						
Dry Matter	g/100g as rcvd	76	77	94	67	56
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	5	6	7	8	6
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	0.10	0.23	< 0.10	0.40	0.57
Total Recoverable Chromium	mg/kg dry wt	13	13	17	13	11
Total Recoverable Copper	mg/kg dry wt	30	39	37	42	46
Total Recoverable Lead	mg/kg dry wt	21	76	28	27	24
Total Recoverable Nickel	mg/kg dry wt	9	8	10	6	6
Total Recoverable Zinc	mg/kg dry wt	47	112	70	97	155
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	0.6	< 0.4	< 0.3	< 0.4	< 0.5
1-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.013	< 0.011	< 0.015	< 0.018
2-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.013	< 0.011	< 0.015	< 0.018
Acenaphthylene	mg/kg dry wt	< 0.013	< 0.013	< 0.011	< 0.015	< 0.018
Acenaphthene	mg/kg dry wt	< 0.013	< 0.013	< 0.011	< 0.015	< 0.018

Sample Type: Soil						
Sample Name:		TP52 0.1m 20-Apr-2023	TP54 0.1m 20-Apr-2023	TP55 0.1m 20-Apr-2023	TP56 0.1m 20-Apr-2023	TP56 2.3m 20-Apr-2023
Lab Number:		3257173.31	3257173.32	3257173.33	3257173.34	3257173.35
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Anthracene	mg/kg dry wt	< 0.013	< 0.013	< 0.011	< 0.015	< 0.018
Benzo[a]anthracene	mg/kg dry wt	0.050	0.013	< 0.011	0.018	< 0.018
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.060	0.016	< 0.011	0.020	< 0.018
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.090	< 0.031	< 0.025	< 0.035	< 0.043
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.089	< 0.031	< 0.025	< 0.035	< 0.043
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	0.071	0.025	< 0.011	0.028	< 0.018
Benzo[e]pyrene	mg/kg dry wt	0.036	0.015	< 0.011	< 0.015	< 0.018
Benzo[g,h,i]perylene	mg/kg dry wt	0.040	0.014	< 0.011	0.016	< 0.018
Benzo[k]fluoranthene	mg/kg dry wt	0.027	< 0.013	< 0.011	< 0.015	< 0.018
Chrysene	mg/kg dry wt	0.049	0.014	< 0.011	0.018	< 0.018
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.013	< 0.013	< 0.011	< 0.015	< 0.018
Fluoranthene	mg/kg dry wt	0.107	0.017	< 0.011	0.040	< 0.018
Fluorene	mg/kg dry wt	< 0.013	< 0.013	< 0.011	< 0.015	< 0.018
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.042	0.014	< 0.011	0.015	< 0.018
Naphthalene	mg/kg dry wt	< 0.07	< 0.07	< 0.06	< 0.08	< 0.09
Perylene	mg/kg dry wt	0.015	< 0.013	< 0.011	< 0.015	< 0.018
Phenanthrene	mg/kg dry wt	0.024	< 0.013	< 0.011	0.017	< 0.018
Pyrene	mg/kg dry wt	0.097	0.017	< 0.011	0.040	< 0.018

Sample Name:		TP57 0.8m 20-Apr-2023	TP57 1.5m 20-Apr-2023
Lab Number:		3257173.36	3257173.37
Individual Tests			
Dry Matter	g/100g as rcvd	72	70
7 Heavy metals plus Boron			
Total Recoverable Arsenic	mg/kg dry wt	6	5
Total Recoverable Boron	mg/kg dry wt	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	0.23	0.13
Total Recoverable Chromium	mg/kg dry wt	18	14
Total Recoverable Copper	mg/kg dry wt	141	40
Total Recoverable Lead	mg/kg dry wt	66	47
Total Recoverable Nickel	mg/kg dry wt	8	6
Total Recoverable Zinc	mg/kg dry wt	86	74
Polycyclic Aromatic Hydrocarbons Screening in Soil*			
Total of Reported PAHs in Soil	mg/kg dry wt	1.3	6.8
1-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.015
2-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.015
Acenaphthylene	mg/kg dry wt	< 0.014	< 0.015
Acenaphthene	mg/kg dry wt	< 0.014	< 0.015
Anthracene	mg/kg dry wt	0.018	0.077
Benzo[a]anthracene	mg/kg dry wt	0.097	0.61
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.127	0.65
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.193	0.98
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.191	0.96
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	0.166	0.78
Benzo[e]pyrene	mg/kg dry wt	0.087	0.37
Benzo[g,h,i]perylene	mg/kg dry wt	0.089	0.35
Benzo[k]fluoranthene	mg/kg dry wt	0.061	0.31
Chrysene	mg/kg dry wt	0.098	0.59
Dibenzo[a,h]anthracene	mg/kg dry wt	0.021	0.099
Fluoranthene	mg/kg dry wt	0.194	1.21
Fluorene	mg/kg dry wt	< 0.014	< 0.015

Sample Type: Soil			
	Sample Name:	TP57 0.8m 20-Apr-2023	TP57 1.5m 20-Apr-2023
	Lab Number:	3257173.36	3257173.37
Polycyclic Aromatic Hydrocarbons Screening in Soil*			
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.093	0.39
Naphthalene	mg/kg dry wt	< 0.07	< 0.08
Perylene	mg/kg dry wt	0.028	0.156
Phenanthrene	mg/kg dry wt	0.055	0.168
Pyrene	mg/kg dry wt	0.190	1.00

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-37
Total of Reported PAHs in Soil	Sonication extraction, GC-MS/MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1, 4-37
7 Heavy metals plus Boron	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 20 mg/kg dry wt	1-37
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, GC-MS/MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.010 - 0.05 mg/kg dry wt	1, 4-37
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1, 4-37
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.024 mg/kg dry wt	1, 4-37
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.024 mg/kg dry wt	1, 4-37

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 27-Apr-2023 and 01-May-2023. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Martin Cowell - BSc
Client Services Manager - Environmental

FocusAnalytics

Semi Quantitative Analysis of Soil

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Site: 33097

Date sample(s) received: 16/11/2022

Date sample(s) analysed: 06/12/2022

Samples taken by: Elliot Bish

Certificate / Job Number: Q-00219/33097

Qualitative Analysis of Asbestos

Lab ID	Sample ID	Sample Details	Sample Weight (g) (as received)	Fibres Identified
1	TP1 0.6M		761	ORF, NAD
2	TP1 2.0M		673	AMO, CHR, ORF
3	TP1 SUR		679	CHR, ORF
4	TP10 0.8m		558	ORF, SMF, NAD
5	TP10 2.0M		849	CHR, ORF, SMF
6	TP10 SUR		728	ORF, NAD
7	TP11 0.6M		703	ORF, NAD
8	TP11 1.5M		699	ORF, NAD
9	TP11 SUR		571	ORF, NAD
10	TP12 1.2M		732	AMO, CHR, ORF
11	TP12 2.7M		690	ORF, NAD
12	TP12 SUR		629	CHR, ORF
13	TP13 1.0M		782	ORF, NAD
14	TP13 3.2M		1004	CHR, ORF
15	TP13 SUR		705	ORF, NAD
16	TP14 0.8M		631	ORF, NAD
17	TP14 1.2M		627	ORF, NAD
18	TP14 SUR		727	ORF, NAD
19	TP15 0.5M		599	ORF, NAD
20	TP15 0.8M		559	ORF, NAD
21	TP15 SUR		601	ORF, NAD
22	TP16 0.3M		657	CHR, ORF
23	TP16 0.5M		632	CHR, ORF
24	TP16 SUR		783	ORF, NAD
25	TP17 0.7M		691	ORF, NAD
26	TP17 3.7M		601	CHR, ORF
27	TP17 SUR		599	ORF, NAD

Qualitative Analysis of Asbestos

Lab ID	Sample ID	Sample Details	Sample Weight (g) (as received)	Fibres Identified
28	TP18 1.2M		683	ORF, NAD
29	TP18 SUR		654	AMO, CHR, ORF
30	TP19 0.8M		785	ORF, NAD
31	TP19 SUR		634	CHR, ORF, SMF
32	TP2 1.8M		722	ORF, NAD
33	TP2 3.0M		494	AMO, CHR, ORF
34	TP2 SUR		688	ORF, NAD
35	TP20 1.5M		732	ORF, NAD
36	TP20 SUR		654	ORF, NAD
37	TP21 1.0M		793	ORF, NAD
38	TP21 SUR		613	ORF, NAD
39	TP22 1.0M		734	ORF, NAD
40	TP22 SUR		542	ORF, NAD
41	TP23 1.2M		732	ORF, NAD
42	TP23 SUR		676	ORF, NAD
43	TP24 1.5M		733	ORF, NAD
44	TP24 SUR		616	ORF, NAD
45	TP25 2.0M		722	ORF, NAD
46	TP25 SUR		735	ORF, NAD
47	TP26 0.8M		642	ORF, NAD
48	TP26 1.5M		646	ORF, NAD
49	TP26 SUR		761	ORF, NAD
50	TP27 1.0M		644	CHR, ORF
51	TP27 1.7M		692	ORF, NAD
52	TP27 SUR		701	ORF, NAD
53	TP28 0.5M		689	ORF, NAD
54	TP28 SUR		678	ORF, NAD
55	TP29 0.3M		649	ORF, NAD
56	TP29 SUR		617	ORF, NAD
57	TP3 0.7M		850	CHR, ORF
58	TP3 2.0M		776	AMO, CHR, ORF, SMF
59	TP3 SUR		710	ORF, NAD
60	TP30 1.5M		768	ORF, NAD
61	TP30 3.5M		779	ORF, NAD
62	TP30 SUR		699	ORF, NAD
63	TP31 1.0M		732	ORF, NAD
65	TP31 SUR		604	ORF, NAD
66	TP32 0.5M		579	CHR, ORF
67	TP32 1.5M		657	ORF, NAD
68	TP32 SUR		557	ORF, NAD
69	TP33 0.5M		698	ORF, NAD
70	TP33 SUR		675	ORF, NAD
71	TP34 0.5M		722	ORF, NAD
72	TP34 SUR		596	AMO, CHR, ORF

Qualitative Analysis of Asbestos

Lab ID	Sample ID	Sample Details	Sample Weight (g) (as received)	Fibres Identified
73	TP35 1.0M		559	CHR, ORF
74	TP35 2.5M		932	CHR, ORF
75	TP35 SUR		596	CHR, ORF
76	TP4 1.0M		705	CHR, ORF
77	TP4 SUR		698	ORF, NAD
78	TP5 2.0M		779	CHR, ORF
79	TP5 3.0M		681	CHR, ORF
80	TP5 SUR		659	CHR, ORF
81	TP6 1.5M		754	AMO, CHR, ORF
82	TP6 3.0M		663	ORF, NAD
83	TP6 SUR		697	ORF, NAD
84	TP7 1.8M		685	ORF, NAD
85	TP7 3.0M		589	ORF, NAD
86	TP7 SUR		618	ORF, NAD
87	TP8 1.0M		634	ORF, NAD
88	TP8 2.0M		638	CHR, ORF
89	TP8 SUR		654	ORF, NAD
90	TP9 1.5M		667	CHR, ORF
91	TP9 2.5M		619	CHR, ORF, SMF
92	TP9 SUR		682	ORF, NAD
93	TR29 2.9M		802	ORF, NAD
94	TR10 0.5M		746	ORF, NAD
95	TR11 0.3M		679	ORF, NAD
96	TR16 0.4M		729	ORF, NAD
97	TR22 1.0M		824	ORF, NAD
98	TR27 0.3M		743	ORF, NAD
99	TR27 4.8M		782	ORF, NAD
100	TR9 0.2M		747	ORF, NAD

Fibre Identification Key:

CHR – Chrysotile (White Asbestos)
AMO – Amosite (Brown / Grey Asbestos)
CRO – Crocidolite – (Blue Asbestos)
UMF – Unknown Mineral Fibre
ORF – Organic Fibre
SMF – Synthetic Mineral Fibre
NFD – No Fibres Detected
NAD – No Asbestos Detected

Scope of Accreditation:

1. The analytical comments marked (*) stated in the semi-quantitative analysis and the calculations in the semi-quantitative analysis of asbestos in soil are beyond Focus Analytics scope of accreditation.
2. The laboratory is not responsible for sampling errors when we have not taken the sample.
3. This certificate should be read in its entirety and shall not be reproduced except in full, without written approval of the laboratory.

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*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
1	TP1 0.6M	761.2	548.6	27.9	(>10mm) Fraction	75.3	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	154.0	-	NAD	-					
					(<2mm) Fraction	319.3	-	NAD	-					
2	TP1 2.0M	672.7	487.7	27.4	(>10mm) Fraction	100.2	-	NAD	-	0.0138	-	<0.001	0.003	0.003
					(10-2mm) Fraction	152.3	0.0095	FFF	100					
					(<2mm) Fraction	235.2	0.0043	FFF	100					
3	TP1 SUR	679.3	496.0	27.0	(>10mm) Fraction	13.4	-	NAD	-	0.0005	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	146.4	-	NAD	-					
					(<2mm) Fraction	336.2	0.0005	FFF	100					
4	TP10 0.8m	557.9	372.0	33.2	(>10mm) Fraction	57.6	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	88.6	-	NAD	-					
					(<2mm) Fraction	225.8	-	NAD	-					
5	TP10 2.0M	848.6	452.8	46.6	(>10mm) Fraction	48.0	-	NAD	-	0.0060	-	<0.001	0.001	0.001
					(10-2mm) Fraction	140.6	0.0021	FFF	100					
					(<2mm) Fraction	264.2	0.0039	FFF	100					

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*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
6	TP10 SUR	728.0	540.6	25.7	(>10mm) Fraction	74.4	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	173.4	-	NAD	-					
					(<2mm) Fraction	292.8	-	NAD	-					
7	TP11 0.6M	702.7	499.7	28.8	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	20.9	-	NAD	-					
					(<2mm) Fraction	478.8	-	NAD	-					
8	TP11 1.5	699.4	462.5	33.8	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	36.3	-	NAD	-					
					(<2mm) Fraction	426.2	-	NAD	-					
9	TP11 SUR	571.2	345.9	39.4	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	44.0	-	NAD	-					
					(<2mm) Fraction	301.9	-	NAD	-					
10	TP12 1.2M	732.2	477.7	34.7	(>10mm) Fraction	32.2	-	NAD	-	0.0238	-	<0.001	0.005	0.005
					(10-2mm) Fraction	148.1	-	NAD	-					
					(<2mm) Fraction	297.4	0.0238	FFF	100					

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*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
11	TP12 2.7M	690.3	445.3	35.5	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	121.0	-	NAD	-					
					(<2mm) Fraction	324.3	-	NAD	-					
12	TP12 SUR	628.6	439.7	30.0	(>10mm) Fraction	22.8	-	NAD	-	0.0090	-	<0.001	0.002	0.002
					(10-2mm) Fraction	144.7	0.0087	FFF	100					
					(<2mm) Fraction	272.2	0.0003	FFF	100					
13	TP13 1.0M	781.9	569.3	27.1	(>10mm) Fraction	116.3	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	177.2	-	NAD	-					
					(<2mm) Fraction	275.8	-	NAD	-					
14	TP13 3.2M	1003.5	761.0	24.1	(>10mm) Fraction	191.9	-	NAD	-	0.0005	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	287.3	-	NAD	-					
					(<2mm) Fraction	281.8	0.0005	FFF	100					
15	TP13 SUR	704.9	507.3	27.9	(>10mm) Fraction	45.3	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	173.4	-	NAD	-					
					(<2mm) Fraction	288.6	-	NAD	-					

