DETAILED SITE INVESTIGATION

71 TRIG ROAD, WHENUAPAI, AUCKLAND

Reference Number: REP-1525B/DSI/JUL21

PREPARED FOR: NEIL CONSTRUCTION LTD

22 JUNE 2021

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Statement

This site investigation has been prepared in accordance with the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011. It has been managed by a suitably qualified and experienced practitioner (SQEP); and reported on in accordance with the current edition of the Ministry for the *Environment's Contaminated Land Management Guidelines No.1 – Reporting on Contaminated Sites in New Zealand.*

Report prepared on behalf of GSL by:	Report reviewed and authorised on behalf of GSL by:
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Thank you for the opportunity to carry out this investigation. Should you have any queries regarding this report please do not hesitate to contact us on 09 475 0222.

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EXECUTIVE SUMMARY

Neil Construction Limited propose to develop the piece of land located at 71 Trig Road through the change in landuse from rural production / vacant rural land to commercial / industrial landuse, the subdivision of the title creating new commercial lots, and site preparatory earthworks involving the disturbance of 51,500 m^3 of soil across the sites 6.7 Ha area.

Geosciences Ltd (GSL) previously conducted a preliminary site investigation on site which identified a portion of the property which was considered to be potentially contaminated as a result of the storage of refuse, horticultural packing materials, and end of life farm machinery, vehicles and above ground fuel storage tanks. A site management plan was provided alongside the PSI which documented the required intrusive investigation of the area following the clearance of the above materials. Following application for earthworks consent, Auckland Council requested that a detailed site investigation be undertaken in order to confirm the activity status of the development under the NES and the associated risks to human and environmental health as a result of the disturbance of soil on the potentially contaminated area. This DSI has been prepared to meet the requirements of Auckland Councils request for information and the requirements of the *National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health* (NES) and Chapter E.30 of the *Auckland Unitary Plan (Operative in Part)* (AUP(OP)).

This DSI involved the collection of 16 discrete soil samples from in and around the barn on site where refuse, horticultural packing materials, farm machinery and vehicles have been stored to supplement the findings of previous investigations. Soil samples were analysed for a suite of heavy metals, organochlorine pesticides (OCPs), polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH) and presence / absence of asbestos as required based on visual observations.

Analysis of the soil samples revealed:

- no soil sample returned concentrations of any contaminant of concern in excess of the NES commercial / industrial SCS;
- one soil sample returned an apparent exceedance of the AUP(OP) permitted activity soil acceptance criteria for zinc, however, this is shown to be a statistical outlier and the concentration of zinc across the investigation area is shown with 95% confidence to not exceed 161.6 mg/kg which falls within the expected naturally occurring background concentration range for non-volcanic soil in the Auckland Region;
- two soil samples from within the barn returned detectable concentrations of petroleum hydrocarbons, while two soil samples to the north of the barn returned detectable traces of OCPs (endrin and endosulfan);
- detectable traces of PAH compounds in one soil sample, however given these concentrations fall on or marginally above the laboratory reporting limit, they are considered to be a result of potential interference from organic matter in the soil matrix;
- statistical analysis of the soil sampling data indicates with 95% confidence that concentrations of heavy metals fall within the expected naturally occurring background concentration ranges for non-volcanic soil in the Auckland Region

It is concluded that the proposed change in landuse, subdivision, and development of the site area highly unlikely to result in any risk to human health or the environment. As a result, the proposed change in landuse and development of the site can be undertaken as a permitted activity under Regulation 8(4) of the NES. With respect to soil disturbance activities, while these concentrations are trace only and the proposed development is highly unlikely to result in any risk to human or environmental health, soil disturbance is unlikely to be able to comply with all aspects of Regulation 8(3). Consequently, soil disturbance will likely trigger Regulation 9 of the NES.

As no soil sample returned concentrations of any contaminant of concern above the AUP(OP) permitted activity soil acceptance criteria, the provisions of Chapter E.30 are not considered to be applicable to the proposed development and no further work, with respect to Chapter E.30 of the AUP(OP) is required.

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1 INTRODUCTION

Geosciences Ltd (GSL) has prepared the following report for Oceania Healthcare in accordance with GSL proposal issued via email on 9 June 2021 and in accordance with GSL standard terms and conditions.

This report has been prepared in accordance with the Ministry for the Environment (MfE) Contaminated Land Management Guidelines (CLMG): No. 1 - *"Guidelines for Reporting on Contaminated Sites in New Zealand"*, and No. 5 – *"Site Investigation and Analysis of Soils"* (References 1 and 2).

2 PROPERTY DETAILS

Location:	71 Trig Road, Whenuapai
Legal Description:	Lot 2 & 5 DP 101583
Size:	6.9775 Ha

The piece of land encompassed by the above legal identifiers is hereafter referred to as 'the site' in this report and the extent is demarcated on Figure 1. The site is currently a vacant rural lot comprising one shed in the northeast corner of the site with the remaining area vacant former horticultural land portions of which are utilised for the cultivation of decorative flowers. The landuse is consistent with the surrounding area where a mix of rural residential and horticultural landuses are noted. To the north of the site is the New Zealand Air Force Whenuapai Air Base.

2.1 ENVIRONMENTAL CONTEXT

The site is a gently sloping vacant rural block with a mixture of cultivated paddocks and rough pasture, with an unpaved access track from Trig Road to the west of the site.

2.1.1 GEOLOGY & GEOHYDROLOGY

The local geology is described by Edbrooke (Reference 7) as Late Pliocene to Middle Pleistocene pumiceous mud, sand and gravel with muddy peat and lignite: Rhyolite pumice, including non-welded ignimbrite, tephra and alluvia of the Puketoka Formation..

The site within the footprint of the Kumeu Waitemata Aquifer Management Area.

2.1.2 TOPOGRAPHY AND DRAINAGE

The has a gentle slope from the high point formed by the access track on the southern boundary of approximately 43 m above sea level (asl) sloping own to the northeast corner of the site with a low point of approximately 26 m asl.

Drainage is via overland flow and soakage through the site's permeable surfaces. The Auckland Council GEOMaps website predicts several minor (2,000 m^2 to 4,000 m^2 catchment) overland flow paths draining the site across the northern boundary. Overland flow is managed by several man-made drainage trenches which run east west across the site

A review of the floodplains, flood prone, or flood sensitive areas of the Auckland Region (available on the Auckland Council GIS) revealed that only a small portion of the northeast corner is predicted to be located on a flood plain related to a larger overland flow path. No areas of the site are listed as being located in flood prone or flood risk areas. The site is not part of the Natural Stream Management areas defined in the Auckland Council GEOMaps Natural Resource overlays.

