NZ Environmental Management

159 & 163 AWAKINO ROAD, DARGAVILLE

LOTS 1 & 2 DP 553122 & LOT 2 DP 116318

DETAILED SITE INVESTIGATION

Job number 2023 23

Consultation

HAIL Reports

Ecological Assessments

Resource Consent Applications

Compliance Monitoring

Water Quality Monitoring

Environmental Management

Pest Reduction Advice

Enrichment Planting

Restoration Advice

Prepared for

MOONLIGHT HEIGHTS

NZEM Quality System:

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350 Kerikeri Road, Kerikeri 0230
m 027 277 0544 t 09 407 3938 www.nzenvironmental.co.nz

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-Contaminants of potential concern and/or analyte selection	✓	
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- Determine the likelihood the contamination poses a risk to identified receptors including potential receptors	✓	
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-Describe limitations of data collected and the assumptions and uncertainties inherent in the data and models used	✓	
Discussion	✓	
Conclusion	✓	
Recommendations if relevant to report purpose		
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SQEP Certificate of Report	✓	
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AUTHORS:

Danette Richards – Environmental Geologist

Danette holds a BSc (Geology) and an MSc (Hons) in Environmental Science. Danette had seven years' experience in exploration mining for base metals in Western Australia prior to returning to New Zealand in 2000 and studying for her Masters (Environmental Science). Her contaminated site investigations work since 2003 includes petroleum storage facilities, timber treatment plants, landfills, agricultural chemical stores, horticultural and agricultural sites. Danette has been working with the current National Environmental Standards (NESCS) since their inception in January 2011.

Heather Windsor – Earth Scientist (CEnvP)

Heather holds a BSc in Earth Sciences and Biology and is a Certified Environmental Practitioner. Heather has more than 20 years' experience with work including testing for contaminants in ground and surface waters, coastal, riverine and ground water quality sampling and data processing. Heather's work includes monitoring of groundwater, geothermal, lakes, springs and rivers, as well as soil and vegetation sampling for hydrocarbon, heavy metals and other contaminants. Heather has been working in the assessment and remediation of soils on HAIL or contaminated sites since the inception of the current National Environmental Standards (NESCS) in January 2011 undertaking assessments on a wide variety of sites, including orchards, commercial and industrial sites. Heather is a member of WasteMINZ and ALGA and holds a Contaminated Site Safety Certificate.

EXECUTIVE SUMMARY

The Site is located at 159 & 163 Awakino Road, Dargaville and has legal description of Lots 1 & 2 DP 553122 & Lot 2 DP 116318.

A private plan change is proposed for changing land use to residential. Land use is currently in pastoral grazing. This report goes to inform the private plan change application. The DSI was prepared in response to requirement from the Kaipara District Council for more information on a historic aerodrome and a proximate landfill.

The property has a land use history of pastoral use with a portion of the site used as an aerodrome from the 1950's to 1981. A top-dressing (aerial/agricultural application) company worked out of the aerodrome. A former, now capped landfill is located along the northern boundary of the Site. About 28% of Lot 2 DP 553122 would be assessed as a HAIL 'Piece of Land'.

The applicable HAIL categories considered were:

A10 - Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds,

A1 - Agrichemicals including commercial premises used by spray contractors for filling, storing or washing out tanks for agrichemical application.

F 1 - Airports including fuel storage, workshops, washdown areas, or fire practice areas

H - Any land that has been subject to the migration of hazardous substances from adjacent land in sufficient quantity that it could be a risk to human health or the environment

I - 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.

Of these category A 1 and F 1 were found to apply within the Piece of Land.

The piece of land over which the HAIL activities have been carried out covers ~8500m^2 and is located around the historic aerodrome buildings on Lot 2 DP 553122.

The scenario used for assessing SCS_{health} in this DSI was: Residential - Standard residential Lot, for single dwelling sites with gardens, including homegrown produce consumption (10 per cent) (NES 2012).