FocusAnalytics

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
16	TP14 0.8M	630.9	436.5	30.7	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	217.4	-	NAD	-					
					(<2mm) Fraction	219.1	-	NAD	-					
17	TP14 1.2M	626.7	414.2	33.8	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	217.9	-	NAD	-					
					(<2mm) Fraction	196.3	-	NAD	-					
18	TP14 SUR	726.8	568.5	21.7	(>10mm) Fraction	83.5	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	243.2	-	NAD	-					
					(<2mm) Fraction	241.8	-	NAD	-					
19	TP15 0.5M	599.0	410.0	31.6	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	169.2	-	NAD	-					
					(<2mm) Fraction	240.8	-	NAD	-					
20	TP15 0.8M	558.9	379.6	32.0	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	170.0	-	NAD	-					
					(<2mm) Fraction	209.6	-	NAD	-					

FocusAnalytics

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
21	TP15 SUR	600.7	436.0	27.3	(>10mm) Fraction	21.4	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	115.6	-	NAD	-					
					(<2mm) Fraction	299.0	-	NAD	-					
22	TP16 0.3m	657.3	484.7	26.2	(>10mm) Fraction	19.8	-	NAD	-	0.0001	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	200.1	-	NAD	-					
					(<2mm) Fraction	264.8	0.0001	FFF	100					
23	TP16 0.5M	631.7	460.6	27.0	(>10mm) Fraction	6.2	-	NAD	-	0.0001	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	238.0	-	NAD	-					
					(<2mm) Fraction	216.4	0.0001	FFF	100					
24	TP16 SUR	782.6	663.8	15.1	(>10mm) Fraction	138.4	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	303.0	-	NAD	-					
					(<2mm) Fraction	222.4	-	NAD	-					
25	TP17 0.7M	690.6	473.5	31.4	(>10mm) Fraction	20.2	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	251.8	-	NAD	-					
					(<2mm) Fraction	201.5	-	NAD	-					

FocusAnalytics

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
26	TP17 3.7M	601.2	287.6	52.1	(>10mm) Fraction	23.3	-	NAD	-	0.0245	-	<0.001	0.009	0.009
					(10-2mm) Fraction	95.1	0.0200	FFF	100					
					(<2mm) Fraction	169.2	0.0045	FFF	100					
27	TP17 SUR	599.4	437.9	26.9	(>10mm) Fraction	15.2	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	112.9	-	NAD	-					
					(<2mm) Fraction	309.8	-	NAD	-					
28	TP18 1.2M	683.2	475.6	30.4	(>10mm) Fraction	14.4	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	140.0	-	NAD	-					
					(<2mm) Fraction	321.2	-	NAD	-					
29	TP18 SUR	654.3	477.8	26.9	(>10mm) Fraction	37.0	-	NAD	-	0.0085	-	<0.001	0.002	0.002
					(10-2mm) Fraction	116.3	0.0085	FFF	100					
					(<2mm) Fraction	324.5	-	NAD	-					
30	TP19 0.8M	784.8	508.2	35.2	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	56.0	-	NAD	-					
					(<2mm) Fraction	452.2	-	NAD	-					

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*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
31	TP19 SUR	633.7	438.6	30.7	(>10mm) Fraction	24.8	-	NAD	-	0.0007	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	116.3	0.0007	FFF	100					
					(<2mm) Fraction	297.5	-	NAD	-					
32	TP2 1.8M	722.0	509.2	29.5	(>10mm) Fraction	25.1	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	195.6	-	NAD	-					
					(<2mm) Fraction	288.5	-	NAD	-					
33	TP2 3.0m	493.6	285.2	42.2	(>10mm) Fraction	26.8	-	NAD	-	0.0025	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	97.0	0.0166	CMP	15					
					(<2mm) Fraction	161.4	-	NAD	-					
34	TP2 SUR	688.4	458.4	33.4	(>10mm) Fraction	15.2	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	153.0	-	NAD	-					
					(<2mm) Fraction	290.2	-	NAD	-					
35	TP20 1.5M	732.0	462.8	36.8	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	15.7	-	NAD	-					
					(<2mm) Fraction	447.1	-	NAD	-					

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*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
36	TP20 SUR	653.7	466.5	28.6	(>10mm) Fraction	49.3	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	150.8	-	NAD	-					
					(<2mm) Fraction	266.4	-	NAD	-					
37	TP21 1.0M	792.8	498.2	37.1	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	40.2	-	NAD	-					
					(<2mm) Fraction	458.0	-	NAD	-					
38	TP21 SUR	612.8	467.3	23.6	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	129.0	-	NAD	-					
					(<2mm) Fraction	338.3	-	NAD	-					
39	TP22 1.0M	734.2	480.0	34.6	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	53.0	-	NAD	-					
					(<2mm) Fraction	427.0	-	NAD	-					
40	TP22 SUR	542.0	377.9	30.3	(>10mm) Fraction	7.7	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	108.0	-	NAD	-					
					(<2mm) Fraction	262.2	-	NAD	-					

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*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
41	TP23 1.2M	731.9	481.5	34.1	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	16.8	-	NAD	-					
					(<2mm) Fraction	464.7	-	NAD	-					
42	TP23 SUR	676.0	448.1	33.7	(>10mm) Fraction	14.4	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	102.7	-	NAD	-					
					(<2mm) Fraction	331.0	-	NAD	-					
43	TP24 1.5M	732.9	481.5	34.2	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	16.8	-	NAD	-					
					(<2mm) Fraction	464.7	-	NAD	-					
44	TP24 SUR	616.1	493.5	19.9	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	40.1	-	NAD	-					
					(<2mm) Fraction	453.4	-	NAD	-					
45	TP25 2.0M	721.8	521.4	27.7	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	29.8	-	NAD	-					
					(<2mm) Fraction	491.6	-	NAD	-					

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*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil														
Date sample(s) received: 16/11/2022 Date sample(s) analysed: 06/12/2022														
Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
46	TP25 SUR	735.2	635.7	13.5	(>10mm) Fraction	120.4	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	297.6	-	NAD	-					
					(<2mm) Fraction	217.7	-	NAD	-					
47	TP26 0.8M	641.6	493.6	23.0	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	107.5	-	NAD	-					
					(<2mm) Fraction	386.1	-	NAD	-					
48	TP26 1.5M	645.7	497.2	22.9	(>10mm) Fraction	10.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	53.2	-	NAD	-					
					(<2mm) Fraction	434.0	-	NAD	-					
49	TP26 SUR	761.0	637.9	16.2	(>10mm) Fraction	98.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	321.2	-	NAD	-					
					(<2mm) Fraction	218.7	-	NAD	-					
50	TP27 1.0M	644.3	500.2	22.3	(>10mm) Fraction	88.1	-	NAD	-	0.0187	-	<0.001	0.004	0.004
					(10-2mm) Fraction	130.8	0.1158	CMP	15					
					(<2mm) Fraction	281.3	0.0013	FFF	100					

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*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
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Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
51	TP27 1.7M	692.3	485.8	29.8	(>10mm) Fraction	6.4	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	72.4	-	NAD	-					
					(<2mm) Fraction	407.0	-	NAD	-					
52	TP27 SUR	700.9	568.0	18.9	(>10mm) Fraction	60.4	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	260.0	-	NAD	-					
					(<2mm) Fraction	247.6	-	NAD	-					
53	TP28 0.5M	689.2	396.0	42.5	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	53.5	-	NAD	-					
					(<2mm) Fraction	342.5	-	NAD	-					
54	TP28 SUR	678.1	521.8	23.0	(>10mm) Fraction	60.8	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	221.4	-	NAD	-					
					(<2mm) Fraction	239.6	-	NAD	-					
55	TP29 0.3M	649.4	445.7	31.3	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	3.9	-	NAD	-					
					(<2mm) Fraction	441.8	-	NAD	-					

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*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
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Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
56	TP29 SUR	617.2	435.7	29.4	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	91.1	-	NAD	-					
					(<2mm) Fraction	344.6	-	NAD	-					
57	TP3 0.7M	850.3	738.9	13.1	(>10mm) Fraction	75.5	-	NAD	-	0.0002	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	246.1	0.0002	FFF	100					
					(<2mm) Fraction	417.3	-	NAD	-					
58	TP3 2.0M	775.9	545.2	29.7	(>10mm) Fraction	60.7	4.3507	CMP	15	0.6597	0.12	<0.001	0.001	0.001
					(10-2mm) Fraction	182.3	0.0050	FFF	100					
					(<2mm) Fraction	302.2	0.0021	FFF	100					
59	TP3 SUR	710.0	501.1	29.4	(>10mm) Fraction	39.1	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	115.3	-	NAD	-					
					(<2mm) Fraction	346.7	-	NAD	-					
60	TP30 1.5M	768.2	568.1	26.0	(>10mm) Fraction	98.7	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	213.7	-	NAD	-					
					(<2mm) Fraction	255.7	-	NAD	-					

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*Semi Quantitative Analysis of Soil

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Date sample(s) received: 16/11/2022
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61	TP30 3.5M	779.0	537.1	31.1	(>10mm) Fraction	16.3	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	248.0	-	NAD	-					
					(<2mm) Fraction	272.8	-	NAD	-					
62	TP30 SUR	699.4	540.0	22.7	(>10mm) Fraction	54.8	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	190.1	-	NAD	-					
					(<2mm) Fraction	295.1	-	NAD	-					
63	TP31 1.0M	731.6	473.7	35.2	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	26.5	-	NAD	-					
					(<2mm) Fraction	447.2	-	NAD	-					
65	TP31 SUR	604.1	448.6	25.7	(>10mm) Fraction	65.9	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	179.6	-	NAD	-					
					(<2mm) Fraction	203.1	-	NAD	-					
66	TP32 0.5M	579.2	371.4	35.9	(>10mm) Fraction	16.5	-	NAD	-	0.0002	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	128.4	-	NAD	-					
					(<2mm) Fraction	226.5	0.0002	FFF	100					

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*Semi Quantitative Analysis of Soil

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Date sample(s) received: 16/11/2022
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67	TP32 1.5M	657.3	428.1	34.8	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	158.1	-	NAD	-					
					(<2mm) Fraction	270.0	-	NAD	-					
68	TP32 SUR	556.9	357.6	35.7	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	105.9	-	NAD	-					
					(<2mm) Fraction	251.7	-	NAD	-					
69	TP33 0.5M	697.7	505.7	27.4	(>10mm) Fraction	10.4	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	207.9	-	NAD	-					
					(<2mm) Fraction	287.4	-	NAD	-					
70	TP33 SUR	675.3	527.2	21.9	(>10mm) Fraction	60.2	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	197.8	-	NAD	-					
					(<2mm) Fraction	269.2	-	NAD	-					
71	TP34 0.5M	721.7	457.1	36.6	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	29.2	-	NAD	-					
					(<2mm) Fraction	427.9	-	NAD	-					

FocusAnalytics

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
72	TP34 SUR	596.1	425.5	28.6	(>10mm) Fraction	5.1	-	NAD	-	0.0119	-	<0.001	0.003	0.003
					(10-2mm) Fraction	204.2	-	NAD	-					
					(<2mm) Fraction	216.2	0.0119	FFF	100					
73	TP35 1.0M	559.4	317.0	43.3	(>10mm) Fraction	0.0	-	NAD	-	0.0005	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	139.6	-	NAD	-					
					(<2mm) Fraction	177.4	0.0005	FFF	100					
74	TP35 2.5M	932.0	581.5	37.6	(>10mm) Fraction	108.0	-	NAD	-	0.0376	-	<0.001	0.007	0.007
					(10-2mm) Fraction	171.9	0.2367	CMP	15					
					(<2mm) Fraction	301.6	0.0021	FFF	100					
75	TP35 SUR	596.1	425.5	28.6	(>10mm) Fraction	5.1	-	NAD	-	0.0001	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	204.2	-	NAD	-					
					(<2mm) Fraction	216.2	0.0001	FFF	100					
76	TP4 1.0M	704.7	523.0	25.7	(>10mm) Fraction	19.8	-	NAD	-	0.0025	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	190.6	0.0022	FFF	100					
					(<2mm) Fraction	312.6	0.0003	FFF	100					

FocusAnalytics

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
77	TP4 SUR	697.6	526.3	24.5	(>10mm) Fraction	45.7	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	157.8	-	NAD	-					
					(<2mm) Fraction	322.8	-	NAD	-					
78	TP5 2.0M	779.2	534.6	31.4	(>10mm) Fraction	157.8	-	NAD	-	0.0034	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	142.9	0.0031	FFF	100					
					(<2mm) Fraction	233.9	0.0003	FFF	100					
79	TP5 3.0M	681.0	492.3	27.7	(>10mm) Fraction	86.0	-	NAD	-	0.0004	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	188.1	-	NAD	-					
					(<2mm) Fraction	218.2	0.0004	FFF	100					
80	TP5 SUR	659.4	482.4	26.8	(>10mm) Fraction	12.9	-	NAD	-	0.0068	-	<0.001	0.001	0.001
					(10-2mm) Fraction	165.7	0.0021	FFF	100					
					(<2mm) Fraction	303.8	0.0047	FFF	100					
81	TP6 1.5M	754.0	556.7	26.2	(>10mm) Fraction	47.6	-	NAD	-	0.0012	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	240.0	-	NAD	-					
					(<2mm) Fraction	269.1	0.0012	FFF	100					

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
82	TP6 3.0M	662.5	454.6	31.3	(>10mm) Fraction	46.9	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	191.6	-	NAD	-					
					(<2mm) Fraction	216.1	-	NAD	-					
83	TP6 SUR	696.6	491.2	29.4	(>10mm) Fraction	16.2	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	90.4	-	NAD	-					
					(<2mm) Fraction	384.6	-	NAD	-					
84	TP7 1.8M	684.9	512.6	25.1	(>10mm) Fraction	63.3	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	165.1	-	NAD	-					
					(<2mm) Fraction	284.2	-	NAD	-					
85	TP7 3.0M	588.6	417.5	29.0	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	232.6	-	NAD	-					
					(<2mm) Fraction	184.9	-	NAD	-					
86	TP7 SUR	618.3	362.3	41.4	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	17.3	-	NAD	-					
					(<2mm) Fraction	345.0	-	NAD	-					

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*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
87	TP8 1.0M	634.4	461.2	27.3	(>10mm) Fraction	16.6	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	231.6	-	NAD	-					
					(<2mm) Fraction	213.0	-	NAD	-					
88	TP8 2.0M	637.9	466.2	26.8	(>10mm) Fraction	45.3	-	NAD	-	0.0023	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	211.2	-	NAD	-					
					(<2mm) Fraction	209.7	0.0023	FFF	100					
89	TP8 SUR	654.2	382.2	41.6	(>10mm) Fraction	8.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	60.1	-	NAD	-					
					(<2mm) Fraction	314.1	-	NAD	-					
90	TP9 1.5M	667.3	491.7	26.3	(>10mm) Fraction	15.8	-	NAD	-	0.0027	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	200.9	-	NAD	-					
					(<2mm) Fraction	275.0	0.0027	FFF	100					
91	TP9 2.5M	618.9	389.0	37.1	(>10mm) Fraction	13.8	-	NAD	-	0.0013	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	139.6	-	NAD	-					
					(<2mm) Fraction	235.6	0.0013	FFF	100					