3 PROPOSED CHANGE IN LANDUSE, SUBDIVISION AND DEVELOPMENT

It is proposed to develop the site through the subdivision of the title and change in landuse from rural production to commercial / industrial landuse and to undertake earthworks involving 51,500 m^3 of disturbance across 6.7 Ha of the site, excluding the riparian margins of the streams on site.

4 STANDARDS AND REGULATIONS

As a result of the above proposed development, it will be necessary to address the requirements of the following standards, rules, and regulations applicable for the site, including the following request for information by Auckland Council.

4.1 AUCKLAND COUNCIL REQUEST FOR FURTHER INFORMATION

Following application for landuse consent to undertake the abovementioned earthworks (Application number LUC60376543), Auckland Council issued a request for further information under Section 92 of the Resource Management Act 1991 (RMA). The request included the following point relating to contaminated land:

10. *"Section 6.2 of the AEE states that the soil disturbance activity is a Controlled Activity under the NES:CS. however, NES:CS Regulation 9(1) requires a Detailed Site Investigation (DSI) to satisfy the Controlled Activity Standards. The submitted Preliminary Site Investigation (PSI) notes an absence of soil sampling within the barn area, which is noted as an area of potential soil contamination. Please either:*
    a. *Provide a DSI, prepared by a suitably qualified and experienced contaminated land practitioner ('SQEP'), in accordance with the Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand (Ministry for the Environment, revised 2011), or,*
    b. *confirm that an NES:CS consent is sought as a Discretionary Activity under NES:CS Regulation 11 for the soil disturbance activity."*

4.2 NATIONAL ENVIRONMENTAL STANDARDS

The *National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health* (NES) (MfE, 2012) ensures that land affected by contaminants in soil is appropriately identified and assessed. When soil disturbance and / or land development activities take place it should be, if necessary, remediated or the contaminants contained to make the land safe for human use.

Under the NES, land is considered to be actually or potentially contaminated if an activity or industry on the MfE Hazardous Activities and Industries List (HAIL) has been, is, or is more likely than not to have been, undertaken on the land. As a previous preliminary site investigation (PSI),

detailed in Section 6 below, noted the potential for activities encompassed on the HAIL may have bene undertaken, in particular around the barn on site, that the Regulations of the NES would be applicable. A detailed site investigation is therefore required in order to establish the activity status under the NES.

4.3 AUCKLAND UNITARY PLAN (OPERATIVE IN PART)

Section 30(1)(f) of the RMA provides the Auckland Council with a statutory duty to investigation land for the purposes of identifying and monitoring contaminated land and for the controls of discharges of contaminants into or onto land or water and discharges of water into water.

The Auckland Unitary Plan (Operative in Part) (AUP(OP)), which was formally notified on 30 September 2013, is a combined regional policy statement, regional coastal plan, regional plan, and district plan. Auckland Council notified an operative in part version of the plan on 15 November 2016 (Reference 4).

Chapter E.30 of the AUP(OP) deals specifically with contaminated land and maintains that Council is required to manage both the use of land containing elevated levels of contaminants and the discharge of contaminants from land containing elevated levels of contaminants. As no appeals have been lodged on Chapter E.30, the provision of that section can be considered operative under Section 87 of the RMA. For all purposes of this investigation, the relevant provisions of the AUP(OP) relating to soil contamination have legal jurisdiction and those provision have been considered where they may have an impact on the proposed development.

5 DETAILED SITE INVESTIGATION OBJECTIVES AND PROJECT DESIGN

The objectives of this investigation were to:

- investigate the soil quality in the area of the barn identified as the potential location of HAIL activities;
- provide an assessment of disposal options for sitewide earthworks, if offsite disposal of soil is required;
- inform on the activity status of the proposed development under the NES and AUP(OP) and the resulting actual or potential risks to human and environmental health; and
- make recommendations on any further work required

To achieve the objectives of the DSI, GSL has undertaken the following:

- a brief review of a previous GSL PSI;
- a site visit for the purpose of collecting soil samples;
- the collection and laboratory analysis of soil samples in accordance with the MfE Contaminated Land Management Guideline No. 5 – *Site Investigation and Analysis of Soils*; and
- the preparation of this report in accordance with Contaminated Land Management Guideline No. 1 – "*Reporting on Contaminated Sites in New Zealand*" (Ministry for the

Environment, 2011) detailing the findings of this investigation and the recommendations, if any, for further work.

6 PRELIMINARY SITE INVESTIGATION – FEBRUARY 2021

Geosciences Limited undertook a Preliminary Site Investigation with limited soil sampling (Ref: *LtR-1525/PSI-LSS/Feb21*)) for the site in February 2021 for Neil Construction Ltd as part of the process of acquiring the piece of land for the purpose of the proposed commercial / industrial development. The scope of GSL's engagement was to provide a pre-purchase ground contamination assessment in accordance with the CLMG requirements for a preliminary site investigation (PSI), and to identify whether any potential soil contamination issues exist on the piece of land and, if so, advise on the likely risks and implications of that discovery.

The investigation included a desktop study that revealed that the property was vacant pasture until the 1980s when market gardening activity was established. Horticultural activity, through the cultivation or ornamental flowers continuing up to the time of the PSI site inspection. As a result, GSL identified that the following potential sources of contamination could be evident on the piece of land:

- Potential bulk storage and use of persistent pesticides during horticultural activities – HAIL Item A.10
- Above ground fuel storage tanks – HAIL Item A.17
- Potential use of lead based paint on a barn on site, and storage of end of life farm machinery in the barn – Hail item I
- Potential for asbestos containing materials in footings of barn – HAIL Item E.1 only when in broken or degraded condition.

Additionally, as the site, in particular the area surrounding the barn was left in very unkempt condition with substantial amounts of rubbish, machinery, and polystyrene produce packing crates as well as being densely overgrown at the time of the site inspection, meant it was not possible to undertake a systematic inspection of the ground surface during the site inspection. It was recommended that following the clearance of the area around the barn that further investigation would be required as a result of the potential HAIL activities relating to the barn.

As part of the PSI a limited soil sampling regime was undertaken which included the collection of three composite soil samples from across the formerly cropped areas on site, and the collection of two discrete soil samples from the location of two disused diesel tanks within the edge of the rubbish pile adjacent to the barn. Composite soil samples were analysed for arsenic, copper, lead and organochlorine pesticides (OCPs) while discrete soil samples were analysed for a suite of heavy metals, OCPs, total petroleum hydrocarbons (TPH), and polycyclic aromatic hydrocarbons (PAHs).