Following a study of the property using historic aerial photographs, and NRC property files, a site visit with soil sampling was carried out.

Sampling was carried out using a stratified sampling regime based on known land use activities. A 20m systematic grid was utilised in the location of ground base areas of the historic aerodrome. Targeted sampling was undertaken around farm sheds, along the boundary and / or down gradient of the land fill, in historic airstrip area with some representative samples collected in areas of pastoral grazing.

All sampling results reported the concentration of the identified contaminants of interest below the applicable soil guideline values for Residential 10% standard except for cadmium in one soil sample. The area around the location of that sample was partially delineated and designated a Control Area.

A review of the conceptual site model indicates the source – pathway – receptor linkages are complete within the Control Area.

A review of conceptual site model indicates the source – pathway – receptor linkages are incomplete outside the Control Area.

1. INTRODUCTION

1.1 INVESTIGATION OBJECTIVES

NZ Environmental Management Ltd was engaged by the landowners to undertake a Detailed Site Investigation (DSI) on Lots 1 & 2 DP 553122 & Lot 2 DP 116318, located at 159 & 163 Awakino Road, Dargaville. The DSI was undertaken in accordance with the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health, 2011 (NESCS). The investigation serves to inform a private plan change application by assessing whether there is any risk to human health on the Site if land use changes to residential living. The DSI provides information on:

a) Site information (history and use),

b) Any likely contaminants from current and historical chemical use, and

c) Information concerning the location, nature, level and extent of any contamination (i.e. Site characterisation).

Information gathered as part of this DSI found that Lots 1 & 2 DP 553122 & Lot 2 DP 116318 together comprise a 42.321 ha Site, listed by the KDC as having Rural zoning.

The area or extent of the proposed plan change is smaller than the Site investigation area.

The property has a history of pastoral and cropping use with a portion of the Site historically being used as an aerodrome. The HAIL activities considered were:

A10 - Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds,

A1 - Agrichemicals including commercial premises used by spray contractors for filling, storing or washing out tanks for agrichemical application.

F 1 - Airports including fuel storage, workshops, washdown areas, or fire practice areas

H - Any land that has been subject to the migration of hazardous substances from adjacent land in sufficient quantity that it could be a risk to human health or the environment

I - 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.

1.2 SITE IDENTIFICATION

Lots 1 & 2 DP 553122 & Lot 2 DP 116318 is located at 159 & 163 Awakino Road, Dargaville (-35.922377° 173.867928°).

The Site is located on the east side of Awakino Road, just prior to the entrance to the Dargaville Resource Recovery Park.

Aerial photographs are shown in Appendix E.

Certificate of Title is given in Appendix C.

1.3 PROPOSED SITE USE

It is proposed to undertake a private plan change to support residential living land use over part of the Site (Appendix A 4).

The investigation extended beyond the extent of the area of proposed plan change on the Site due to the requirement from the KDC to cover off potential adverse impacts from the adjacent (capped) landfill site.

2. SITE DESCRIPTION

2.1 ENVIRONMENTAL SETTING

2.1.1 GEOLOGY AND HYDROLOGY

Soil onsite is an Orthic Gley[1] soil which is mapped as Kara silt loam on the western flat, Tangitiki sandy loam and sand on the slopes and Kaipara clay and clay loam on the eastern flat areas[2]. Kara silt loam soils are podzols formed on terrace alluvium parent rock. Tangitiki sandy loam and sand form from sand parent material and Kaipara clay and clay loams soils form on flood plain with sand, clay and alluvium parent materials.

The contour is flat to the west, then moderately sloping toward the north down to another flat area. The surface drainage patterns over the Lot are shown in Appendix E 11.

Drinking water is derived from rainwater.

The property is located in the Northern Wairoa catchment. No groundwater bores are located within 1 km of the Site[4]. Part of the Site is low lying with a drain connection to the Northern Wiroa River which is influenced by tide at this location. The drain passing through the Site is down hydraulic gradient of the capped landfill.