FocusAnalytics

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
92	TP9 SUR	681.7	524.9	22.9	(>10mm) Fraction	53.7	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	172.4	-	NAD	-					
					(<2mm) Fraction	298.8	-	NAD	-					
93	TR29 2.9M	801.7	556.1	30.6	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	146.1	-	NAD	-					
					(<2mm) Fraction	410.0	-	NAD	-					
94	TR10 0.5M	745.9	632.4	15.1	(>10mm) Fraction	106.1	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	317.8	-	NAD	-					
					(<2mm) Fraction	208.5	-	NAD	-					
95	TR11 0.3M	678.5	502.9	25.8	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	82.1	-	NAD	-					
					(<2mm) Fraction	420.8	-	NAD	-					
96	TR16 0.4M	728.8	571.3	21.5	(>10mm) Fraction	25.2	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	228.7	-	NAD	-					
					(<2mm) Fraction	317.4	-	NAD	-					

FocusAnalytics

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 16/11/2022
Date sample(s) analysed: 06/12/2022

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
97	TR22 1.0M	824.1	479.0	41.9	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	114.9	-	NAD	-					
					(<2mm) Fraction	364.1	-	NAD	-					
98	TR27 0.3M	742.7	615.2	17.1	(>10mm) Fraction	68.1	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	233.4	-	NAD	-					
					(<2mm) Fraction	313.7	-	NAD	-					
99	TR27 4.8M	781.5	493.8	36.8	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	145.6	-	NAD	-					
					(<2mm) Fraction	348.2	-	NAD	-					
100	TR9 0.2M	747.3	589.7	21.1	(>10mm) Fraction	80.4	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	230.4	-	NAD	-					
					(<2mm) Fraction	278.9	-	NAD	-					

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Analysis Method:

Samples submitted have been analysed to determine the mass fraction of asbestos in soil using low powered stereo microscopy followed by polarised light microscopy (PLM) including dispersion staining techniques as documented in (AS 4964-2004), Method for the qualitative identification of asbestos in bulk samples, BRANZ, New Zealand Guidelines for *Assessing and Managing Asbestos in Soils:2017 and (TP 04) our internal method Technical Procedure for Qualitative and Semi Qualitative analysis of asbestos in soil.*

Product Identification Key:

BTP	Bituminous Product	LSE	Loose Fill Insulation
CMP	Cement Product	NAD	No Asbestos Detected
COM	Composite	PPR	Paper Product
FFF	Free Fibres	RPL	Reinforced Plastics
FIB	Fibre Board	TXC	Textured Coating
GCP	Gaskets (compressed)	VNP	Vinyl Products
GRW	Gaskets (rope/woven)	VPP	Vinyl with paper backing
INB	Insulating Board	WVP	Woven Product

Interpretation of Key:

[a] Percentage of Asbestos in product is adopted from HSG 264 - 2012 Asbestos the survey guide, Appendix 2, ACMS in buildings and categorized in our internal Technical Procedure (TP04) for Qualitative and Semi-Quantitative analysis of asbestos in soil. A dash (-) denotes that there was no asbestos found in that fraction.

[b] Total Mass of Asbestos is the sum mass of asbestos-by-asbestos type in product type([a]) plus the mass of free fibre asbestos. A dash (-) denotes that there was no total mass of asbestos calculated asbestos found in that fraction.

[c] Bonded Asbestos Containing Material in the greater than 10mm fraction as percentage of the total sample (% w/w). A dash (-) denotes that there was no bonded asbestos containing materials found in that fraction.

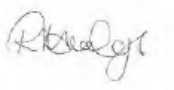
[d] Asbestos as Fibrous Asbestos (FA) in greater than 10mm fraction as percentage of total sample (% w/w).

[e] Asbestos as Asbestos Fines (AF) in less than 10mm fraction as a percentage of total sample (% w/w).

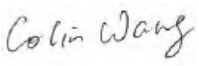
[f] Total Friable Asbestos combining Fibrous Asbestos and Asbestos Fines as the percentage weight for weight of the total sample (% w/w).

Sample Retention: Hold soil samples will only be stored for one month from date of receipt.

Analyst Name: Rebecca Rawlings

Analyst Signature: 

Reviewed By KTP: Colin Wang

Reviewer Signature: 

Focus Analytics

Semi Quantitative Analysis of Soil

Client: Fraser Thomas LTD
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Email: ebish@ftl.co.nz
Address: 21 El Kobar Drive

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Unit C1, 4 Pacific Rise
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Auckland 1060
Tel: +64 (0) 9 525 0568

Site: : 33097

Date sample(s) received: 27/04/2023

Date sample(s) analysed: 3/05/2023

Samples taken by: EB/BLM

Certificate / Job Number: Q-00417/33097

Qualitative Analysis of Asbestos

Lab ID	Sample ID	Sample Details	Sample Weight (g) (as received)	Fibres Identified
1	HA1 0.2-0.6m		569	**ORF, NAD**
2	TP37 0.2m		786	**ORF, NAD**
3	TP38 0.1m		704	**ORF, NAD**
4	TP38 0.3m		644	**CHR, ORF**
5	TP 38 2.0m		753	**ORF, NAD**
6	TP39 0.2m		671	**ORF, NAD**
7	TP39 0.5m		827	**CHR, ORF**
8	TP40 0.6m		765	**ORF, NAD**
9	TP40 1.0m		672	**AMO, CHR, ORF**
10	TP41 cap 0.2m		751	**ORF, NAD**
11	TP42 cap 0.2m		842	**ORF, NAD**
12	TP42 cap 1.0m		708	**ORF, NAD**
13	TP43 cap 0.3m		696	**ORF, NAD**
14	TP43 cap 0.7m		572	**ORF, NAD**
15	TP44 cap 0.4m		835	**ORF, NAD**
16	TP44 IF 1.0m		721	**ORF, NAD**
17	TP45 cap 0.2m		788	**ORF, NAD**
18	TP46 0.1m		677	**ORF, NAD**
19	TP46 0.3m		553	**ORF, NAD**
20	TP47 0.1m		541	**ORF, NAD**
21	TP48 0.1m		498	**ORF, NAD**
22	TP49 0.1m		573	**ORF, NAD**
23	TP50 0.1m		785	**ORF, NAD**
24	TP50 0.3m		673	**CHR, ORF**
25	TP50 0.5m		656	**CHR, ORF**
26	TP51 0.1m		581	**ORF, NAD**
27	TP51 0.25m		530	**ORF, NAD**

Qualitative Analysis of Asbestos

Lab ID	Sample ID	Sample Details	Sample Weight (g) (as received)	Fibres Identified
28	TP52 0.1m		672	**ORF, NAD**
29	TP54 0.1m		639	**CHR, ORF**
30	TP55 0.1m		910	**ORF, NAD**
31	TP56 0.1m		504	**CHR, ORF**
32	TP56 2.3m		533	**ORF, NAD**
33	TP57 0.8m		698	**ORF, NAD**
34	TP57 1.5m		598	**ORF, NAD**

Fibre Identification Key:

CHR – Chrysotile (White Asbestos)
AMO – Amosite (Brown / Grey Asbestos)
CRO – Crocidolite – (Blue Asbestos)
UMF – Unknown Mineral Fibre
ORF – Organic Fibre
SMF – Synthetic Mineral Fibre
NFD – No Fibres Detected
NAD – No Asbestos Detected

Scope of Accreditation:

1. The analytical comments marked (*) stated in the semi-quantitative analysis and the calculations in the semi-quantitative analysis of asbestos in soil are beyond Focus Analytics scope of accreditation.
2. The laboratory is not responsible for sampling errors when we have not taken the sample.
3. This certificate should be read in its entirety and shall not be reproduced except in full, without written approval of the laboratory.

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*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 27/04/2023
Date sample(s) analysed: 3/05/2023

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
1	HA1 0.2-0.6m	569.2	450.8	20.8	(>10mm) Fraction	91.8	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	163.7	-	NAD	-					
					(<2mm) Fraction	195.3	-	NAD	-					
2	TP37 0.2m	786.2	659.0	16.2	(>10mm) Fraction	108.8	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	324.1	-	NAD	-					
					(<2mm) Fraction	226.1	-	NAD	-					
3	TP38 0.1m	704.3	610.7	13.3	(>10mm) Fraction	111.5	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	206.3	-	NAD	-					
					(<2mm) Fraction	292.9	-	NAD	-					
4	TP38 0.3m	643.9	513.3	20.2	(>10mm) Fraction	58.0	-	NAD	-	0.0014	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	148.0	0.0014	FFF	100					
					(<2mm) Fraction	307.3	-	NAD	-					
5	TP 38 2.0m	753.1	588.4	21.9	(>10mm) Fraction	132.7	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	196.0	-	NAD	-					
					(<2mm) Fraction	259.7	-	NAD	-					

FocusAnalytics

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 27/04/2023
Date sample(s) analysed: 3/05/2023

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
6	TP39 0.2m	670.5	552.1	17.6	(>10mm) Fraction	109.4	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	160.4	-	NAD	-					
					(<2mm) Fraction	282.3	-	NAD	-					
7	TP39 0.5m	826.7	678.9	17.8	(>10mm) Fraction	118.1	-	NAD	-	0.0051	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	265.6	0.0051	FFF	100					
					(<2mm) Fraction	295.2	-	NAD	-					
8	TP40 0.6m	765.3	602.0	21.3	(>10mm) Fraction	85.2	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	233.8	-	NAD	-					
					(<2mm) Fraction	283.0	-	NAD	-					
9	TP40 1.0m	671.7	499.4	25.6	(>10mm) Fraction	53.3	-	NAD	-	0.0413	-	<0.001	0.008	0.008
					(10-2mm) Fraction	191.8	0.1273	INB	25					
					(<2mm) Fraction	254.3	0.0095	FFF	100					
10	TP41 cap 0.2m	751.2	663.5	11.7	(>10mm) Fraction	248.9	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	253.9	-	NAD	-					
					(<2mm) Fraction	160.7	-	NAD	-					

FocusAnalytics

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 27/04/2023
Date sample(s) analysed: 3/05/2023

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
11	TP42 cap 0.2m	841.7	720.1	14.4	(>10mm) Fraction	176.8	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	322.6	-	NAD	-					
					(<2mm) Fraction	220.7	-	NAD	-					
12	TP42 cap 1.0m	707.7	516.5	26.9	(>10mm) Fraction	38.7	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	282.5	-	NAD	-					
					(<2mm) Fraction	195.3	-	NAD	-					
13	TP43 cap 0.3m	695.5	595.4	14.3	(>10mm) Fraction	101.7	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	346.7	-	NAD	-					
					(<2mm) Fraction	147.0	-	NAD	-					
14	TP43 cap 0.7m	572.3	408.6	28.6	(>10mm) Fraction	47.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	202.0	-	NAD	-					
					(<2mm) Fraction	159.6	-	NAD	-					
15	TP44 cap 0.4m	834.8	734.5	11.9	(>10mm) Fraction	237.1	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	343.6	-	NAD	-					
					(<2mm) Fraction	153.8	-	NAD	-					

FocusAnalytics

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 27/04/2023
Date sample(s) analysed: 3/05/2023

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
16	TP44 IF 1.0m	721.0	539.9	25.1	(>10mm) Fraction	108.1	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	292.6	-	NAD	-					
					(<2mm) Fraction	139.2	-	NAD	-					
17	TP45 cap 0.2m	788.1	708.6	10.1	(>10mm) Fraction	205.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	368.4	-	NAD	-					
					(<2mm) Fraction	135.2	-	NAD	-					
18	TP46 0.1m	677.1	482.9	28.7	(>10mm) Fraction	26.9	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	174.8	-	NAD	-					
					(<2mm) Fraction	281.2	-	NAD	-					
19	TP46 0.3m	553.2	365.7	33.9	(>10mm) Fraction	36.2	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	183.2	-	NAD	-					
					(<2mm) Fraction	146.3	-	NAD	-					
20	TP47 0.1m	540.6	357.1	33.9	(>10mm) Fraction	23.4	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	149.2	-	NAD	-					
					(<2mm) Fraction	184.5	-	NAD	-					

FocusAnalytics

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 27/04/2023
Date sample(s) analysed: 3/05/2023

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
21	TP48 0.1m	498.0	342.7	31.2	(>10mm) Fraction	25.3	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	186.3	-	NAD	-					
					(<2mm) Fraction	131.1	-	NAD	-					
22	TP49 0.1m	572.9	403.6	29.4	(>10mm) Fraction	31.2	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	191.2	-	NAD	-					
					(<2mm) Fraction	181.2	-	NAD	-					
23	TP50 0.1m	785.2	583.1	25.7	(>10mm) Fraction	140.3	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	213.8	-	NAD	-					
					(<2mm) Fraction	229.0	-	NAD	-					
24	TP50 0.3m	672.5	502.4	25.2	(>10mm) Fraction	109.1	-	NAD	-	0.0001	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	122.0	0.0001	FFF	100					
					(<2mm) Fraction	271.3	-	NAD	-					
25	TP50 0.5m	656.1	537.9	18.0	(>10mm) Fraction	151.8	-	NAD	-	0.0025	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	163.5	0.0025	FFF	100					
					(<2mm) Fraction	222.6	-	NAD	-					

FocusAnalytics

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 27/04/2023
Date sample(s) analysed: 3/05/2023

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
26	TP51 0.1m	580.6	421.9	27.3	(>10mm) Fraction	46.2	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	162.7	-	NAD	-					
					(<2mm) Fraction	213.0	-	NAD	-					
27	TP51 0.25m	530.1	332.9	37.2	(>10mm) Fraction	0.0	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	93.8	-	NAD	-					
					(<2mm) Fraction	239.1	-	NAD	-					
28	TP52 0.1m	672.4	505.6	24.8	(>10mm) Fraction	59.8	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	212.9	-	NAD	-					
					(<2mm) Fraction	232.9	-	NAD	-					
29	TP54 0.1m	639.2	481.5	24.6	(>10mm) Fraction	53.7	-	NAD	-	0.0213	-	<0.001	0.004	0.004
					(10-2mm) Fraction	200.0	0.0201	FFF	100					
					(<2mm) Fraction	227.8	0.0012	FFF	100					
30	TP55 0.1m	910.0	824.5	9.4	(>10mm) Fraction	7.6	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	559.7	-	NAD	-					
					(<2mm) Fraction	257.2	-	NAD	-					

FocusAnalytics

*Semi Quantitative Analysis of Soil

*Semi Quantitative Analysis of Asbestos in Soil

Date sample(s) received: 27/04/2023
Date sample(s) analysed: 3/05/2023

Lab ID	Sample ID	As received weight (g)	Dry weight (g)	Moisture (%)	Fraction size (mm)	Dry fraction weight (g)	Asbestos product weight (g)	Asbestos product type	Percentage of asbestos in product [a]	Total mass of Asbestos in sample [b]	Bonded Asbestos containing material in sample (% w/w) [c]	Asbestos as FA (% w/w) [d]	Asbestos as AF (% w/w) [e]	Total Fibrous Asbestos + Asbestos Fines (Friable) (% w/w) [f]
31	TP56 0.1m	504.0	333.8	33.8	(>10mm) Fraction	12.7	-	NAD	-	0.0095	-	<0.001	0.003	0.003
					(10-2mm) Fraction	124.3	0.0087	FFF	100					
					(<2mm) Fraction	196.8	0.0008	FFF	100					
32	TP56 2.3m	533.0	326.2	38.8	(>10mm) Fraction	55.5	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	140.7	-	NAD	-					
					(<2mm) Fraction	130.0	-	NAD	-					
33	TP57 0.8m	697.6	536.6	23.0	(>10mm) Fraction	142.1	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	161.7	-	NAD	-					
					(<2mm) Fraction	232.8	-	NAD	-					
34	TP57 1.5m	597.6	421.0	29.5	(>10mm) Fraction	70.2	-	NAD	-	-	-	<0.001	<0.001	<0.001
					(10-2mm) Fraction	159.1	-	NAD	-					
					(<2mm) Fraction	191.7	-	NAD	-					

FocusAnalytics

Analysis Method:

Samples submitted have been analysed to determine the mass fraction of asbestos in soil using low powered stereo microscopy followed by polarised light microscopy (PLM) including dispersion staining techniques as documented in (AS 4964-2004), Method for the qualitative identification of asbestos in bulk samples, BRANZ, New Zealand Guidelines for *Assessing and Managing Asbestos in Soils:2017 and (TP 04) our internal method Technical Procedure for Qualitative and Semi Qualitative analysis of asbestos in soil.*

Product Identification Key:

BTP	Bituminous Product	LSE	Loose Fill Insulation
CMP	Cement Product	NAD	No Asbestos Detected
COM	Composite	PPR	Paper Product
FFF	Free Fibres	RPL	Reinforced Plastics
FIB	Fibre Board	TXC	Textured Coating
GCP	Gaskets (compressed)	VNP	Vinyl Products
GRW	Gaskets (rope/woven)	VPP	Vinyl with paper backing
INB	Insulating Board	WVP	Woven Product

Interpretation of Key:

[a] Percentage of Asbestos in product is adopted from HSG 264 - 2012 Asbestos the survey guide, Appendix 2, ACMS in buildings and categorized in our internal Technical Procedure (TP04) for Qualitative and Semi-Quantitative analysis of asbestos in soil. A dash (-) denotes that there was no asbestos found in that fraction.