Analytical results revealed that soil across the wider site area has not been adversely impacted by historical landuses, composite soil samples returned concentrations of OCPs below laboratory reporting limits and concentrations of arsenic, copper, and lead well within the expected naturally occurring background concentration ranges. Two soil samples collected adjacent to the discarded fuel storage tanks returned concentrations of cadmium, copper, lead, and zinc in excess of the expected naturally occurring background concentration ranges and soil sample SS1 returned low level TPH concentrations which fell well within the Tier 1 soil acceptance criteria set by the MfE

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Petroleum Guidelines).

The soil sampling plan from the investigation is provided in Figure 2, while tabulated analytical results of this investigation are attached in Table 1 below.

Table 1: February 2021 Analytical Results[1]

	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	C15-C36[5]
SS1	5.1	**0.830**	12.7	**52.5**	19.3	8.91	**211**	**123**
SS2	12	0.43	24.0	**146**	**128**	22.4	165	<50
SC1	1.1	-	-	6.5	6.12	-	-	-
SC2	1.4	-	-	8.12	5.29	-	-	-
SC3	2.7	-	-	9.33	10.3	-	-	-
NES[2]	70	1,300	6,300	>10,000	3,300	NL	NL	NA[6,7]
AUP(OP)[3]	100	7.5	400	352	250	325	250	NA[7,8]
Background[4]	0.4-12	<0.1-0.65	2-55	1-45	<5-65	0.9-35	9-180	ND

Notes:

1. All concentrations measured in mg/kg
2. National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health – commercial / industrial outdoor worker (unpaved)
3. Auckland Unitary Plan (Operative in Part) - Table E.30.6.1.4.1 Permitted activity soil acceptance criteria
4. Auckland Regional Council Technical Publication No. 153 - Expected naturally occurring background concentration ranges for non-volcanic soils in the Auckland region
5. No detection in the <C15 chain length hydrocarbons
6. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand – Tier 1 soil acceptance criteria for TPH (C15-C36) commercial / industrial use all pathways for silty clay surface (<1m) soil
7. NA indicates the estimated criterion exceeds 20,000 mg/kg. at 20,000 mg/kg residual sperate phase is expected to have formed in the soil matrix
8. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminates Sites in New Zealand – Soil acceptance criteria for protection of groundwater, silty clay surface soils GW depth 2m
9. Values in **BOLD** exceed the NES criteria, values in **BOLD** exceed the AUP(OP) criteria, values in **BOLD** exceed the Background ranges
10. ND = not detected / NL = no limit

The PSI concluded that the soil on the wider site area was highly unlikely to present a risk to human or environmental health as a result of the proposed development. However, as a result of the detection of hydrocarbons an elevated heavy metal concentrations around the barn the regulations of the NES would be applicable to the proposed development of the site and recommended that further investigation of the area surrounding the barn was required in order to establish the level or risk involved and to provide a full assessment of the activity status under the NES and AUP(OP).

6.1 SITE MANAGEMENT PLAN

As a result of the findings of the PSI-LSS as documented in the above section, a site management plan (SMP) (ref: *Rep-1525a/SMP/Feb21*) was prepared by GSL to document the basic earthworks controls to be in place for any soil disturbance activities on site.

The SMP also provided the framework for the investigation of the area surrounding the barn with systematic soil sampling at a rate of twice the recommended rate under CLMG No 5 for an area of that size.

The SMP recommended that following the clearance of the refuse and vegetation surrounding the barn that soil sampling should include the collection of up to 12 discrete soil sample on a grid pattern across the area surrounding the barn for analysis of heavy metals, TPH PAH and OCPs as required by the findings of the visual inspection, and four soil samples from within the immediate curtilage of the barn for the analysis of lead and asbestos.

A revised copy of the SMP has been provided alongside this DSI to be submitted to Auckland Council for approval prior to the commencement of earthworks on the site.

7 JULY 2021 SITE INSPECTIONS

GSL personnel undertook two site inspections of the piece of land under investigation on 6 July and 12 July 2021 for the purpose of collecting soil samples as required by the SMP.

7.1 6 JULY 2021

At the time of the 6 July inspection GSL personnel met with representatives of Neil Construction Ltd and Hick Bros Civil to discuss the requirements of the SMP. At the time of the inspection the machinery and vehicles had been removed from the barn, two soil samples were collected from the earth floor within the shed. Minor surficial staining was noted in areas where vehicles and machinery had been stored, no hydrocarbon odours or indications of gross hydrocarbon contamination were noted within the barn.

Following discussion, it was decided to move the refuse and packing materials stockpiled outside the barn to within the barn using a bulldozer in order to enable the visual inspection and soil sampling of the area around the barn.

7.2 12 JULY 2021

Following notification that the surrounding area had been cleared, GSL undertook a second inspection on 12 July 2021 in order to carry out the soil sampling (as documented in Section9 below) and visual inspection of the ground surface. At the time if the inspection the area to the east of the barn had been cleared using a bulldozer with the bulk of the material shifted to the interior of the barn, the surface had been cleared of vegetation and subsequently stabilised with straw.

During the visual inspection it was clear that the bulk of the polystyrene packing materials and refuse to the east of the barn were stockpiled on a residual concrete slab, the extent of which is mapped on Figure 3. Additionally, the location of the two discarded above ground fuel storage tanks noted in the PSI site inspection appears to have been at the northern edge of the slab,

however, as indicated on Figure 3, the norther and northeast corner of the slab had been partially removed at some stage. It was unclear from inspection of the ground surface where the tanks may have originally been situated as there were no visual or olfactory indications, such as staining, or hydrocarbon aromas noted anywhere on the site during the inspection that would have identified their location.

Inspection of the rubbish when moved to the interior of the barn indicates that the bulk of the material was the polystyrene packing crates, with minor household type refuse including some small appliances. There was no putrescible waste noted in the refuse, and no organic matter or any other indications of fuel or persistent pesticide storage noted either in the refuse, or across the area of investigation.

Site photos are included in Appendix B.

8 REVISED CONCEPTUAL SITE MODEL FOR POTENTIAL CONTAMINATION

Based on the findings of the previous investigation GSL developed the following revised conceptual site model for actual and potential contamination on the site. The following sections identify the sources, expected spatial distributions of contaminants and intrusive investigation requirements in order to fully define the identified impacted soils on site.