According to the NRC flood mapping, the property could be impacted by a 1:100 flood event in the northern area[3] (Appendix A 5).

2.2 SITE INSPECTION

A Site inspection (walkover) was carried out by H. Windsor on 24 June 2023. Weather conditions at the time of inspection were variably foggy or overcast with passing showers. Photographs were taken and shown in Appendix F. A map showing photo location points is given in Appenidix F 10.

An aerial showing the contemporary Site layout is given in Appendix E 11.

2.2.1 SITE LAYOUT

The Site is an irregularly shaped collection of adjoining Lots containing two residences. One residence is located on Lot 2 DP553122 in the location of an historic aero clubrooms (159 Awakino Road). Animal stock yards are located close to this residence (Appendix F 4) with the historic hanger for the aeroclub is also present (Appendix F 3). A tractor shed with animal shelters is located east of the 159 Awakino Road residence in the historic runway area (Appendix F 5 - F 7).

A second residence is located in the middle of the Site on Lot 2 DP 116318 (163 Awakino Road). Another implement shed is located north of the 163 Awakino Road residence (Appendix F 8), but outside the footprint of the proposed plan change. A dam is located west of the 159 Awakino Road residence.

2.2.2 CURRENT SITE USES

At the time of visit all the Site was in pasture, however in the growing season, the flat northern areas are used to cultivate Kumara. Due to the heavy clay nature of the soils

[1] https://soils-maps.landcareresearch.co.nz/
[2] https://nrcgis.maps.arcgis.com/apps/webappviewer/index.html?id=fd6bac88893049e1beae97c3467408a9
[3] https://fndc.maps.arcgis.com/apps/webappviewer/index.html?id=3baf5c44f716429497077101518a2342#

minimal animals are stocked in winter with only two small herds of young beef cattle and three sheep seen during the Site visit.

2.2.3 SITE CONDITION AND SURROUNDING ENVIRONMENT

The property is well maintained. Fences and buildings are sound and drains clear (Appendix F 9). Evidence of the use of herbicide to keep vegetation under control was seen during the Site visit.

No staining or odour was noted during the Site visit.

Recent earthworks on Site were identified on Lot 2 DP 116318; these are associated with the formation of the driveway (next to the resource recovery park and landfill), a house platform and the construction of a dam.

Surrounding land use is a mix of residential (west along Awakino road), production and the historic capped landfill and current Dargaville Resource Recovery Park (Appendix F 1). The Site is not marked as erosion prone on NRC maps[4].

[4] https://localmaps.nrc.govt.nz/localmapsviewer/?map=79f54a18dcae4fbd9e1cf774aa2de871#

3. HISTORICAL SITE USE

3.1 SUMMARY OF SITE HISTORY

The history of the land was obtained by reviewing council property files, aerial photographs, and title information and from discussions with the current landowners and a top-dressing pilot who worked from the airfield in the early 1970's (K. Perreau).

Information regarding the title information is summarised in Appendix I 5. Aerial photographs are provided in Appendix E.

The rohe map on Te Puni Kokiri show the location of the property as being within the Te Roroa rohe.

A photograph taken in 1952 shows the whole Site in pasture (Appendix E 1). An old dairy shed is located on an adjacent property, Lot 3 DP 116318, which may have served the Site when it was part of a larger pastoral unit.

Documents dated 1937 show plans for an aerodrome in the general location of Site. In 1953 the Dargaville Aero Club was formed, and an airstrip, smaller than that originally planned in 1937 was created. Clubrooms and a hanger for the aeroclub were built on the elevated western flat area of the Site (Appendix E 2). The landowner in the airstrip area in 1958 is listed as the County of Hobson and Borough of Dargaville (Appendix I 5). By 1966 Barr Brothers Top dressing was also operating from the airstrip and their shed was located between the aero club and the road (Appendix E 3). One Mobil underground fuel tank was located between the aeroclub and the Barr Brothers shed. Fuel for the Aeroclub was stored above ground in 44-Gallon drums (pers. comm., K. Perreau) (Appendix A 8).