[b] Total Mass of Asbestos is the sum mass of asbestos-by-asbestos type in product type([a]) plus the mass of free fibre asbestos. A dash (-) denotes that there was no total mass of asbestos calculated asbestos found in that fraction.

[c] Bonded Asbestos Containing Material in the greater than 10mm fraction as percentage of the total sample (% w/w). A dash (-) denotes that there was no bonded asbestos containing materials found in that fraction.

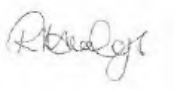
[d] Asbestos as Fibrous Asbestos (FA) in greater than 10mm fraction as percentage of total sample (% w/w).

[e] Asbestos as Asbestos Fines (AF) in less than 10mm fraction as a percentage of total sample (% w/w).

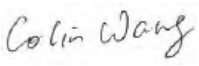
[f] Total Friable Asbestos combining Fibrous Asbestos and Asbestos Fines as the percentage weight for weight of the total sample (% w/w).

Sample Retention: Hold soil samples will only be stored for one month from date of receipt.

Analyst Name: Rebecca Rawlings

Analyst Signature: 

Reviewed By KTP: Colin Wang

Reviewer Signature: 

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Certificate of Analysis

Client:	Fraser Thomas Limited	**Lab No:**	3247082	SPv2
Contact:	Elliot Bish	**Date Received:**	19-Apr-2023	
	C/- Fraser Thomas Limited	**Date Reported:**	05-May-2023	
	PO Box 204006	**Quote No:**	117021	
	Highbrook	**Order No:**	PO000879	
	Auckland 2161	**Client Reference:**	33097	
		Submitted By:	Ben Laing-McConnell	

Sample Type: Sediment

Sample Name:		S1 17-Apr-2023	S2 17-Apr-2023 1:30 pm	S3 17-Apr-2023	S4 17-Apr-2023
Lab Number:		3247082.6	3247082.7	3247082.8	3247082.9
Individual Tests					
Dry Matter	g/100g as rcvd	41	17.9	39	40
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	31	< 20
Heavy metals screen level As,Cd,Cr,Cu,Ni,Pb,Zn					
Total Recoverable Arsenic	mg/kg dry wt	5	8	6	4
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.70	0.52	0.27
Total Recoverable Chromium	mg/kg dry wt	7	12	12	9
Total Recoverable Copper	mg/kg dry wt	14	22	24	15
Total Recoverable Lead	mg/kg dry wt	10.2	15.5	18.9	14.0
Total Recoverable Nickel	mg/kg dry wt	4	7	6	4
Total Recoverable Zinc	mg/kg dry wt	28	151	129	68
Asbestos in Soil					
As Received Weight	g	185.8	166.0	239.4	184.9
Dry Weight	g	97.7	36.0	128.3	80.3
<2mm Subsample Weight	g dry wt	54.9	22.5	54.4	31.8
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.
Description of Asbestos Form		-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Solids*					
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.6	< 1.4	< 0.7	< 0.6
1-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
2-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Acenaphthene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Anthracene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.058	< 0.14	< 0.061	< 0.058
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.057	< 0.14	< 0.061	< 0.058
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Benzo[e]pyrene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Chrysene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Fluorene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03

Sample Type: Sediment					
Sample Name:		S1 17-Apr-2023	S2 17-Apr-2023 1:30 pm	S3 17-Apr-2023	S4 17-Apr-2023
Lab Number:		3247082.6	3247082.7	3247082.8	3247082.9
Polycyclic Aromatic Hydrocarbons Screening in Solids*					
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Naphthalene	mg/kg dry wt	< 0.12	< 0.3	< 0.13	< 0.12
Perylene	mg/kg dry wt	0.07	< 0.06	< 0.03	0.05
Phenanthrene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03
Pyrene	mg/kg dry wt	< 0.03	< 0.06	< 0.03	< 0.03

Sample Type: Aqueous						
Sample Name:		S1 17-Apr-2023	S2 17-Apr-2023	S3 17-Apr-2023	S4 17-Apr-2023	P2 17-Apr-2023 12:30 pm
Lab Number:		3247082.1	3247082.2	3247082.3	3247082.4	3247082.5
Individual Tests						
Total Organic Carbon (TOC)‡	mg/L	-	-	-	-	4.3
pH	pH Units	6.8	6.7	6.7	-	6.9
Total Alkalinity	g/m³ as $CaCO_3$	-	-	-	-	410
Electrical Conductivity (EC)	mS/m	12.7	13.4	12.9	-	102.1
Total Suspended Solids	g/m³	< 3	< 3	6	-	-
Dissolved Boron	g/m³	-	-	-	-	29
Total Boron	g/m³	0.0154	0.078	0.060	-	-
Dissolved Iron	g/m³	-	-	-	-	< 0.02
Total Iron	g/m³	0.57	0.73	0.77	-	-
Dissolved Mercury	g/m³	-	-	-	-	< 0.00008
Total Mercury	g/m³	< 0.00008	< 0.00008	< 0.00008	-	-
Total Potassium	g/m³	3.6	3.7	3.7	-	-
Chloride	g/m³	16.2	16.5	15.9	-	13.4
Total Ammoniacal-N	g/m³	0.025	< 0.010	0.018	-	< 0.010
Nitrite-N	g/m³	0.007	0.003	0.006	-	< 0.002
Nitrate-N	g/m³	0.89	0.81	0.91	-	1.99
Nitrate-N + Nitrite-N	g/m³	0.89	0.82	0.91	-	1.99
Sulphate	g/m³	4.3	3.8	3.5	-	149
Polycyclic Aromatic Hydrocarbons Trace in Water, By Liq/Liq						
Acenaphthene	g/m³	-	-	-	< 0.000008	-
Acenaphthylene	g/m³	-	-	-	< 0.000008	-
Anthracene	g/m³	-	-	-	< 0.000008	-
Benzo[a]anthracene	g/m³	-	-	-	< 0.000008	-
Benzo[a]pyrene (BAP)	g/m³	-	-	-	< 0.000008	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	g/m³	-	-	-	< 0.000008	-
Benzo[g,h,i]perylene	g/m³	-	-	-	< 0.000008	-
Benzo[k]fluoranthene	g/m³	-	-	-	< 0.000008	-
Chrysene	g/m³	-	-	-	< 0.000008	-
Dibenzo[a,h]anthracene	g/m³	-	-	-	< 0.000008	-
Fluoranthene	g/m³	-	-	-	< 0.000008	-
Fluorene	g/m³	-	-	-	< 0.000008	-
Indeno(1,2,3-c,d)pyrene	g/m³	-	-	-	< 0.000008	-
Naphthalene	g/m³	-	-	-	< 0.00004	-
Phenanthrene	g/m³	-	-	-	< 0.000008	-
Pyrene	g/m³	-	-	-	< 0.000008	-

Analyst's Comments

‡ Analysis subcontracted to an external provider. Refer to the Summary of Methods section for more details.

Appendix No.1 - Watercare Report

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Sediment

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	6-9
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	6-9
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	6-9
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	6-9
Total Recoverable Boron	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	20 mg/kg dry wt	6-9
Heavy metals screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	6-9
Polycyclic Aromatic Hydrocarbons Screening in Solids*	Sonication extraction, GC-MS/MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.010 - 0.05 mg/kg dry wt	6-9
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	6-9
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	6-9
<2mm Subsample Weight	Sample dried at 100 to 105°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	6-9
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	6-9
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	6-9

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Total Organic Carbon (TOC)	Total Organic Carbon by Non-dispersive infrared detection - Carbon, Inorganic Carbon and Total Organic Carbon. Subcontracted to Watercare Services Ltd, Auckland.	0.5 mg/L	5
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3, 5
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	1-3
pH	pH meter. APHA 4500-H^+ B 23rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3, 5
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	5
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	1-3, 5
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m^3	1-3
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	5
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.005 g/m^3	5
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0053 g/m^3	1-3

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.02 g/m³	5
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.021 g/m³	1-3
Dissolved Mercury	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m³	5
Total Mercury	Bromine Oxidation followed by Atomic Fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m³	1-3
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.053 g/m³	1-3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	1-3, 5
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH_4-N = NH_4^+-N + NH_3-N). APHA 4500-NH_3 H (modified) 23rd ed. 2017.	0.010 g/m³	1-3, 5
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m³	1-3, 5
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	1-3, 5
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m³	1-3, 5
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	1-3, 5
Polycyclic Aromatic Hydrocarbons Trace in Water, By Liq/Liq	Liquid / liquid extraction, GC-MS/MS analysis. In-house based on US EPA 8270.	0.000005 g/m³	4

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 20-Apr-2023 and 05-May-2023. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Kim Harrison MSc
Client Services Manager - Environmental

watercare
Laboratory Services

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Certificate of Analysis
Laboratory Reference:230502-138

Attention:	Subcontracting .	*Final Report:*	**507967-0**
Client:	**R J HILLS**	*Report Issue Date:*	**04-May-2023**
Address:	**28 Duke Street, Frankton, Hamilton, 3204**	*Received Date:*	**02-May-2023**
		Sampled By:	**Hills**
Client Reference:	**EnvSubWC 314**	*Laboratory Activity Dates:*	**04-May-2023 - 04-May-2023**
Purchase Order:	**159466**	*Quote Reference :*	**15559**

All samples received outside of holding time (DOC - 48 hrs, TOC - 5 days) for analysis. Results may not accurately reflect composition of sample at the time of sampling.

Sample Details	WATERS
Lab Sample ID:	**230502-138-1**
Client Sample ID:	3247082.5
Sample Date/Time	17/04/2023 12:30
Description:	Ground Water

Organics

Total Organic Carbon by Non-dispersive infrared detection

Total Organic Carbon	mg/L	4.3

*Results marked with * are not accredited to International Accreditation New Zealand. A dash indicates no test performed.*

Where samples have been supplied by the client, they are tested as received.
The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Organics				
Total Organic Carbon by Non-dispersive infrared detection				
Total Organic Carbon	APHA (online edition) 5310 B	0.1 mg/L	All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

Watercare Laboratory Services is a division of Watercare Services Limited .

Peter Boniface

KTP Signatory

Appendix E

QA/QC

RPD Calculations

RPD Calculations: Former Tokanui Psychiatric Hospital

Parameter	TP21 (SUR)	DUP01	RPD (%)	TP23 (1.2m)	DUP02	RPD (%)
Total Recoverable Arsenic	3	3	0.00	3.00	3.00	0.00
Total Recoverable Boron	< 20	< 20	-	< 20	< 20	-
Total Recoverable Cadmium	0.11	0.11	0.00	< 0.10	< 0.10	-
Total Recoverable Chromium	7	7	0.00	7	7	0.00
Total Recoverable Copper	14	15	6.90	15	13	14.29
Total Recoverable Lead	39	41	5.00	14.3	12.3	15.04
Total Recoverable Nickel	5	5	0.00	4	3	28.57
Total Recoverable Zinc	55	57	3.57	41	38	7.59

Note: Results in *I talics* exceed 30% RPD. Results in red exceed 50% RPD

Parameter	TP4 (SUR)	DUP07	RPD (%)	TP6 (SUR)	DUP08	RPD (%)
Total Recoverable Arsenic	5	5	0.00	5.00	4.00	22.22
Total Recoverable Boron	< 20	< 20	-	< 20	< 20	-
Total Recoverable Cadmium	0.19	0.29	*41.67*	0.18	0.28	*43.48*
Total Recoverable Chromium	10	13	26.09	9	9	0.00
Total Recoverable Copper	24	28	15.38	24	37	*42.62*
Total Recoverable Lead	43	46	6.74	35	37	5.56
Total Recoverable Nickel	7	11	*44.44*	8	8	0.00
Total Recoverable Zinc	73	144	*65.44*	82	191	*79.85*

Note: Results in *I talics* exceed 30% RPD. Results in red exceed 50% RPD

Parameter	TP25 (SUR)	DUP03	RPD (%)	TP27 (1.0m)	DUP04	RPD (%)
Total Recoverable Arsenic	3	3	0.00	5.00	7.00	*33.33*
Total Recoverable Boron	< 20	< 20	-	< 20	< 20	-
Total Recoverable Cadmium	0.14	0.15	6.90	0.24	0.2	18.18
Total Recoverable Chromium	24	23	4.26	13	11	16.67
Total Recoverable Copper	18	17	5.71	29	26	10.91
Total Recoverable Lead	17.8	17.9	0.56	220	270	20.41
Total Recoverable Nickel	12	12	0.00	6	6	0.00
Total Recoverable Zinc	79	77	2.56	139	134	3.66

Note: Results in *I talics* exceed 30% RPD. Results in red exceed 50% RPD

Parameter	TP47 0.1m	DUP01	RPD (%)	TP52 0.1m	DUP02	RPD (%)
Total Recoverable Arsenic	6	5	18.18	5.00	6.00	18.18
Total Recoverable Boron	< 20	< 20	-			-
Total Recoverable Cadmium	0.54	0.56	3.64	0.1	0.1	0.00
Total Recoverable Chromium	12	12	0.00	13	13	0.00
Total Recoverable Copper	47	48	2.11	30	28	6.90
Total Recoverable Lead	26	27	3.77	21	18.5	12.66
Total Recoverable Nickel	6	5	18.18	9	7	25.00
Total Recoverable Zinc	104	101	2.93	47	45	4.35