8.1 SOURCES OF CONTAMINATION

As identified in the previous investigation, potential historical use of lead based paint may have impacted the soil in the immediate area surrounding the shed. Additionally, it was noted that asbestos containing materials, while not observed in the structure itself, may have been utilised as boxing material for the sheds concrete footings.

The impacts of lead based paint can be encompassed under Item I on the MfE HAIL where a risk to human or environmental health is present, while asbestos containing material is included on the MfE HAIL as Item E.1 when in broken or degraded condition.

The only other potential source of contamination noted in the area is the ancillary discharges associated outdoor storage of refuse, discarded above ground fuel storage tanks, and horticultural produce packing materials. The site inspection did not reveal any further indications of the exact location of historical fuel or persistent pesticide storage. While the bulk storage of persistent pesticides is included under Item A.10 on the MfE HAIL and the above ground storage of fuels in included as Item A.17, there was no indication of the bulk storage of pesticides in any of the refuse (an no detections had been identified in previous limited soil sampling), nor was there any further evidence of fuel storage.

As a wide range of contaminants of concern may be related to the potential sources of contamination, heavy metals, organochlorine pesticides, polycyclic aromatic hydrocarbons, and where appropriate total petroleum hydrocarbons and presence / absence of asbestos have been identified as an appropriate suite of analysis in order to assess the risks associated with the above activities.

8.2 EXPECTED SPATIAL DISTRIBUTION

The above potential sources of contamination are expected to result in the following spatial distributions of contaminants.

8.2.1 LEAD BASED PAINT AND ACM

Lead paint can infiltrate the soil surrounding structures when in degraded flaking condition, or during times of routine maintenance such as scraping or sanding where insufficient ground protection is utilised. Similarly, asbestos fibres / fragment can infiltrate the soil immediately surrounding structures when in degraded or broken condition.

As lead paint flakes and asbestos fibres / ACM fragments are generally not mobile in the soil matrix without mechanical assistance, it is expected that the impacted area arising from their degradation and discharge to the soil will be limited to the immediate surrounding area of the identified source. Elevated concentrations of lead and detection of asbestos can be elevated in the immediate curtilage of buildings and are expected to attenuate rapidly to background ranges with increasing distance from the source, and generally within approx. 5 m lateral distance. Likewise with depth, elevated concentrations are not expected to be pervasive through the soil profile with attenuation to background concentrations expected within the uppermost 500 mm of soil.

8.2.2 ABOVE GROUND FUEL STORAGE

The bulk storage of fuels in above ground storage tanks presents the potential for localised, discrete hotspots in the area of the tanks where fuelling activities and refilling of tanks may result in leaks or spills. Unless large scale spills of fuel occur, it is unlikely that impacts would extend past the immediate area of the tank. As hydrocarbons are volatile, any dispersion of spills or leaks will bias towards evaporation rather than infiltration into deeper soils, resulting in surficial impacts where residual components of the hydrocarbon remain in the surface soil. It would not be expected that impacts would extend beyond the uppermost 300 mm to 500 mm in the immediate area unless a larger scale spill had occurred. As no evidence for any leaks of spills was noted in the site inspections, the only area considered to be potentially impacted is the soil immediately surrounding the area of the two tanks at the northern end of the concrete slab.

8.2.3 STORAGE OF REFUSE AND HORTICULTURAL PACKING MATERIALS

Given no putrescible material was observed in the refuse, and the bulk of the material being polystyrene packing material, it is expected that the soil underlying the refuse present a low risk of potential contamination through the diffuse release of any residual contaminants through rainwater percolation. As the majority of the refuse was stored on a concrete slab, the area surrounding the slab is considered to be the highest risk for potential contamination as a result of run off of rainwater percolated through the refuse. The potential for a hotspot surrounding the slab is noted, concentrations of potential contaminants would be expected to be elevated around the immediate perimeter of the slab and attenuating with distance from the slab. The topsoil horizon around the slab is considered the highest risk for potential contamination, diffuse run off of potentially impacted stormwater is not expected to present a high risk for impacts to deeper soil horizons given the high clay content and reasonably low permeability of the surrounding soil.

8.3 INTRUSIVE INVESTIGATION REQUIREMENTS

In order to investigate the soil quality in and around the barn area, a judgemental soil sampling regime is appropriate including the following soil sampling:

- targeted soil sampling around the barn to assess the potential impacts of lead based paint and ACM;
- targeted soil sampling inside the barn to assess the potential impacts of storage of end-of-life farm machinery and vehicles;
- targeted soil sampling in the presumed location of above ground fuel storage and refuelling activities; and
- systematic, grid-based soil sampling across the area of refuse storage with a bias towards the perimeter of the concrete slab identified as the highest risk for diffuse run off of stormwater percolated through the refuse and packing materials

9 SOIL SAMPLING AND ANALYSIS

Based on the conceptual model developed in the previous investigation and revised above, GSL conducted a judgemental grid based intrusive investigation which included the collection of soil samples at twice the recommended density for a piece of land of this size by CLMG No. 5. Sixteen discrete surface soil samples were collected from across the full extent of the identified HAIL area using an approximate 10 m spaced grid as a starting point for the intrusive investigation. As noted in Section 7 above, a residual concrete slab was found to underly the central portion of the area, soil sampling was therefore biased towards sampling off the edges of the slab as the most likely areas to display impacts. Soil samples (DS1-DS3) were collected from within the barn where machinery and vehicles had been stored (DS1 and DS2) and the high traffic area at the barns entrance (DS3). While three soil samples (DS9, DS15, and DS16) were collected from the immediate curtilage of the barn as an assessment of potential impacts of lead based paint and asbestos within the footings.

During soil sampling it was noted that large amounts of organic material (vegetation) were entrained in the uppermost soil surface, some partially decomposed vegetation was present in areas where packing materials and refuse had obscured the ground surface. Additionally, some saturated peat was encountered in the shallow subsurface across the area, consistent with the published geology of the site.

Soil samples were collected from the surface 0-75 mm topsoil horizon using a stainless steel hand auger. Soil samples were placed directly in laboratory provided glass sample jars with the date, sample identification number, sample depth, location, and initials of the sampler noted on the bag. Once collected sample jars were placed in a chilly bin with ice packs in order to preserve any volatile components in the soil samples.

Soil sample locations are set out on Figure 3.

9.1 LABORATORY ANALYSIS AND QUALITY CONTROL

Soil samples for analysis of lead were dispatched to Eurofins Environmental Testing Ltd in Auckland for analysis of the contaminants of concern as identified in Section 8 above.