The soil on site is heavy clay and is prone to waterlogging with the runway relatively short, consequently the use of the airfield was restricted to local planes only. One top dressing plane was known to have crashed on take-off at the northern end of the runway (not on the Site), the pilot was uninjured, there was no fire, and the plane was salvaged (pers. comm., K. Perreau).

The Dargaville Aero Club relocated to another site 2.5km to the east in about 1981 taking the Barr brothers shed with them as their first club rooms (pers. comm., K. Perreau). The Barr Brothers ceased flying from the Awakino Road location (Appendix E 4, E 5). Plans for the new aeroclub are dated 1981 and the land ownership at the Site changed out of council hands in July 1981. Since 1981 the land has been used for grazing. The aeroclub hanger remains (Appendix F 3) and a house in now located where the club rooms were sited.

It is the understanding of K. Perreau that the underground fuel tank was removed from the ground following the decommissioning of the airstrip. Mr Perreau did not personally observe the decommissioning and he could not locate any aeroclub member who was around 40 years ago who could verify the tank removal. No documentation regarding tank removal is located in NRC or KDC files. No firefighting equipment was located on the aerodrome.

To the west of the driveway to 163 Awakino Road and along the western boundary is located a capped landfill. The landfill can be seen in aerial photographs taken in 1979 and 1984 (Appendix E 4 – E 5) but may have been present earlier. Aerial photographs taken in 1996 and 2000 show capping was being undertaken and by 2003 the site is vegetated. The land fill was officially closed in 2004 (Appendix D). By 2003 the Dargaville Resource Recovery Park was operating as a recycling depot to the west of the area.

A number of environmental incidents have been noted against the landfill and transfer station which are documented in Appendix D 3. Four of these are odour issues, three are smoke nuisance, two relate to noise and one to vermin. One incident (REQ.400646) that occurred in 1994, relates to consent compliance relating to leachate and coverage of refuse. Of these incidents only the latter would potentially be relevant to this investigation however no further information regarding that incident was available in NRC records (Appendix D 5).

A discharge permit (4433) issued by NRC in 1994 allowed for *'discharge of up to 5 cubic metres of leachate per day from a refuse landfill at Dargaville after treatment in a natural wetland to ground and an unnamed tributary of Awakino river on map Reference P07:890-866 subject to conditions….'* (Appendix D 8).

The leachate from the covered landfill is directed down hydraulic gradient and through a natural wetland before discharging into the un-named tributary of the Awakino River (labelled 'drain' and 'wetland' in Appendix A 2). Water in the waterway or 'drain' is monitored annually by NRC at three sites as per requirements of Resource Consent AUT.004433.02.02 dated 2017(Appendix D 5 & D 7). A summary of the water-quality results collected by the NRC over last 10 years are given in Appendix D 6[5]. Of note were data collected at discharge point (site 105147) in 2/12/2015 which appears to show some elevated concentrations of metals in the water, however this is likely due to noted clearing of the drain upstream which would have mobilised sediment into the 'drain'. Some elevated zinc concentrations observed at discharge point and downstream monitoring sites were also present in water upstream of landfill discharge point. No elevated concentrations of metals have been measured since 2015 aside from one copper result at the landfill outlet dated 22/3/22, the copper recorded 30m downstream sample at same time was compliant[6].

The Site is not listed on the NRC selected land use register and no incidents were lodged against the Site in the property files (Appendix D 1 & D 2). A summary of information held KDC property files is presented in Appendix I 6.

3.1.1 Previous Investigation

No previous investigations were identified as part of this investigation.

For expediency a Preliminary Site Investigation was not undertaken before this DSI as land use included known HAIL activities (the airfield) and the KDC requested DSI level investigation within this area and investigation regarding vicinity to landfill.

3.1.2 Preliminary Sampling

No preliminary sampling was carried out.