Note: Results in *I talics* exceed 30% RPD. Results in red exceed 50% RPD

DUP01 + DUP02 collected in April 2023 Investigaiton

Parameter	TP29 (SUR)	DUP05	RPD (%)	TP31 (1.0m)	DUP06	RPD (%)
Total Recoverable Arsenic	3	3	0.00	2.00	< 2	-
Total Recoverable Boron	< 20	< 20	-	< 20	< 20	-
Total Recoverable Cadmium	< 0.10	< 0.10	-	< 0.10	< 0.10	-
Total Recoverable Chromium	9	9	0.00	6	6	0.00
Total Recoverable Copper	15	14	6.90	10	11	9.52
Total Recoverable Lead	19.1	18	5.93	15.5	15.2	1.95
Total Recoverable Nickel	4	4	0.00	3	3	0.00
Total Recoverable Zinc	52	48	8.00	32	34	6.06

Note: Results in *I talics* exceed 30% RPD. Results in red exceed 50% RPD

Appendix F

Environment Waikato Groundwater Bore Database Search

Well Number	Distance to Start Point	Well Name	Drilling Date	Company Name	Easting	Northing	Latitude	Longitude	Location Accuracy	Elevation	Static Water Level	Geothermal	Depth	Max Diameter	Consents/water use
72_4297	849.57	Bore 72 - Station 4297	29/09/2008	Barham United Welldrillers Limited	1804063	5783529	-38.07301	175.3264		40	12.75	No	80	200	Construct a well for municipal, stock and domestic water supply purposes
72_10906	850.08	Bore 72 - Station 10906			1804682	5784846	-38.06101	175.33308	<100.0m			No			to construct, use and maintain a well for nursery irrigation
72_4997	905.92	Bore 72 - Station 4997	07/04/2010	Barham United Welldrillers Limited	1803626	5785210	-38.05797	175.32095		41	7.5	No	79.5	100	Construct a well for household water supply and stock watering purposes
72_5356	950.97	Bore 72 - Station 5356	16/05/2011	Barham United Welldrillers Limited	1804119	5783434	-38.07385	175.32707		40	10.5	No	79	100	Construct a well for municipal, stock and domestic water supply purposes
70_1114	963.55	Bore 70 - Station 1114	02/07/1997	Brown Bros (N.Z.) Limited	1804303	5783468	-38.0735	175.32916		35.2		No	2		Construct a well for groundwater monitoring purposes
70_1117	963.55	Bore 70 - Station 1117	02/07/1997		1804303	5783468	-38.0735	175.32916		35.2		No	5	50	Construct a well for municipal, stock and domestic water supply purposes
70_1119	963.55	Bore 70 - Station 1119	03/07/1997		1804303	5783468	-38.0735	175.32916		35.2		No	3.5	50	NA - unable to locate
70_1116	963.55	Bore 70 - Station 1116	02/07/1997		1804303	5783468	-38.0735	175.32916		35.2		No	5	50	NA - unable to locate
70_1121	963.55	Bore 70 - Station 1121	03/07/1997		1804303	5783468	-38.0735	175.32916		35.2		No	5.5	50	NA - unable to locate
70_1115	963.55	Bore 70 - Station 1115	02/07/1997		1804303	5783468	-38.0735	175.32916		35.2		No	3.5	50	NA - unable to locate
70_1118	963.55	Bore 70 - Station 1118	02/07/1997		1804303	5783468	-38.0735	175.32916		35.2		No	5	50	NA - unable to locate
70_1120	963.55	Bore 70 - Station 1120	03/07/1997		1804303	5783468	-38.0735	175.32916		35.2		No	4	50	NA - unable to locate

Appendix G

Landfill Area/Volume Estimates

Area A Summary

Area A west: uncontrolled fill, no reduction in volume applied
Area A east: fill in trenches 3m wide, with 1m spacings between, apply 25% volume reduction

	Area A west (m^3)	Area A East (m^3)	Max volume estimate (m^3)	Min volume estimate (m^3)
Topsoil	242	874	1116	1116
Cover	600	6150	6750	6750
Fill	2903	13411	16313	12960
Natural	236	1363	1599	1258

Volume Calculations - Area A West

Area: 1180 m^2

Testpit	Soils	Depth BGL	Depth	Weighting	Depth x Weight	Volume
TP1	Topsoil	0.2	0.2	0.218	0.044	52
	Cover	0.7	0.5		0.109	129
	Fill	3	2.3		0.502	593
	Natural	-	0.2		0.044	52
TP2	Topsoil	0.25	0.25	0.149	0.037	44
	Cover	0.8	0.55		0.082	97
	Fill	3.3	2.5		0.373	440
	Natural	-	0.2		0.030	35
TP3	Topsoil	0.2	0.2	0.118	0.024	28
	Cover	0.7	0.5		0.059	70
	Fill	3.6	2.9		0.343	405
	Natural	-	0.2		0.024	28
TP4	Topsoil	0.3	0.3	0.089	0.027	32
	Cover	1	0.7		0.063	74
	Fill	4	3		0.268	316
	Natural	-	0.2		0.018	21
TP35	Topsoil	0.1	0.1	0.180	0.018	21
	Cover	0.7	0.6		0.108	127
	Fill	3.1	2.4		0.431	508
	Natural	-	0.2		0.036	42
TP38	Topsoil	0.2	0.2	0.175	0.035	41
	Cover	0.5	0.3		0.052	62
	Fill	3	2.5		0.437	516
	Natural	-	0.2		0.035	41
TP39	Topsoil	0.3	0.3	0.070	0.021	25
	Cover	0.8	0.5		0.035	41
	Fill	2.3	1.5		0.105	124
	Natural	-	0.2		0.014	17

Check area weighting is correct: Weighting should =1 ----> 1.000

Soil Stats	Average (m)	Min (m)	Max (m)
Topsoil	0.205	0.100	0.300
Cover	0.508	0.300	0.700
Fill	2.460	1.500	3.000

Volume totals

Topsoil	242 m^3
Cover	600 m^3
Fill	2903 m^3
Natural	236 m^3

Volume Calculations - Area A East

Area: 6815 m^2

Testpit	Soils	Depth BGL	Depth	Weighting	Depth x Weight	Volume
TP5	Topsoil	0.1	0.1	0.075	0.008	51
	Cover	1	0.9		0.068	462
	Fill	4.2	3.2		0.241	1643
	Natural	-	0.2		0.015	103
TP6	Topsoil	0.1	0.1	0.110	0.011	75
	Cover	1.2	1.1		0.120	821
	Fill	4.3	3.1		0.340	2314
	Natural	-	0.2		0.022	149
TP7	Topsoil	0.2	0.2	0.136	0.027	185
	Cover	1	0.8		0.109	742
	Fill	2.9	1.9		0.258	1761
	Natural	-	0.2		0.027	185
TP8	Topsoil	0.1	0.1	0.108	0.011	74
	Cover	1.3	1.2		0.130	886
	Fill	3.6	2.3		0.249	1697
	Natural	-	0.2		0.022	148
TP9	Topsoil	0.1	0.1	0.122	0.012	83
	Cover	0.9	0.8		0.098	665
	Fill	3.2	2.3		0.281	1913
	Natural	-	0.2		0.024	166
TP10	Topsoil	0.2	0.2	0.147	0.029	200
	Cover	0.8	0.6		0.088	600
	Fill	3	2.2		0.323	2199
	Natural	-	0.2		0.029	200
TP11	Topsoil	0.1	0.1	0.127	0.013	86
	Cover	1.1	1		0.127	863
	Fill	1.3	0.2		0.025	173
	Natural	-	0.2		0.025	173
TP12	Topsoil	0.1	0.1	0.116	0.012	79
	Cover	1.2	1.1		0.128	869
	Fill	2.7	1.5		0.174	1185
	Natural	-	0.2		0.023	158
TP40	Topsoil	0.1	0.1	0.059	0.006	40
	Cover	0.7	0.6		0.036	243
	Fill	2	1.3		0.077	525
	Natural	-	0.2		0.012	81

Check area weighting is correct: Weighting should =1 ----> 1.000

Soil Stats	Average (m)	Min (m)	Max (m)
Topsoil	0.128	0.100	0.200
Cover	0.902	0.600	1.200
Fill	1.968	0.200	3.200

Volume totals

Topsoil	874 m^3
Cover	6150 m^3
Fill	13411 m^3
Natural	1363 m^3

Volume Calculations - Area B

Area: 2790 m^2

Testpit	Soils	Depth BGL	Depth	Weighting	Depth x Weight	Volume
TP13	Topsoil	0.2	0.2	0.349	0.070	195
	Cover	0.5	0.3		0.105	293
	Fill	3.2	2.7		0.944	2633
	Natural	-	0.2		0.070	195
TP14	Topsoil	0.2	0.2	0.216	0.043	121
	Cover	0.8	0.6		0.130	362
	Fill	1.2	0.4		0.087	242
	Natural	-	0.2		0.043	121
TP15	Topsoil	0.1	0.1	0.324	0.032	90
	Cover	0.5	0.4		0.129	361
	Fill	1	0.5		0.162	452
	Natural	-	0.2		0.065	181
TP16	Topsoil	0.1	0.1	0.110	0.011	31
	Cover	0.2	0.1		0.011	31
	Fill	0.5	0.3		0.033	92
	Natural	-	0.2		0.022	61

Check area weighting is correct: 1.000 Weighting should = 1

Soil Stats	Average (m)	Min (m)	Max (m)
Topsoil	0.157	0.100	0.200
Cover	0.375	0.100	0.600
Fill	1.225	0.300	2.700

Volume totals

Topsoil	437 m^3
Cover	1047 m^3
Fill	3418 m^3
Natural	558 m^3

Volume Calculations - Area C

Area: 1180 m^2

Testpit	Soils	Depth BGL	Depth	Weighting	Depth x Weight	Volume
TP17	Topsoil	0.1	0.1	0.381	0.038	45
	Cover	0.7	0.6		0.228	269
	Fill	3.7	3		1.142	1347
	Natural	-	0.2		0.076	90
TP18	Topsoil	0.2	0.2	0.619	0.124	146
	Cover	0.6	0.4		0.248	292
	Fill	0.6	0		0.000	0
	Natural	-	0.2		0.124	146

Check area weighting is correct: 1.000 Weighting should = 1

Soil Stats	Average (m)	Min (m)	Max (m)
Topsoil	0.162	0.100	0.200
Cover	0.476	0.400	0.600
Fill	1.142	0.000	3.000

Volume totals

Topsoil	191 m^3
Cover	562 m^3
Fill	1347 m^3
Natural	236 m^3

Volume Calculations - Area D

Area: 2443 m^2

Testpit	Soils	Depth BGL	Depth	Weighting	Depth x Weight	Volume
TP27	Topsoil	0.2	0.2	0.334	0.067	163
	Cover	0.4	0.2		0.067	163
	Fill	1.7	1.3		0.435	1062
	Natural	-	0.2		0.067	163
TP30	Topsoil	0.05	0.05	0.273	0.014	33
	Cover	0.3	0.25		0.068	167
	Fill	3.2	2.9		0.792	1934
	Natural	-	0.2		0.055	133
TP31	Topsoil	0.2	0.2	0.194	0.039	95
	Cover	0.2	0		0.000	0
	Fill	0.2	0		0.000	0
	Natural	-	0.2		0.039	95
TP36	Topsoil	0.1	0.1	0.199	0.020	49
	Cover	0.2	0.1		0.020	49
	Fill	2	1.8		0.357	873
	Natural	-	0.2		0.040	97

Check area weighting is correct: 1.000 Weighting should = 1

Soil Stats	Average (m)	Min (m)	Max (m)
Topsoil	0.139	0.050	0.200
Cover	0.155	0.000	0.250
Fill	1.584	0.000	2.900

Volume totals

Topsoil	340 m^3
Cover	379 m^3
Fill	3869 m^3
Natural	489 m^3

Volume Calculations - Area E

Area: 659 m^2

Testpit	Soils	Depth BGL	Depth	Weighting	Depth x Weight	Volume
TP25	Topsoil	0.1	0.1	1.000	0.100	66
	Cover	0.3	0.2		0.200	132
	Fill	0.3	0		0.000	0
	Natural	-	0.2		0.200	132

Check area weighting is correct: 1.000 Weighting should = 1

Soil Stats	Average (m)	Min (m)	Max (m)
Topsoil	0.100	0.100	0.100
Cover	0.200	0.200	0.200
Fill	0.000	0.000	0.000

Volume totals

Topsoil	66 m^3
Cover	132 m^3
Fill	0 m^3

Volume Calculations - Area F

Area: 932 m^2

Testpit	Soils	Depth BGL	Depth	Weighting	Depth x Weight	Volume
TP26	Topsoil	0.2	0.2	1.000	0.200	186
	Cover	0.5	0.3		0.300	280
	Fill	4.5	4		4.000	3728
	Natural	-	0.2		0.200	186

Check area weighting is correct: 1.000 Weighting should = 1

Soil Stats	Average (m)	Min (m)	Max (m)
Topsoil	0.200	0.200	0.200
Cover	0.300	0.300	0.300
Fill	4.000	4.000	4.000

Volume totals

Topsoil	186 m^3
Cover	280 m^3
Fill	3728 m^3

Volume Calculations - Area G

Area: 1305 m^2

Testpit	Soils	Depth BGL	Depth	Weighting	Depth x Weight	Volume
TP19	Topsoil	0.1	0.1	0.179	0.018	23
	Cover	0.5	0.4		0.071	93
	Fill	0.5	0		0.000	0
	Natural	-	0		0.000	0
TP20	Topsoil	0.2	0.2	0.251	0.050	66
	Cover	0.4	0.2		0.050	66
	Fill	0.4	0		0.000	0
	Natural	-	0		0.000	0
TP21	Topsoil	0.1	0.1	0.196	0.020	26
	Cover	0.8	0.7		0.137	179
	Fill	0.8	0		0.000	0
	Natural	-	0		0.000	0
TP22	Topsoil	0.2	0.2	0.254	0.051	66
	Cover	0.2	0		0.000	0
	Fill	0.2	0		0.000	0
	Natural	-	0.2		0.051	66
TP23	Topsoil	0.1	0.1	0.093	0.009	12
	Cover	0.1	0		0.000	0
	Fill	0.1	0		0.000	0
	Natural	-	0.2		0.019	24
TP24	Topsoil	0.1	0.1	0.026	0.003	3
	Cover	0.1	0		0.000	0
	Fill	0.1	0		0.000	0
	Natural	-	0.2		0.005	7

Check area weighting is correct: 1.000 Weighting should = 1

Soil Stats	Average (m)	Min (m)	Max (m)
Topsoil	0.151	0.100	0.200
Cover	0.259	0.000	0.700
Fill	0.000	0.000	0.000