Eurofins are accredited by International Accreditation New Zealand (IANZ) for the analysis undertaken.

9.2 ACCEPTANCE CRITERIA AND RELEVANT GUIDELINES

The NES mandates fourteen soil contaminant standards (SCS) for the protection of human health for organic compounds and inorganic elements for various landuse criteria. The NES human health SCS criteria for commercial / industrial workers (unpaved) have been applied as a risk assessment to human health in light of the proposed development.

The NES does not set a soil contaminant standard for petroleum hydrocarbons, however under the hierarchy defined in MfE Contaminated Land Management Guideline No. 2 the Tier 1 soil acceptance criteria set by the MfE *Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand* where appropriate, analytical results have been compared to these criteria as an appropriate New Zealand risk-based guideline.

The AUP(OP) also set permitted activity environmental discharge and soil acceptance criteria for potentially contaminated land against which the results have been compared.

Results are also compared to the background concentration ranges of inorganic elements in soils in the Auckland Region for non-volcanic soils.

10 ANALYTICAL RESULTS

A comparison of the analytical results with the relevant guideline criteria is provided in Table 2 and Table 3 below. Copies of the laboratory chain of custody document (COC) and analytical transcripts are attached in Appendix C, while a discussion of the results is provided below. All three soil samples analysed for presence / absence of asbestos returned no detectable asbestos at the laboratory limit of reporting, these results have therefore been omitted from the tables below.

Table 2: July 2021 Heavy Metal Analytical Results[1]

	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc
DS1	8.7	0.17	16	13	22	10	57
DS2	4.5	0.37	10	25	16	6.8	81
DS3	6.2	0.29	12	20	19	6.3	120
DS4	4.6	0.13	10	11	14	6.5	34
DS5	11	**1.6**	12	26	28	9.8	64
DS6	3.8	0.22	7.4	6.7	11	4.0	21
DS7	7.5	0.12	12	19	22	7.8	54
DS8	6.7	0.40	9.2	13	18	8.8	140
DS9	-	-	-	-	47	-	-
DS10	7.6	0.52	11	16	34	5.0	**490**
DS11	11	0.14	14	11	22	9.3	89
DS12	2.1	0.23	6.2	4.5	7.3	2.8	14
DS13	1.7	0.09	5.1	14	7.2	3.2	27
DS14	2.8	0.29	6.9	8.4	18	3.8	35
DS15	-	-	-	-	45	-	-
DS16	-	-	-	-	34	-	-
NES	70	1,300	6,300	>10,000	3,300	NL	NL
AUP(OP)	100	7.5	400	325	250	105	400
Background	0.7-12	<0.1-0.65	2-55	1-45	<5-65	0.9-35	9-180

Notes:

1. All concentrations measured in mg/kg
2. National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health – commercial / industrial outdoor worker (unpaved)
3. Auckland Unitary Plan (Operative in Part) - Table E.30.6.1.4.1 Permitted activity soil acceptance criteria
4. Auckland Regional Council Technical Publication No. 153 - Expected naturally occurring background concentration ranges for non-volcanic soils in the Auckland region
5. Values in **BOLD** exceed the NES criteria, values in **BOLD** exceed the AUP(OP) criteria, values in **BOLD** exceed the Background ranges
6. ND = not detected / NL = no limit

Table 3: July 2021 Organic Compounds Analytical Results[1]

	C15-C36[5]	Flouranthene	Pyrene	Endrin	Endosulfan
DS1	<20	<0.03	<0.03	<0.01	<0.01
DS2	**61**	<0.03	<0.03	<0.01	<0.01
DS3	<20	<0.03	<0.03	**0.02**	<0.01
DS4	-	<0.03	<0.03	<0.01	<0.01
DS5	-	<0.03	<0.03	<0.01	**0.01**
DS6	-	<0.03	<0.03	<0.01	<0.01
DS7	<20	<0.03	<0.03	<0.01	<0.01
DS8	<20	<0.03	<0.03	<0.01	<0.01
DS9	-	<0.03	<0.03	<0.01	<0.01
DS10	-	<0.03	<0.03	<0.01	<0.01
DS11	-	<0.03	<0.03	<0.01	<0.01
DS12	-	**0.04**	**0.04**	<0.01	<0.01
DS13	-	<0.03	<0.03	<0.01	<0.01
DS14	-	<0.03	<0.03	<0.01	<0.01
NES[2]	NA[6,7]	82,000[9]	NA[7]	340[10]	6,800[10]
AUP(OP)[3]	NA[7,8]	210[11]	1.3	0.05[11]	0.9[11]
Background[4]	ND	ND	ND	ND	ND

Notes:

1. All concentrations measured in mg/kg
2. National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health – commercial / industrial outdoor worker (unpaved)
3. Auckland Unitary Plan (Operative in Part) - Table E.30.6.1.4.1 Permitted activity soil acceptance criteria
4. Auckland Regional Council Technical Publication No. 153 - Expected naturally occurring background concentration ranges for non-volcanic soils in the Auckland region
5. No detection in the <C15 chain length hydrocarbons
6. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand – Tier 1 soil acceptance criteria for TPH (C15-C36) commercial / industrial use all pathways for silty clay surface (<1m) soil
7. NA indicates the estimated criterion exceeds 20,000 mg/kg. at 20,000 mg/kg residual sperate phase is expected to have formed in the soil matrix
8. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminates Sites in New Zealand – Soil acceptance criteria for protection of groundwater, silty clay surface soils GW depth 2m
9. Supplemental Guidance for Developing Soil Screening Levels at Superfund Sites (US EPA) – Commercial / industrial landuse, ingestion-dermal pathway indoor worker receptor
10. Supplemental Guidance for Developing Soi Screening Levels at Superfund Sites (US EPA) – Soil screening levels outdoor worker receptor ingestion-dermal pathway
11. Supplemental Guidance for Developing Soi Screening Levels at Superfund Sites (US EPA) – Soil screening level, migration to groundwater, dilution factor = 1

12. Values in **BOLD** exceed the NES criteria, values in **BOLD** exceed the AUP(OP) criteria, values in **BOLD** exceed the Background ranges
13. ND = not detected / NL = no limit

10.1 HEAVY METALS

No soil sample returned concentrations of heavy metals in excess of the NES commercial / industrial SCS. Only soil sample DS10 returned a concentration of zinc which marginally exceeds the AUP(OP) permitted activity soil acceptance criteria.

Soil sample DS5 returned a concentration of cadmium which exceeds the expected naturally occurring background concentration range.