[5] Data table only shows water quality results for last ten years, more information was provided but was not presented in table to simplify results.
[6] Using values for compliance given in landfill consent conditions 1994, Appendix D 8

4. SAMPLING AND ANALYSIS PLAN SUMMARY

4.1 SAMPLING DESIGN PLAN

The Area of Investigation includes all of Lots 1 & 2 DP 553122 & Lot 2 DP 116318 and includes the identified Piece of Land around the airfield (Appendix A 3 & A 4). Judgemental sampling was undertaken over the whole Site with systematic sampling within the identified Piece of Land. As a gully was located between the landfill and much of the investigation Site, sampling along the boundary was restricted, with soil samples collected along the driveway area where the landfill was closest to the Site, and down hydraulic gradient.

Three surface water samples were also collected from the drain that flows past the landfill and through the Site. Borehole water samples were not collected.

Sampling and analysis (of the identified contaminants of concern) was undertaken as part of the DSI. The aim of the sampling is to:

- determine the presence of and/or general extent of any soil contamination and the potential adverse impact of such contamination on human health, and
- obtain sufficient information to make an estimate of risk posed by contamination to human health.

As per NESCS 2012 requirements, standards only need to be developed for the contaminants of interest (COI) for the piece of land, given the activities and industries that have occurred or likely to have occurred. Based on the land use summary, the following NESCS priority contaminants were considered as potential COI for 159 & 163 Awakino Road, Dargaville:

- Metals (including arsenic & cadmium)
- Pesticides (organochlorines (OCP's))
- Hydrocarbons (TPH/PAH)

The location of the underground fuel tank in the aerodrome area or location of aboveground fuel storage at aeroclub were not known at time of Site visit. No visual sign of hydrocarbons was seen during Site visit and as such, samples were not collected for hydrocarbons in this area. Samples were collected from surface and 1.0m deep along vicinity of the boundary with the landfill and tested for heavy metals with TPH screening and PAH analysis as an indicator of potential leaching from landfill.

NZE utilise a qualitative screening approach to the selection of the COI that although does not guarantee that other hazardous substances are not present in the land, it does indicate a lower probability that those contaminants will occur in the soil (MfE 2011).

The land-use history obtained as part of this investigation indicates that potential contaminants would likely be predominantly heterogeneous in distribution and confined to the area of use.

- Stratified sampling was utilised to inform the conceptual site model and the risk assessment over the Site. One area of systematic sampling was undertaken in aerodrome area with targeted sampling over the remainder of the Site used to inform the conceptual site model.
- Sampling was carried out by H. Windsor on 24 June 2023.

- The Sampling and Analysis Plan is shown in Appendix G.

- Sampling was carried out using a stainless-steel spade (grab technique) for surface sample. Depth samples were collected using either a hand posthole borer or hand auger.

- Surface samples were collected from a depth of between 0 - 0.15m. Depth samples in systematic sampling, targeted shed target areas and in general field area were collected from 0.3m and 0.5m depths. Depth proximate to the boundary with the landfill were collected at 0.5m and 1.0m depths.

- Field screening techniques were not utilised.

- Background samples were not collected.

4.2 FIELD AND LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

To avoid cross contamination, disposable nitrile gloves were worn during sampling and changed between every sample. Sampling equipment was cleaned between each sample as per section 5.3 of MfE 2021, Contaminated Land Management Guidelines No 5.

The labelled samples were couriered to Hill Laboratories under chain of custody documentation (Appendix H). As per the contaminants of interest identified as part of the DSI, the laboratory was instructed, where applicable, to analyse the sample for COI.

- Sixty-three of the field samples were analysed for heavy metals; thirty-seven individual analyses and twelve composite analyses.

- Twenty-two samples were composited and analysed for OCP's as five composite samples.

Two duplicate samples were collected as part of this DSI within the systematic samples only[7]. The field duplicates was collected at the same time as the primary soil samples using the same procedures.