Volume totals

Topsoil	197 m^3
Cover	338 m^3
Fill	0 m^3

Volume Calculations - Area H

Area: 1979 m^2

Testpit	Soils	Depth BGL	Depth	Weighting	Depth x Weight	Volume
TP32	Topsoil	0	0	0.114	0.000	0
	Cover	0.3	0.3		0.034	68
	Fill	1.5	1.2		0.137	272
	Natural	-	0.2		0.023	45
TP33	Topsoil	0	0	0.132	0.000	0
	Cover	0	0		0.000	0
	Fill	0.3	0.3		0.040	79
	Natural	-	0.2		0.026	52
TP34	Topsoil	0	0	0.254	0.000	0
	Cover	0	0		0.000	0
	Fill	0.5	0.5		0.127	252
	Natural	-	0.2		0.051	101
TP37	Topsoil	0	0	0.280	0.000	0
	Cover	0	0		0.000	0
	Fill	0.4	0.4		0.112	222
	Natural	1.1	0.2		0.056	111
TP54	Topsoil	0	0	0.055	0.000	0
	Cover	0	0		0.000	0
	Fill	0.2	0.2		0.011	22
	Natural	-	0.2		0.011	22
TP55	Topsoil	0	0	0.164	0.000	0
	Cover	0	0		0.000	0
	Fill	0.2	0.2		0.033	65
	Natural	-	0.2		0.033	65

Check area weighting is correct: 1.000 Weighting should = 1

Soil Stats	Average (m)	Min (m)	Max (m)
Topsoil	0.000	0.000	0.000
Cover	0.034	0.000	0.300
Fill	0.460	0.000	1.200

Volume totals

Topsoil	0 m^3
Cover	68 m^3
Fill	910 m^3
Natural	396 m^3

Volume Calculations - Area I

Area: 1570 m^2

Testpit	Soils	Depth BGL	Depth	Weighting	Depth x Weight	Volume
TP50	Topsoil	0.2	0.2	0.266	0.053	84
	Cover	0.2	0		0.000	0
	Fill	1.9	1.7		0.452	710
	Natural	-	0.2		0.053	84
TP56	Topsoil	0	0	0.281	0.000	0
	Cover	0	0		0.000	0
	Fill	2.3	2.3		0.647	1016
	Natural	-	0.2		0.056	88
TP57	Topsoil	0.1	0.1	0.453	0.045	71
	Cover	0.1	0		0.000	0
	Fill	2	1.9		0.860	1351
	Natural	-	0.2		0.091	142

Check area weighting is correct: 1.000 Weighting should = 1

Soil Stats	Average (m)	Min (m)	Max (m)
Topsoil	0.099	0.000	0.200
Cover	0.000	0.000	0.000
Fill	1.960	1.700	2.300

Volume totals

Topsoil	155 m^3
Cover	0 m^3
Fill	3078 m^3

Appendix H

Flood Risk Assessment

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MEMORANDUM: TOKANUI HOSPITAL – DISPOSAL SITES FLOOD RISK ASSESSMENT (REV 1)

Date: 17/07/2023

From: Tim Bohles/ Sean Finnigan

Subject: Tokanui Hospital – Disposal Sites Flood Risk Assessment

To: Toitū Te Whenua, Land Information New Zealand – Kim Wepasnick

FTL have completed a flood risk assessment focussing of the potential effect of a flood event on the existing historical landfill areas (disposal sites) at the Tokanui Hospital. The landfill extents have been estimated from the FTL 2022-23 intrusive investigation.

1.0 STORMWATER FLOW ESTIMATION

Stormwater catchments were delineated from the LINZ LiDAR survey for the immediate area, and 2007-2008 Waikato LiDAR data for the catchment area outside of the site. Two main catchments were delineated, referred to as the southern and western catchments in this Memo. The southern catchment (440ha) drains to the main stream, which flows through it in a south to north direction. The western catchment (166ha) drains through the hospital site's detention storage areas and enters the main stream near Te Mawhai Road. Refer Figure 1 for catchment locations.

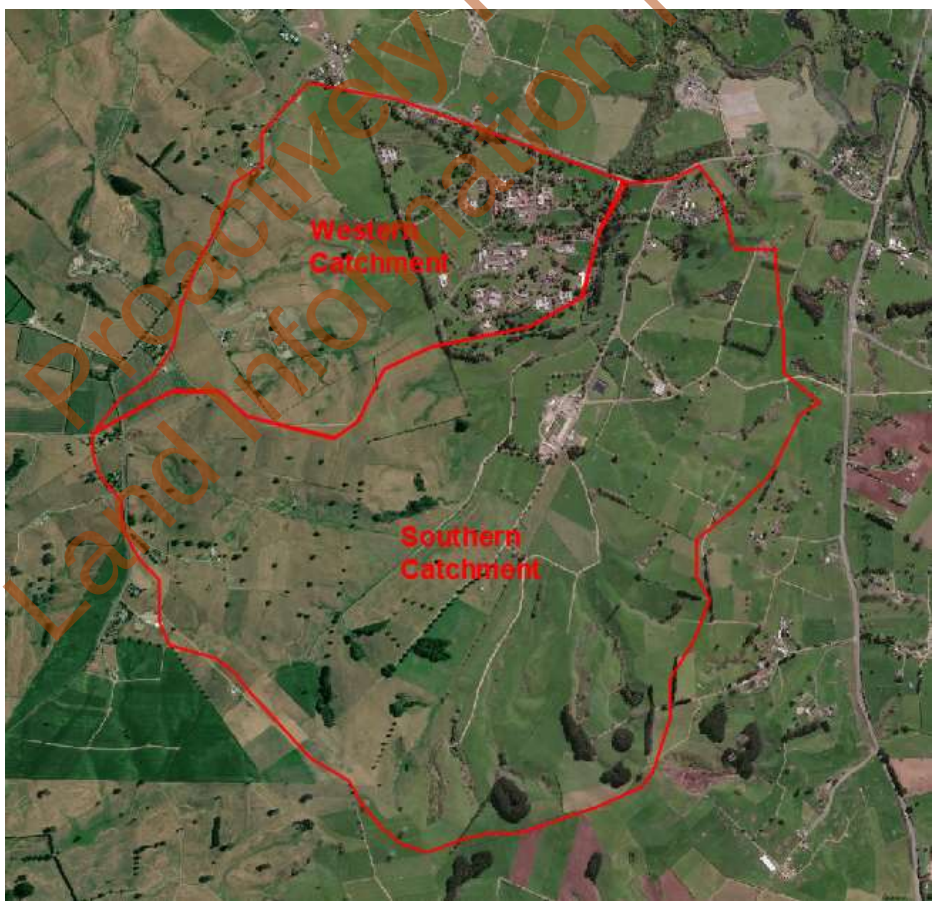

Figure 1: Catchment Locations

Stormwater flows were calculated using the Waikato Stormwater Runoff Modelling Guideline TR20/06 methodology. The catchment is primarily composed of alluvium and colluvium gravel sand and mud. A curve number of 74 was assumed for the entire area corresponding to good condition,

open space with group C soils. The catchment flow hydrograph was modelled in HEC-HMS for the 1% Annual Exceedance Probability (AEP) rainfall event, as well as the 1% AEP (annual exceedance probability) event including an allowance for climate change. Climate change was accounted for by using the HIRDS RCP8.5 rainfall scenario for the years 2081-2100. This is considered more conservative than allowing for a 2.1 degree increase in climate as specified by the Waikato Stormwater Runoff Modelling Guideline. Refer Appendix A for associated calculations.

Stormwater culverts were modelled in four locations as shown on Figure 2. Culvert 1 under Te Mawhai Road was assumed to be 1500mm in diameter as it could not be located[1]. Culvert 2 under the smaller former hospital access road was assumed to be 1350mm in diameter as it also could not be located. Culvert 3 was surveyed and is 1350mm in diameter. Culvert 4 is 1000mm in diameter, based on historic plans provided by LINZ. The assumed culvert diameters were based on the expectation that culverts 1 and 2 would be at least as large as culvert 3 and engineering judgement.

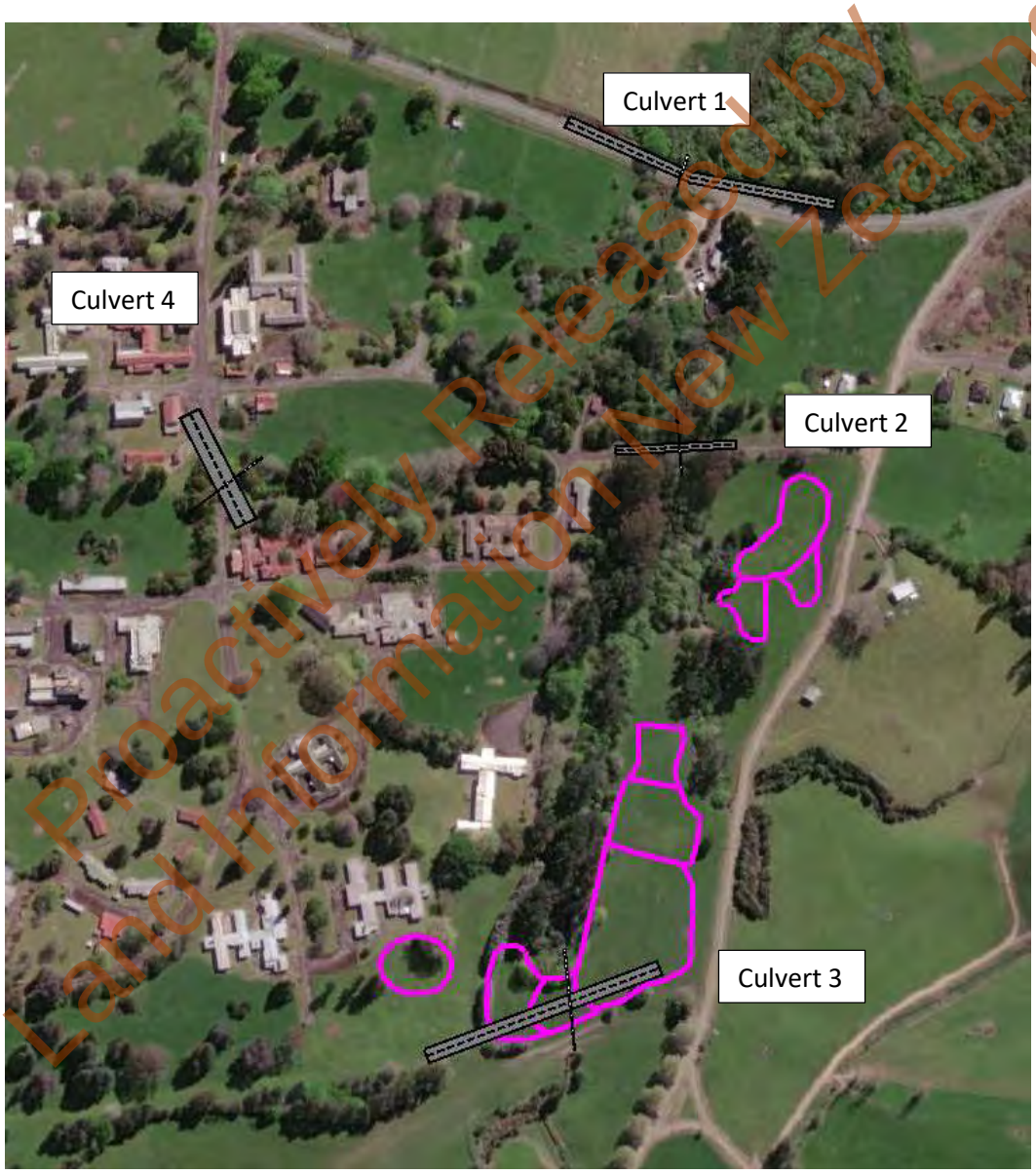

Figure 2: Culvert Locations

2.0 STORMWATER MODELLING

2.1 Methodology

[1] Since the modelling was undertaken, Waipa District Council have advised that this culvert is a 1600mm dia concrete pipe (according to their RAMM records) installed in the early 1970s. The modelling has not been revised for this minor change, as it is not expected to have a significant effect on the results.

The flood extent was modelled using HEC-RAS 2D software. A TIN surface was formed from the LINZ LiDAR and 2007-2008 Waikato LiDAR. A uniform Mannings roughness of 0.06 was assumed for the entire area. This Mannings roughness value represents a clay channel bed with light brush and trees. Surveyed stream cross sections at six locations (refer Appendix B) were used to validate that the LiDAR was reasonably accurate within the area. This is commented on further in section 2.7 of this Memo.

2.2 Modelling Scenarios

Four scenarios were modelled:

- Scenario 1: All culverts fully blocked – 1% AEP + allowance for climate change
- Scenario 2: All culverts fully operational – 1% AEP + allowance for climate change
- Scenario 3: All culverts fully operational – 1% AEP storm event
- Scenario 4: All culverts fully operational, but removing the access road bund/Culvert 2 to allow flows to drain through the stream more easily- 1% AEP + allowance for climate change

Site inspections of the culverts found that culverts 3 and 4 appear to be fully operational while both culverts 1 and 2 could not be located – some ponding does occur upstream of both of these culverts, suggesting that they are partially blocked to a reasonable extent. Hence, the most realistic scenarios, representing the actual current situation, allowing for climate change, are considered to be somewhere between Scenarios 1 and 2.

Scenario 4 was included as a possible mitigation option. The culvert 2 embankment comprises a former road crossing of the stream into the hospital site, which is now redundant. The culvert 2 embankment level is approximately 36m RL, while the Te Mawhai Road embankment (over Culvert 1) is approximately 33m RL. Preliminary flood modelling showed flood levels are largely controlled by these embankments. Hence, this scenario was included to test whether removal of this culvert and associated embankment would result in a significant reduction in flood levels due to the elevation difference of the two embankments.

2.3 Flood Extents

Flood maps were generated for the four scenarios and are shown on FTL Drawing 33097/12, with further information in Appendix A. These show that there is a high risk of some of the historic landfilling areas being inundated by the 1% AEP storm event, with and without climate change, as summarised in the following table. The main areas at risk of flooding are in order of decreasing severity: Area A (west) and H > Area G > Area C > Area B > Area A (east) > Area I. Areas D, E and F are all outside the modelled flood extent for all four scenarios.

For Scenario 4, removal of Culvert 2 and the associated embankment results in a significant reduction compared with other scenarios. It reduces flooding to less than Scenario 3 (1% AEP storm event) in all locations, except in Areas A (west) and H and upstream of this because this area is controlled by the Culvert 3 embankment.

Table 1: Flood Modelling Results – Flooded Areas

Scenario	**3**	**2**	**1**	**4**
Culvert Status	Fully operational	Fully operational	All blocked	Fully operational
Storm Event	1% AEP	1% AEP + CC	1% AEP + CC	1% AEP + CC
Mitigation Option	None	None	None	Culvert 2 and associated embankment removed
Area	**Flooded Areas, m^2 (% of total area)**			
A West (1,180m^2)	1,180 (100%)	1,180 (100%)	1,180 (100%)	1,130 (96%)
A East (6,820m^2)	420 (6%)	1,480 (22%)	2,400 (35%)	350 (5%)
B (2,790m^2)	790 (28%)	1,340 (48%)	2,540 (91%)	380 (14%)
C (1,180m^2)	760 (64%)	960 (81%)	1,180 (100%)	490 (42%)
D (2,440m^2)	0 (0%)	0 (0%)	10 (0.4%)	0 (0%)
E (660m^2)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
F (930m^2)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
H (1,980m^2)	1,740 (88%)	1,980 (100%)	1,980 (100%)	1,810 (91%)
I (1,570m^2)	0 (0%)	20 (1%)	110 (7%)	0 (0%)

2.4 Flood Levels

Flood levels vary depending on the scenario and location. Flood levels have been indicated on FTL Drawing 33097/12.