All other soil samples returned concentrations of heavy metals within the expected naturally occurring background concentration ranges for non-volcanic soil in the Auckland Region.

Statistical analysis through the 95% Upper Confidence Limit Calculations in accordance with CLMG No. 5 is included in Section 10.6.

10.2 ORGANOCHLORINE PESTICIDES (OCPS)

No soil sample returned concentrations of any OCPs above the NES commercial / industrial SCS or the AUP(OP) permitted activity soil acceptance criteria.

Soil samples DS2 and DS5 returned trace detections of endrin (0.02 mg/kg) and endosulfan (0.01 mg/kg)respectively, both of the returned concentrations are marginally above the laboratory reporting limits and well within the applicable human health and environmental protection criteria. As the detections fall on or marginally above the laboratory limit of reporting and are within the laboratory error margins, these detections are considered to be indistinguishable from the limit of reporting and are therefore considered to be inconsequential and are disregarded.

No other soil returned detectable concentrations of OCPs at the laboratory limits of reporting.

10.3 POLYCYCLIC AROMATIC HYDROCARBONS (PAHS)

No soil sample returned detections of PAHs in excess of the NES commercial / industrial SCS or the AUP(OP) permitted activity soil acceptance criteria.

Only soil sample DS12 returned detectable traces of non-carcinogenic PAHs fluoranthene and pyrene which fall well within the landuse criteria, and only marginally above the laboratory detection limits. For the same reasons as the OCP detections described in Section 10.2 above, and given the high organic content of the soil, and as DS12 was located outside of the refuse / packing materials area, it is considered highly likely that these detections are as a result of organic interference in the soil matrix and are indistinguishable from the limit of reporting. These detections can therefore be considered to be erroneous.

10.4 TOTAL PETROLEUM HYDROCARBONS (TPHS)

No soil sample returned detections of TPH above the Petroleum Guidelines criteria for the protection of human health or groundwater. Soil sample DS2 from within the barn returned a trace detection (61 mg/kg) of long chain (C15-C36) hydrocarbons which falls well within the Petroleum Guidelines criteria.

10.5 ASBESTOS

No soil sample submitted for the analysis of asbestos returned detectable asbestos fibres or respirable fibres at the laboratory limit of reporting.

10.6 95% UPPER CONFIDENCE LIMIT CALCULATIONS

The 95% Upper Confidence Limit (95% UCL) is used where a statistically designed sampling regime is employed in order to be representative of the actual environmental conditions on site. GSL utilised a judgemental grid based soil sampling regime across the area, given the broadly systematic approach utilised (noting that a grid based approach was modified on site due to the concrete surface), the 95% UCL method is therefore an appropriate statistical approach.

Statistical analysis of the analytical results confirms a normal distribution of contaminants in the surface soil horizons. Consequently, the use of the 95% UCL is justified as the method calculates the mean concentration plus or minus the confidence limit, in this case indicating that there is only a 5% probability that concentrations will exceed the calculated arithmetic mean concentration described below.

Copies of the 95% UCL calculation sheets for the elements below are included as Appendix D.

10.6.1 95% UCL - ZINC

The calculated 95% UCL average concentration for zinc in the area of the investigation, is **161.594** mg/kg indicating with 95% confidence that the concentration of zinc in the topsoil across this area will not exceed that value. As a result, it is noted that the apparent DS10 zinc exceedance is a statistical outlier and can be disregarded.

The concentration of zinc in the topsoil horizon across the investigation area is considered to be within the expected naturally occurring background concentration range for non-volcanic soil in the Auckland Region.

10.6.2 95% UCL - CADMIUM

The calculated 95% UCL average concentration for cadmium in the investigation area is **0.56** mg/kg indicating with 95% confidence that the cadmium concentration in the topsoil will not exceed this value.

The cadmium concentrations in the area of investigation are considered to be within the expected naturally occurring background concentration range for non-volcanic soil in the Auckland Region.

10.6.3 95% UCL - COPPER

The calculated 95% UCL average concentration for copper in the investigation area is **41.92** mg/kg indicating with 95% confidence that the cadmium concentration in the topsoil will not exceed this value.

The copper concentrations in the area of investigation are considered to be within the expected naturally occurring background concentration range for non-volcanic soil in the Auckland Region

10.6.4 95% UCL - LEAD

The calculated 95% UCL average concentration for lead in the investigation area is **39.63** mg/kg indicating with 95% confidence that the cadmium concentration in the topsoil will not exceed this value.

The lead concentrations in the area of investigation are considered to be within the expected naturally occurring background concentration range for non-volcanic soil in the Auckland Region

11 CONCLUSIONS

GSL conducted a detailed site investigation on a portion of the piece of land at 71 Trig Road Whenuapai previously identified as potentially contaminated as a result of the storage of horticultural packing materials, refuse, disused fuel tanks and machinery. The DSI included the collection of 16 discrete surface soil samples on a judgemental, grid based soil sampling regime around the identified area with a judgemental bias towards sampling at the margins of a residual concrete slab adjacent to the barn and surrounding the immediate curtilage of the barn.

Soil samples were analysed for heavy metals, OCPs, PAHs, and TPH or asbestos as appropriate, analysis of the results revealed:

- no soil sample returned concentrations of any contaminant of concern in excess of the NES commercial / industrial SCS, or any other SCS threshold;
- one soil sample returned an apparent exceedance of the AUP(OP) permitted activity soil acceptance criteria for zinc, however, this is shown to be a statistical outlier and the concentration of zinc across the investigation area is shown with 95% confidence to not exceed 161.6 mg/kg which falls within the expected naturally occurring background concentration range for non-volcanic soil in the Auckland Region;
- two soil samples from within the barn returned detectable concentrations of petroleum hydrocarbons;
- detectable traces of PAH compounds one soil sample and OCPs in two soil samples, however given these concentrations fall on or marginally above the laboratory reporting limit, they are considered to be indistinguishable from the limit of reporting and a result of potential interference from organic matter in the soil matrix;
- statistical analysis of the soil sampling data indicates with 95% confidence that concentrations of heavy metals fall within the expected naturally occurring background concentration ranges for non-volcanic soil in the Auckland Region

- It is concluded that the proposed change in landuse, subdivision, and development are highly unlikely to result in any risk to human or environmental health.