- Quality assurance (QA) sample 2362 was collected as a duplicate of soil sample 2348. Quality assurance (QA) sample 2361 was collected as a duplicate of soil sample 2351.

All samples are kept in storage for two months by the laboratory in case re-analysis of the samples is required.

Laboratory testing was carried out by Hills Laboratories Ltd. The lab is an NZS/ISO/IEC 17025:2005 accredited laboratory which incorporates the aspects of ISO 9000 relevant to testing laboratories. Original laboratory transcripts are attached to this report (Appendix H).

[7] The judgmental samples were collected to inform conceptual site model and duplicates, although desirable were not collected due to timeframe and financial considerations.

5. SAMPLING RESULTS

5.1 SOIL SAMPLING

A total of sixty-three samples were collected over the Site. Samples were collected by H. Windsor on 24 June 2023. Samples were collected as stratified samples as per Sampling and Analysis Plan (Appendix G).

- Soils were largely collected as per the plan. One extra soil sample was collected around the perimeter of a pile of uncovered wooden fence posts. Samples along the boundary with the landfill were adjusted to the topography to try to collect samples down hydraulic gradient.
- Sampling data including soil descriptions is given in Appendix I 1.
- A piece of glass and plastic was found at 1.0 m depth in sample 2301 located near the present resource recovery park, which may indicate some rubbish in this area, i.e., windblown debris or could be due to recent earthworks to form the driveway in this area.

5.2 FIELD OBSERVATIONS

A table showing the GPS location and log of sampled soils is shown in Appendix I 1, I 2 & I 3.

5.3 BASIS FOR GUIDELINE VALUES

The laboratory results are compared to the Soil Contaminant Standards, ($SCSs_{health}$), at which exposure is judged to be acceptable because any adverse effects on human health for most people are likely to be no more than minor. The $SCSs_{health}$, have been calculated for five generic land-use exposure types to reflect different land use scenarios.

The scenario used for assessing $SCSs_{health}$ in this DSI was: Residential - Standard residential lot, for single dwelling sites with gardens, including homegrown produce consumption (10 per cent) (NES 2012).

$SCSs_{(health)}$, have two functions:

1) Health-based trigger values - $SCSs_{health}$, represent a human health risk threshold above which:
   a) The effects on human health may be unacceptable over time,
   b) Further assessment of a site is required to be undertaken.
2) Remediation targets - $SCSs_{health}$, represent the maximum concentrations of contaminants at or beneath which land is considered 'safe for human use' and the risk to people is considered to be acceptable.

5.4 BACKGROUND CONCENTRATIONS

Predicted Background Concentration (PBC) estimates of the background concentration (mg/kg) of arsenic, cadmium, chromium, copper, lead, nickel and zinc across New Zealand are available by Landcare Research on the Land Resource Information Systems portal NZ[8]. The effective median, and 95th quantile is calculated based on geological unit classification (Appendix A 6). For Northland, however the numbers of samples these values are based on are limited and it is our understanding that the FNDC do not accept these background figures at this time.

More statistically robust background concentrations are available for volcanic soils for the Auckland region, and these are shown in Appendix A 7 and Table 1.

5.5 SOIL RESULTS

The laboratory tests undertaken on samples collected 24 June 2023 show the concentrations of the selected NES analytes. The results are summarised in Table 1. All values are mg/kg dry weight. The laboratory report is given in Appendix H.

The laboratory results were compared to the NESCS 2012 soil contaminant standard values, at which exposure is judged to be acceptable because any adverse effects on human health for most people are likely to be no more than minor.

- A total of sixty-three soil samples were collected across the Site.
- When compared to the NESCS applicable guideline value, Residential 10% produce (2012), soil chemistry for all samples returned results below the applicable guideline values for all heavy metals except for cadmium in two samples.
- When compared to the NESCS applicable standards, all returned results for organochlorine pesticides were below laboratory detection limits.
- All returned results for Total Petroleum Hydrocarbons and Polycyclic Aromatic Hydrocarbons were below laboratory detection limits.
- All PAH results were below the potency equivalency factors (PEF) for assessing potential carcinogenicity of PAH mixture as per Table 40 of Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health (Appendix I 8).