2.5 Scour/Erosion Effects

Stream channels evolve over time to convey a certain level of flow commonly referred to as the "channel forming flow" or "bankfull discharge" which generally ranges from recurrence intervals of 1 to 2.5 years. Streams will adjust and further evolve when flows are altered as a result of land use changes, development in the catchment, damming, or other mechanisms. Higher discharge rates can result in erosive processes leading to channel widening and increases in channel cross-section area.

Shear stress is often used to predict whether streams are stable or not. Shear stress increases with increasing flow depth and increasing water surface gradient.

Culvert 2 is located below all landfill areas. During a storm event, stream flows and velocities will gradually increase, until the culvert starts to throttle these flows/velocities, resulting in water ponding upstream of the culvert, increasing the flow depth but decreasing the water surface gradient. For simplicity here, flow velocity has been adopted as a proxy for shear stress effects, as velocity is affected both by flow depth and water surface gradient. If Culvert 2 was removed, Culvert 1 would still exhibit a throttle effect, but the associated ponding does not extend as far upstream as previously, and hence some of the areas abutting the landfill may experience higher stream velocities than currently and hence be subject to greater scour/erosion than the current situation. Similarly, if a storm were to hit with a peak rainfall very soon after the beginning of the storm, velocities within the channel may be greater as the stream may not have began backing up (i.e. more of a flash flood situation). These situations have been covered under the modelled scenarios, and the maximum velocity within the stream channel was found to be relatively low during the peak of an extreme storm event, due to backing up of water over the crossing at culverts 1 and 2. A maximum of 1.2m/s was calculated for the fully blocked scenario, where water will overtop culvert 2 and rush down the stream. Otherwise typical velocities are predicted to be between 0.5-0.7m/s. Under the NZ Transport Agency Stormwater Treatment for State Highway Infrastructure, the maximum permissible velocity to control stream erosion for stiff clays is 1.14m/s. It is therefore considered that stream erosion is unlikely to be an issue, based on the limited modelling undertaken to date.

Furthermore, historical plans show this stretch of the stream and further downstream to the Pūniu River were historically a swamp (see Figure 3), which is consistent with observations of water ponding in this area and the stream bed being relatively flat, with a measured gradient from LiDAR data of 0.5% between cross-sections C and E.

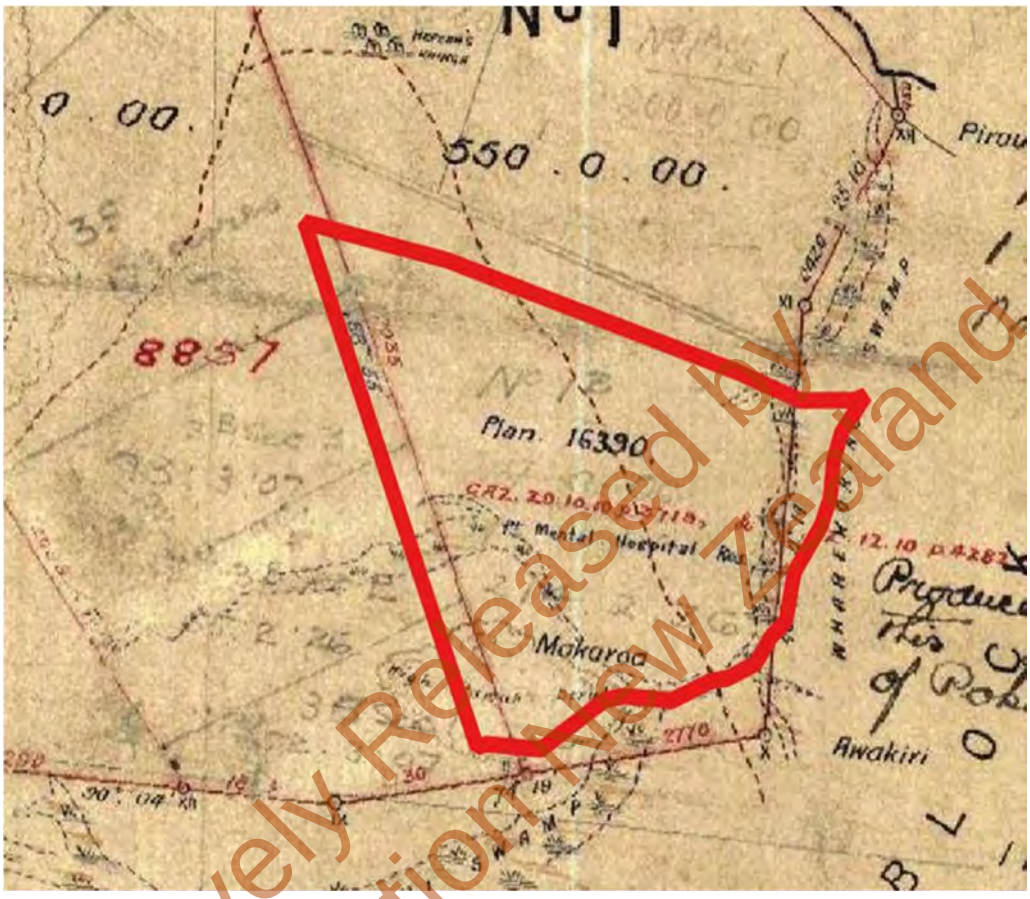

Figure 3: Tokanui Hospital Site – Historical Plan showing former swamps (from CFG, 2023)

2.6 Discussion

The HEC-RAS modelling showed that the landfill areas A, B, C, G and H are currently likely to be inundated to varying extents during a 1% AEP storm event, particularly if the culverts are blocked or become blocked during the storm, with these effects worsening with predicted climate change. This ponded water may result in increased infiltration into the landfill and potentially increase the leaching of contaminants from affected landfill areas.

The velocity through the stream is likely to be low indicating that it is unlikely that significant erosion will occur.

Landfill area A effectively dams the stream, with culvert 1 passing under it. Modelling has shown this area to be inundated during a 1% AEP event, with the culvert being overtopped and flood waters flowing overland through Area A . Velocities over the bunded area where the culvert passes may be moderate-high. This could result in localised scour/erosion along the overland flowpath, potentially exposing the underlying landfill materials, and in the worst case, uplifting some of these materials and carrying them into the stream. This effect has not been quantified as part of the modelling done to date.

Flood levels could be significantly reduced by removing the access road at culvert 2. This would prevent the inundation of the majority of the landfill areas during a 1% AEP storm. However, it should be noted that this access road acts to detain water within the catchment, and removing it may result in higher peak flows downstream. Downstream discharges were calculated as 2.5m^3/s for the completely blocked scenario 1, 10.7m^3/s for the unblocked scenario 2, and 33m^3/s for scenario 4

which allowed for the culvert 2 embankment being removed. Overall this shows that the bund performs a good detention function for the overall catchment.

Below Culvert 1, the stream flows approximately 700m before entering the considerably larger Pūniu River. Mangatoatoa Marae is located on the eastern side of the stream before the confluence with the Pūniu River. There are no other buildings along this section of the stream. Downstream effects of culvert 2 removal are considered likely to be less than minor, as the Marae is approximately 9m above the level of the stream, and as such should not be affected by an increase in the stream flows. This can be checked as part of further design work for removal of this culvert.

Removal of culvert 2 may also have some ecological benefits, which the project ecologists should be able to comment on.

2.7 Modelling Limitations

The accuracy of this modelling is subject to the following main limitations:

- Use of estimated diameters for culverts 1 and 2. Once these culverts are located and their dimensions confirmed, the model can be rerun to check effects on flood levels. However, the culverts are not expected to be significantly larger than assumed for this assessment and hence flood extents and levels are considered unlikely to change significantly.
- The surveyed stream cross-sections agreed reasonably well with LiDAR survey data at cross-sections, but were consistently higher than LiDAR survey data at cross-sections A-D. LiDAR data was used in the model to avoid surface discontinuities affecting running of the model, but the ground surface could potentially be higher by 0.3-0.8m from cross-sections A-D, resulting in some increases in flood level in these areas. This is not anticipated to have a significant effect on the flood extents however, as the cross sections are fairly consistent in shape relative to LiDAR, and as such will still spread out a similar amount. If this were to have an effect, the flood extents on landfill areas A or B might be slightly reduced.
- Use of a uniform Mannings roughness of 0.06. Flooding has been shown to primarily be controlled by water backing up behind Culvert 2 and hence flood levels are not expected to be sensitive to variations in Mannings values. This could be checked through sensitivity testing if required.
- Only the 1% AEP storm has been modelled to date. Hence, the critical storm which results in the onset of flooding over landfilled areas and the frequency of flooding has not yet been established.

3.0 CONCLUSION

Flood modelling has shown that there is a potential hazard posed by flooding of former landfill areas in a 1% AEP storm event with and without climate change. Several areas are estimated to be inundated in a 1% AEP storm event. Area H and A (west) of the landfill are likely to be eroded by flood waters. There is potential for flood levels to be significantly reduced by removal of the access road at culvert 2; however this may result in increases to peak flows downstream and associated increased flood levels in the stream but a preliminary assessment indicates this is unlikely to affect the only nearby downstream property with buildings – the Mangatoatoa Marae. This should be checked during the next phase of work.

4.0 DISCLAIMER

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

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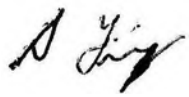
We do not assume any liability for misrepresentation or items not visible, accessible or present at the subject site during the time of the site inspection; or for the validity or accuracy of any information provided by our client or third parties that have been utilised in the preparation of this report.

The conclusions and recommendations expressed herein should be read in conjunction with the remainder of this report and should not be referred to out of context with the remainder of this report.

Yours sincerely
FRASER THOMAS LIMITED



S M Finnigan
Director – Environmental

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Incl:
Drawing 33097/12-15
Appendix A: Catchment and Flow Calculations

Drawings

Legend

- Flood extent scenario 1
- Flood extent scenario 2
- Flood extent scenario 3
- Flood extent scenario 4
- 12.0 — Existing contours (@1m intervals)
- Indicative landfill areas
- Approximate extent of Non-Engineered Fill

Max water levels and velocity
Scenario 1: 35.87mRL, 0.6m/s
Scenario 2: 35.53mRL, 0.5m/s
Scenario 3: 35.02mRL, 0.5m/s
Scenario 4: 33.90mRL, 0.6m/s

Max water levels and velocity
Scenario 1: 35.87mRL, 1.1m/s
Scenario 2: 35.53mRL, 0.5m/s
Scenario 3: 35.02mRL, 0.5m/s
Scenario 4: 33.91mRL, 0.7m/s

Max water levels and velocity
Scenario 1: 35.87mRL, 1.2m/s
Scenario 2: 35.53mRL, 0.7m/s
Scenario 3: 35.02mRL, 0.6m/s
Scenario 4: 33.94mRL, 1.0m/s

Max water levels
Scenario 1: 35.87mRL
Scenario 2: 35.55mRL
Scenario 3: 35.10mRL
Scenario 4: 35.21mR

Area A
Area A
Area B
Area C
Area D
Area E
Area F
Area G
Area H
Area I

0 30 60
Scale 1: 1500 m

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DESIGNED			
DRAWN	TB	14/02/23	
CHECKED			

REVISION	CHANGES	CHECKED	DATE

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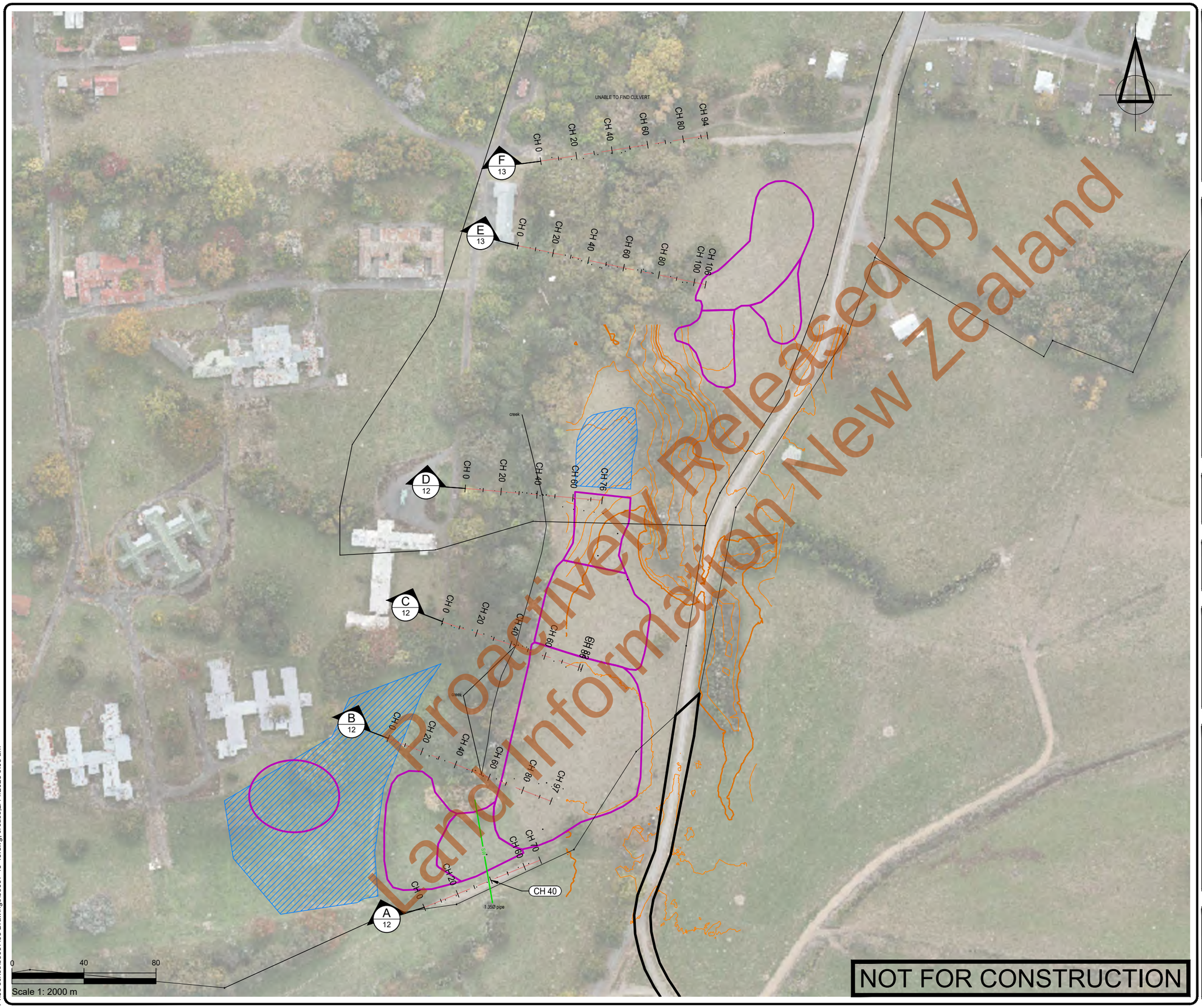