11.1 NATIONAL ENVIRONMENTAL STANDARDS

Due to the low-level detection of petroleum hydrocarbons with the footprint of the barn, where vehicles and machinery have historically been stored, the regulations of the NES will be applicable to the proposed change in landuse, subdivision, and development. While these concentrations are trace only and the proposed development is highly unlikely to result in any risk to human or environmental health, soil disturbance is unlikely to be able to comply with all aspects of Regulation 8(3). Consequently, soil disturbance will likely trigger Regulation 9 of the NES. Should Neil Construction Ltd wish to address matters in an alternative manner, the location and extent of hydrocarbon impacted soil could be removed from site and disposed under the permitted activity rules prior to any site wide earthworks commencing. To achieve this, stabilisation and separation between two earthworks phases would be required.

GSL notes that any future change in landuse and subdivision aspects of the proposed development can be undertaken as a permitted activity under Regulation 8(4) of the NES.

A revised version of the SMP has been provided alongside this DSI for submission to Auckland Council for approval and in order to address the request for information under Section 92 of the RMA.

11.2 AUCKLAND UNITARY PLAN (OPERATIVE IN PART)

As statistical analysis of the soil sampling data has indicated that no concentrations of any contaminants are above the AUP(OP) permitted activity soil acceptance criteria, the piece of land does not meet the AUP(OP) definition of *"land containing elevated levels of contaminants"*. As a result, the provisions of Chapter E.30 of the AUP(OP) will not be applicable to the proposed change in landuse, subdivision, or development of the piece of land.

12 ASSESSMENT OF SOIL QUALITY

As documented in Section 10 above, statistical analysis of the soil sampling data indicates with 95% confidence that heavy metal concentrations fall within the expected naturally occurring background concentration ranges for non-volcanic soils in the Auckland Region. While trace detections of noncarcinogenic PAH compounds were returned in one soil sample, it is noted that these concentrations can potentially be attributed to organic interference in the soil matrix as a result of the peat content of the soil and / or breakdown of vegetation underlying the packing materials. Additionally, the process of excavation and loading of this soil will likely dilute those concentrations to a level of non-detection and therefore full compliance with the cleanfill definition.

As a result, GSL considers that outside of the area impacted by low level hydrocarbons and OCPs contained the barn and a small area to the north, the soil across the site is consistent with the AUP(OP) definition of cleanfill and can be disposed of as such.

The following extent of soil is considered to be of managed fill quality (Figure 5):

1. Area north of barn encompassing barn footprint with low level hydrocarbon and OCP impacts:

Area:	88 m^2
Depth:	300 mm
Volume:	26.4 m^3
Tonnage:	approx. 42 tonnes (1.6 tonnes / m^3, actual conversion may vary)

GSL notes that all soil is suitable to remain on site if development and earthworks plans allow for the use of soil as cut to fill and top cover.

Depending on earthworks requirements GSL notes that any disposal of topsoil from across the site should in the first instance be biased toward the offsite disposal of cleanfill from across the full extent of the property in order to minimise disposal costs for controlled disposal of the non cleanfill area.

13 REFERENCES

1. Ministry for the Environment (2003) — *Contaminated Land Management Guidelines No.1: Reporting on contaminated Sites in New Zealand*. Ministry for the Environment, Wellington, New Zealand.

2. Ministry for the Environment (2003) — *Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils*. Ministry for the Environment, Wellington, New Zealand.

3. Ministry for the Environment (2012) - Users Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health. Ministry for the Environment, Wellington, New Zealand.

4. Ministry for the Environment (2011) – *Methodology for Deriving Standards for contaminants in Soil to Protect Human Health.* Ministry for the Environment, Wellington, New Zealand.

5. Auckland Council (2013) –*Auckland Unitary Plan (Operative in Part)*, Auckland, New Zealand.

6. Auckland Regional Council (2001) – *Background Concentrations of Inorganic Elements in Soils from the Auckland region (TP153)* – Auckland.

7. Edbrooke, S.W (2001) — *Geology of the Auckland Urban Area,* Institute of Geological and Nuclear Sciences Geological Map 3, Lower Hutt, New Zealand.

8. Auckland Council (2011) - *Auckland Council GEOMAPS*. http://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

14 LIMITATIONS

The conclusions and all information in this Report are given strictly in accordance with and subject to the following limitations and recommendations:

1. The assessment undertaken to form this conclusion is limited to the scope of work agreed between GSL and the client, or the client's agent as outlined in this Report. This report has been prepared for the sole benefit of the client and neither the whole nor any part of this report may be used or relied upon by any other party.
2. The investigations carried out for the purposes of the report have been undertaken, and the report has been prepared, in accordance with normal prudent practice and by reference to applicable environmental regulatory authority and industry standards, guidelines and assessment criteria in existence at the date of this report.
3. This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by GSL for use of any part of this report in any other context.
4. This Report was prepared on the dates and times as referenced in the report and is based on the conditions encountered on the site and information reviewed during the time of preparation. GSL accepts no responsibility for any changes in site conditions or in the information reviewed that have occurred after this period of time.
5. Where this report indicates that information has been provided to GSL by third parties, GSL has made no independent verification of this information except as expressly stated in the report. GSL assumes no liability for any inaccuracies in or omissions to that information.
6. Given the limited Scope of Works, GSL has only assessed the potential for contamination resulting from past and current known uses of the site.
7. Environmental studies identify actual sub-surface conditions only at those points where samples are taken and when they are taken. Actual conditions between sampling locations or differ from those inferred. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from that predicted. Nothing can be done to prevent the unanticipated and GSL does not guarantee that contamination does not exist at the site.
8. Except as otherwise specifically stated in this report, GSL makes no warranty or representation as to the presence or otherwise of asbestos and/or asbestos containing materials ("ACM") on the site. If fill has been imported on to the site at any time, or if any buildings constructed prior to 1970 have been demolished on the site or materials from such buildings disposed of on the site, the site may contain asbestos or ACM .
9. No investigations have been undertaken into any off-site conditions, or whether any adjoining sites may have been impacted by contamination or other conditions originating from this site. The conclusion set out above is based solely on the information and findings contained in this report.
10. Except as specifically stated above, GSL makes no warranty, statement or representation of any kind concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the site.
11. The investigation and remediation of contaminated sites is a field in which legislation and interpretation of legislation is changing rapidly. Our interpretation of the investigation findings should not be taken to be that of any other party. When approval from a statutory authority is required for a project, that approval should be directly sought by the client.
12. Use, development or re-development of the site for any purpose may require planning and other approvals and, in some cases, environmental regulatory authority and accredited site auditor approvals. GSL offers no opinion as to whether the current use has any or all approvals required, is operating in accordance with any approvals, the likelihood of obtaining any approvals, or the conditions and obligations which such approvals may impose, which may include the requirement for additional environmental works.
13. GSL makes no determination or recommendation regarding a decision to provide or not to provide financing with respect to the site. The on-going use of the site and/or use of the site for any different purpose may require the owner/user to manage and/or remediate site conditions, such as contamination and other conditions, including but not limited to conditions referred to in this report.
14. Except as required by law, no third party may use or rely on, this report unless otherwise agreed by GSL in writing. Where such agreement is provided, GSL will provide a letter of reliance to the agreed third party in the form required by GSL.
15. To the extent permitted by law, GSL expressly disclaims and excludes liability for any loss, damage, cost or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in this Report. GSL does not admit that any action, liability or claim may exist or be available to any third party.
16. Except as specifically stated in this section, GSL does not authorise the use of this report by any third party.