[8] https://lris.scinfo.org.nz/layer/48470-pbc-predicted-background-soil-concentrations-new-zealand/

Table 1 – Laboratory Results for Metals and OCP's

24/06/2023	Total Recoverable Arsenic	Total Recoverable Boron	Total Recoverable Cadmium	Total Recoverable Chromium	Total Recoverable Copper	Total Recoverable Lead	Dieldrin	Total Reported DDT Isomers
	As	B	Cd	Cr	Cu	Pb	PBT	DDT
All values reported as dry weight	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Detection limit	2	20	0.1	0	2	0.4	0.10	0.03
Landfill proximate samples								
2301	<2		0.12	5	7	8.9		
2302	<2		0.20	5	5	4.5		
2303	3		0.25	11	14	16.9		
2304	3		0.11	21	13	9.1		
2305 (0.5m depth)	<2		<0.10	4	5	9.1		
2306 (1.0 depth)	<2		<0.10	6	4	8.8		
2307 (0.5m depth)	5		<0.10	11	7	7.8		
2308 (1.0 depth)	2		<0.10	15	10	10.8		
2309 (0.5m depth)	3		<0.10	23	8	10.5		
2310 (1.0 depth)	11		<0.10	29	12	8.5		
2311 (0.5 depth)	4		<0.10	22	9	9.0		
2312 (1.0 depth)	3		<0.10	13	7	5.7		
composite 2301, 2302, 2303, 2304							<0.017	<0.10
composite 2306, 2308, 2310, 2312							<0.015	<0.09
Airfield - Systematic samples								
2339	<2		0.17	3	8	4.7		
2340	3		0.63	22	50	16.6		
2341	6		0.32	44	47	16.0		
2342	<2		0.11	62	23	4.8		
2343	<2		0.32	4	15	6.3		
2344	<2		0.57	23	52	10.1		
2345	<2		1.70	56	69	19.9		
2346	<2		<0.1	2	5	1.8		
2347	3		0.32	26	49	10.9		
2348	2		0.29	12	17	6.7		
2349	<2		0.11	22	24	4.8		
2350	<2		3.20	18	37	11.3		
2351	<2		2.10	7	17	22.0		
2352	<2		0.11	5	3	2.0		
2353	<2		0.10	62	32	4.9		
2354	<2		0.21	55	34	7.0		
2355	18		7.40	55	106	102.0		
2356	<2		0.10	<2	<2	1.8		
2357 (0.3 depth)	<2		<0.10	4	<2	1.3		
2358 (0.5 depth)	<2		<0.10	<2	<2	2.6		
2359 (0.3 depth)	<2		<0.10	10	7	4.0		
2360 (0.5 depth)	2		<0.10	15	8	4.4		
2361	<2		2.10	9	16	23.0		
2362	2		0.28	10	16	5.9		
Min			<0.1					
Max			7.40					
Standard Deviation			1.81					
95% UCL			1.74					
composite 2340, 2342, 2345, 2347							<0.019	<0.12
composite 2349, 2351, 2353, 2355							<0.014	<0.09
Pasture land use-samples								
composite 2313, 2315	8		0.23	20	16	6.3		
composite 2316, 2317	9		0.20	20	18	9.6		
composite 2314, 2319	<2		0.26	3	4	3.0		
composite 2318, 2320	<2		0.17	2	3	5.4		
composite 2321, 2322	<2		<0.10	<2	<2	1.1		
composite 2314, 2317, 2320, 2322							<0.015	<0.09
Shed proximate samples								
composite 2323, 2324	8		0.13	17	25	8.0		
composite 2325, 2326	7		<0.10	19	16	7.4		
composite 2335, 2336	<2		<0.10	<2	2	1.9		
composite 2329, 2334	<2		0.16	6	8	3.0		
composite 2332, 2333	<2		0.13	<2	3	2.3		
composite 2331, 2331b	<2		0.17	7	16	3.5		
composite 2327, 2337 (0.3 depth)	3		0.11	8	5	4.1		
composite 2328, 2338 (0.5 depth)	4		<0.10	13	7	6.9		
2330	<2		0.18	3	5	2.3		
composite 2323, 2330							<0.015	<0.09
NES Soil Guideline Values April 2012								
Rural residential/lifestyle block	17	>10000	0.8	290	>10000	160	1.1	45
Residential 10% produce	20	>10000	3.0	460	>10000	210	3	70
High-density residential	45	>10000	230	1500	>10000	500	45	240
Recreation	80	>10000	400	2700	>10000	880	70	400
Commercial/industrial outdoor worke	70	>10000	1300	6300	>10000	3300	160	1000
Background Auckland Volcanic Soils	0.4 - 12	<0.1 - 0.65	<0.1 - 0.65	3 - 125	20 - 90	<1.5 - 65		