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DRAWING No 33097/13

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Legend

Lidar level

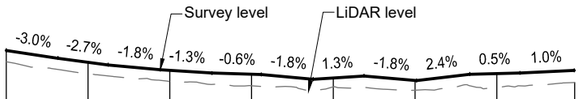
Survey level

0 15 30

Scale 1: 750 m

0 1.0 2.0 3.0 4.0 5.0 10

Scale 1:150

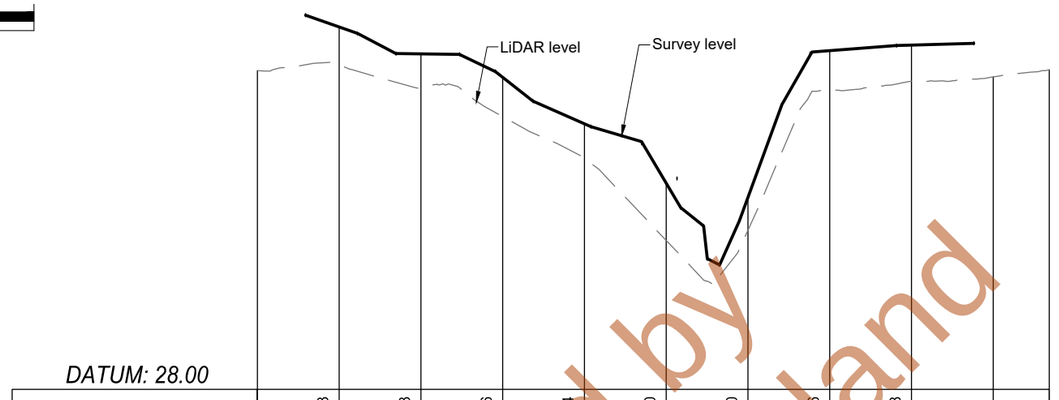


DATUM: 32.00

LEVEL DIFF	0.28	0.28	0.27	0.28	0.22	0.24	0.34	
SURVEY LEVELS	35.29	35.00	34.80	34.71	34.62	34.56	34.72	
LIDAR LEVELS	35.01	34.72	34.53	34.42	34.40	34.32	34.38	34.50
CHAINAGE	0	10	20	30	40	50	60	70

Cross Section A

Scale 1:750 horiz, 1:150 vert

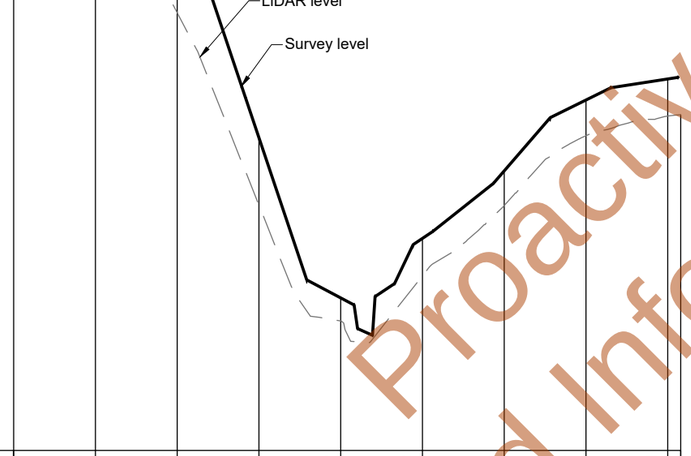


DATUM: 28.00

LEVEL DIFF	0.93	0.83	0.96	0.84	1.40	0.80	0.96	0.88		
SURVEY LEVELS	36.86	36.20	35.63	34.49	33.05	32.70	36.28	36.42		
LIDAR LEVELS	35.79	35.94	35.37	34.67	33.66	31.65	31.89	35.32	35.53	35.64	35.82
CHAINAGE	0	10	20	30	40	50	60	70	80	90	97

Cross Section B

Scale 1:750 horiz, 1:150 vert



DATUM: 28.00

LEVEL DIFF	0.90	1.35	1.65	0.56	0.92	0.84	0.87	0.91	
SURVEY LEVELS	41.26	40.05	35.64	31.73	33.18	34.83	36.56	37.08	
LIDAR LEVELS	40.22	40.37	38.70	34.00	31.16	32.26	33.98	35.69	36.17	36.20
CHAINAGE	0	10	20	30	40	50	60	70	80	82

Cross Section C

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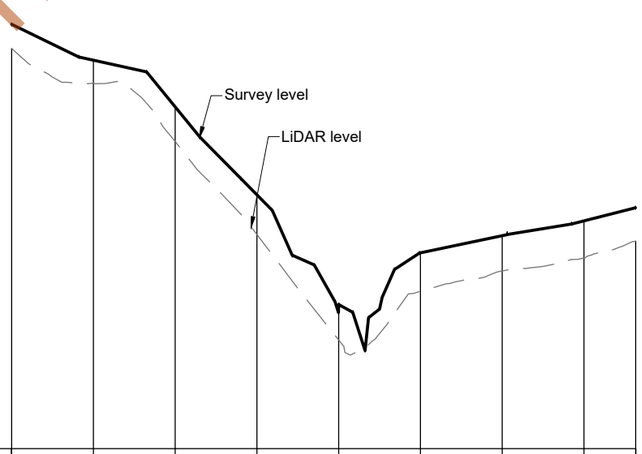

DATUM: 28.00

LEVEL DIFF	0.56	0.85	0.97	0.87	0.94	0.86	0.91	
SURVEY LEVELS	37.50	36.36	34.21	31.52	32.79	33.21	33.57	
LIDAR LEVELS	37.78	36.94	35.51	33.23	30.66	31.85	32.35	32.66	33.07
CHAINAGE	0	10	20	30	40	50	60	70	76

Cross Section D

Scale 1:750 horiz, 1:150 vert

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SURVEY CROSS SECTIONS SHEET 1

Fraser Thomas

ENGINEERS • RESOURCE MANAGERS • SURVEYORS

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STATUS

FOR INFORMATION

Construction works shall commence only on receipt of and in accordance with the Council or Council organisation stamped approved drawings, unless otherwise indicated.

SCALE AS SHOWN (A3)

DRAWING No 33097/14

REVISION -

P:\33 series\33097\03 Drawings\33097-13-15.dwg, crouse,2/14/2023 9:03 am

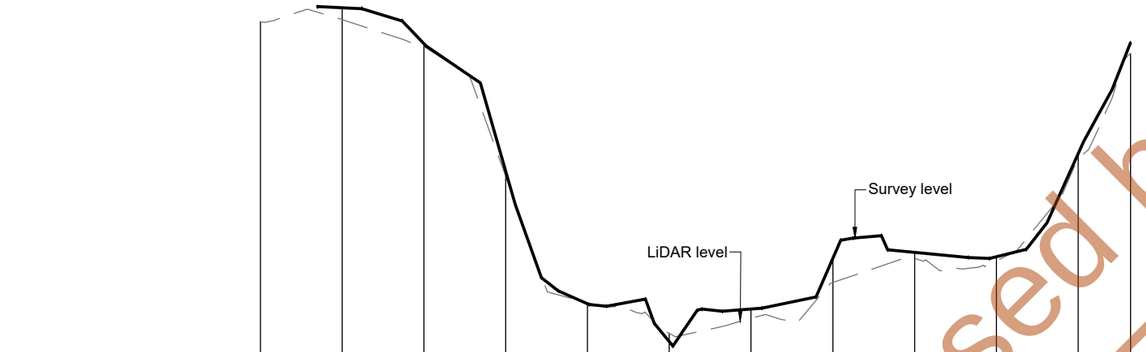
Legend

Lidar level

Survey level

0 ## ##
Scale 1: ### m

0 1.0 2.0 3.0 4.0 5.0 10
Scale 1:150



DATUM: 26.00

LEVEL DIFF		0.29	0.07	0.13	-0.02	-0.20	0.23	0.59	0.15	0.10	0.18
SURVEY LEVELS		37.86	36.98	33.86	30.62	29.69	30.49	31.73	31.88	31.77	34.29
LIDAR LEVELS	37.52	37.57	36.91	33.73	30.65	29.90	30.27	31.14	31.73	31.67	34.12	36.74
CHAINAGE	0	10	20	30	40	50	60	70	80	90	100	106

Cross Section E

Scale 1:750 horiz, 1:150 vert

DATUM: 32.00

LEVEL DIFF		-0.14	-0.20	-0.12	0.12	1.26	0.25	0.02	0.14	0.14	
SURVEY LEVELS		37.05	36.57	36.36	36.27	37.30	36.22	36.36	36.52	36.85	
LIDAR LEVELS	37.15	37.19	36.77	36.48	36.16	36.04	35.97	36.33	36.38	36.70	36.84
CHAINAGE	0	10	20	30	40	50	60	70	80	90	94

Cross Section F

Scale 1:750 horiz, 1:150 vert

SURVEYED	FTL	15/12/22	APPROVED DATE
DESIGNED			
DRAWN	TB	14/02/23	
CHECKED			

REVISION	CHANGES	CHECKED	DATE

NOTES

CLIENT
TOITŪ TE WHENUA LAND INFORMATION NEW ZEALAND

PROJECT
FORMER TOKANUI HOSPITAL DEMOLITION AND REMEDIATION PROJECT

TITLE
SURVEY CROSS SECTIONS SHEET 2

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SCALE AS SHOWN (A3)

DRAWING No 33097/15 REVISION -

NOT FOR CONSTRUCTION

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Appendix A
Catchment and Flow Calculations

Catchment West

Catchment characteristics

	Soil Group	CN	Area (ha)	
Undisturbed pasture	C	74	160	(Pasture good condition)
Reinstated pasture	D	80	0	(Pasture good condition)
Capped area	D	89	0	(Pasture poor condition)
Total Area	160			
Weighted CN	74			
S	89.2432432			
Ia	4.46216216			

Time of concentration

Sheet and shallow concentrated flow

Length of flow	200	m
Slope	10.500	%
Mannings n	0.045	
Time	16.16	Minutes

Open channel flow 1

Slope	0.037	m/m		
Mannings n	0.035			
Channel base width	0.5	m		
Channel height	0.5	m		
Channel side slope 1:	3			
Hydraulic radius	0.273			
Velocity	2.30	m/s	Q check	2.300125
Length	820	m		
Time	5.94	Minutes		

Open channel flow 2

Slope	0.0029	m/m		
Mannings n	0.035			
Channel base width	2	m		
Channel height	1.5	m		
Channel side slope	3			
Hydraulic radius	0.849			
Velocity	1.38	m/s	Q check	13.47767
Length	1030	m		
Time	12.42	Minutes		

Pipe flow N/A

Gradient	
Diameter	
Velocity	
Length	
Time	

Total time of concetration

Time	34.52	Minutes
Lag time	0.38	Hours

Catchment time of concentration check

Length	2500
Height difference	54.5
Time	35.17

Catchment South

Catchment characteristics

	Soil Group	CN	Area (ha)	
Undisturbed pasture	C	74	440	(Pasture good condition)
Reinstated pasture	D	80	0	(Pasture good condition)
Capped area	D	89	0	(Pasture poor condition)
Total Area	440			
Weighted CN	74			
S	89.2432432			
Ia	4.46216216			

Time of concentration

Sheet and shallow concentrated flow

Length of flow	160	m
Slope	20.000	%
Mannings n	0.045	
Time	13.19	Minutes

Open channel flow 1

Slope	0.039	m/m		
Mannings n	0.035			
Channel base width	0.5	m		
Channel height	0.5	m		
Channel side slope 1:	5			
Hydraulic radius	0.268			
Velocity	2.33	m/s	Q check	3.497912
Length	700	m		
Time	5.00	Minutes		

Open channel flow 2

Slope	0.0061	m/m		
Mannings n	0.035			
Channel base width	2	m		
Channel height	1.5	m		
Channel side slope	3			
Hydraulic radius	0.849			
Velocity	2.00	m/s	Q check	19.46425
Length	2140	m		
Time	17.87	Minutes		

Pipe flow N/A

Gradient	
Diameter	
Velocity	
Length	
Time	

Total time of concetration

Time	36.06	Minutes
Lag time	0.40	Hours

Catchment time of concentration check

Length	3000
Height difference	72
Time	39.00

Catchment Flow Summary

Western catchment 1% AEP storm

Summary Results for Subbasin "Catchment West"

Project: 33097 catchment flows Simulation Run: 1% AEP
Subbasin: Catchment West

Start of Run:	18Jan2023, 00:00	Basin Model:	Basin 1
End of Run:	20Jan2023, 00:00	Meteorologic Model:	1% AEP
Compute Time:	27Jan2023, 15:15:23	Control Specifications:	Control 1

Volume Units: ○ MM ◉ 1000 M3

Computed Results

Peak Discharge:	15.98940 (M3/S)	Date/Time of Peak Discharge:	18Jan2023, 12:30
Precipitation Volume:	241.45920 (1000 M3)	Direct Runoff Volume:	145.59947 (1000 M3)
Loss Volume:	95.85974 (1000 M3)	Baseflow Volume:	0.00000 (1000 M3)
Excess Volume:	145.59947 (1000 M3)	Discharge Volume:	145.59947 (1000 M3)

Southern catchment 1% AEP storm

Summary Results for Subbasin "Catchment south"

Project: 33097 catchment flows Simulation Run: 1% AEP
Subbasin: Catchment south

Start of Run:	18Jan2023, 00:00	Basin Model:	Basin 1
End of Run:	20Jan2023, 00:00	Meteorologic Model:	1% AEP
Compute Time:	27Jan2023, 15:15:23	Control Specifications:	Control 1

Volume Units: ○ MM ◉ 1000 M3

Computed Results

Peak Discharge:	41.83201 (M3/S)	Date/Time of Peak Discharge:	18Jan2023, 12:30
Precipitation Volume:	664.01280 (1000 M3)	Direct Runoff Volume:	400.39853 (1000 M3)
Loss Volume:	263.61427 (1000 M3)	Baseflow Volume:	0.00000 (1000 M3)
Excess Volume:	400.39853 (1000 M3)	Discharge Volume:	400.39853 (1000 M3)

Western catchment 1% AEP + climate change storm

Summary Results for Subbasin "Catchment West"

Project: 33097 catchment flows Simulation Run: 1% AEP cc
Subbasin: Catchment West

Start of Run:	18Jan2023, 00:00	Basin Model:	Basin 1
End of Run:	20Jan2023, 00:00	Meteorologic Model:	Met 1
Compute Time:	27Jan2023, 12:00:55	Control Specifications:	Control 1

Volume Units: ○ MM ◉ 1000 M3

Computed Results

Peak Discharge:	21.67060 (M3/S)	Date/Time of Peak Discharge:	18Jan2023, 12:30
Precipitation Volume:	295.48160 (1000 M3)	Direct Runoff Volume:	192.84731 (1000 M3)
Loss Volume:	102.63429 (1000 M3)	Baseflow Volume:	0.00000 (1000 M3)
Excess Volume:	192.84731 (1000 M3)	Discharge Volume:	192.84731 (1000 M3)

Southern catchment 1% AEP + climate change storm

Summary Results for Subbasin "Catchment south"

Project: 33097 catchment flows Simulation Run: 1% AEP cc
Subbasin: Catchment south

Start of Run:	18Jan2023, 00:00	Basin Model:	Basin 1
End of Run:	20Jan2023, 00:00	Meteorologic Model:	Met 1
Compute Time:	27Jan2023, 12:00:55	Control Specifications:	Control 1

Volume Units: ○ MM ◉ 1000 M3

Computed Results

Peak Discharge:	56.74596 (M3/S)	Date/Time of Peak Discharge:	18Jan2023, 12:30
Precipitation Volume:	812.57440 (1000 M3)	Direct Runoff Volume:	530.33011 (1000 M3)
Loss Volume:	282.24429 (1000 M3)	Baseflow Volume:	0.00000 (1000 M3)
Excess Volume:	530.33011 (1000 M3)	Discharge Volume:	530.33011 (1000 M3)