FIGURES

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Level 1, 47 Clyde Road,
Browns Bay, 0630
Tel: (09) 475 0222

Figure 1 - Site Locality

71 Trig Road, Whenuapai

Reference:	J1525
Date:	21/09/2020
Drawn:	DW
Approved:	COB

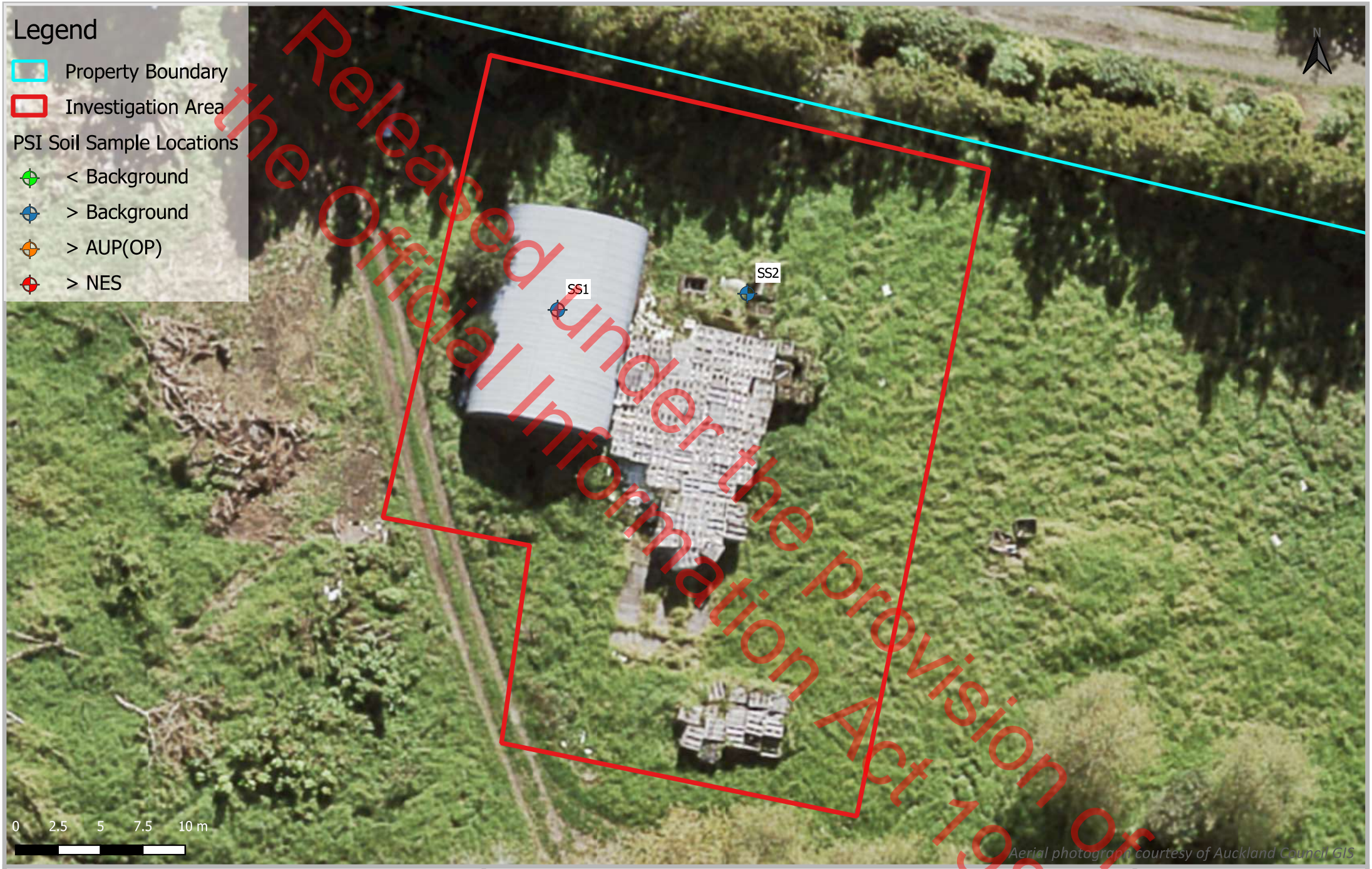

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Figure 2 - PSI Discrete Soil Sample Locations

71 Trig Road, Whenuapai

Reference:	J1525b
Date:	21/07/2021
Drawn:	DW
Approved:	COB

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Figure 3 - Extent of Residual Concrete Slab

71 Trig Road, Whenuapai

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Date:	21/07/2021
Drawn:	DW
Approved:	COB

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Figure 4 - DSI Soil Sample Locations

71 Trig Road, Whenuapai

Reference:	J1525b
Date:	21/07/2021
Drawn:	DW
Approved:	COB

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Figure 5 - Managed Fill Extent

71 Trig Road, Whenuapai

Reference:	J1525b
Date:	21/07/2021
Drawn:	DW
Approved:	COB

APPENDIX A LABORATORY TRANSCRIPTS

APPENDIX B SITE PHOTOGRAPHS

PLATE 1: INTERIOR OF BARN ON 6 JULY INSPECTION

PLATE 2: INTERIOR OF BARN ON 6 JULY INPSECTION

PLATE 3: AREA OF INVESTIGATION FOLLOWING CLEARANCE AND STRAW STABILISATION

PLATE 4: AREA OF INVESTIGATION FOLLOWING CLEARANCE AND STRAW STABILISATION

PLATE 5: AREA OF INVESTIGATION FOLLOWING CLEARANCE AND STRAW STABILISATION

PLATE 6: AREA OF INVESTIGATION FOLLOWING CLEARANCE AND STRAW STABILISATION