Table 2 – Stage 1 Laboratory Results for Hydrocarbons

TPH					
All values reported as dry weight	C7-C9	C15-C36	Total (C10-C14)	Total (C15-C36)	total C7 -C36)
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2301	<20		<20	<40	<80
2303	<40		<30	<60	<120
2304	<30		<30	<50	<100
2306	<20		<20	<40	<80
2310	<30		<30	<50	<100
2312	<20		<20	<40	<80
Tier 1 Soil Acceptance Criteria for TPH Residential use, ALL PATHWAYS					
(Clay) <1 m	(15,000) [m]		(570) [x]	NA	
(Clay) 1-4 m	(NA) [m]		(2900) [x]	NA	
PAH					
All values reported as dry weight	Napthalene	Pyrene	Benzo(a) pyrene		
	mg/kg	mg/kg	mg/kg		
2306	<0.07	<0.014	<0.014		
2310	<0.10	<0.02	<0.02		
2312	<0.07	<0.014	<0.014		
Tier 1 Soil acceptance criteria Residential use(1,3,6) ALL PATHWAYS					
(Clay) surface <1 m	71[v]	(1600)[p]	0.27[p]		
(Clay) surface 1-4 m	(360)[v]	NA	(25)[m]		

NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site.
Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons.
v - Volatilisation
m - Maintenance/Excavation
p - Produce
x - PAH surrogate

5.5.1 Statistical Analysis of Results

Eighteen of the returned results from the systematic sampling were used to calculate the mean, standard deviation and 95% UCL for the concentration of cadmium in the soil (duplicates and depth samples not included). This number was the number of samples required to identify a contaminant hotspot of radius 12 m (sample and analysis plan Appendix G). ProUCL statistic results table shown in Appendix I 7.

Table 3 – ProUCL results on systematic samples for cadmium.

24/06/2023	Total Recoverable Cadmium
	Cd
All values reported as dry weight	mg/kg
Detection limit	0.1
Min	<0.1
Max	7.40
Standard Deviation	1.81
95% UCL	1.74
Residential 10% produce	3.00

- Statistics were not carried out on any other analyte as all other results were below applicable guideline values.

- Quality assurance sampling showed the percentage variability between all samples ranged from 0% - 25%. Variability of less than 30-50% would be considered acceptable with the noted variability between all samples within this range. Variability can be used to represent the analytical precision (or uncertainty in analytical results) and can better define the area around the guideline value where analytical results are ambiguous (MfE 2011, Guideline No 5). The soil chemistry and variability are considered representative of the soils at the Site. It was noted however that the Hill Laboratory results states sample heterogeneity was higher than expected within lab samples checks on one chromium sample.

5.5.2 Discussion of Cadmium Soil Results

- The guideline value for cadmium in applicable Residential with 10% produce land use scenario is 3 mg/kg (soil pH 5).
- The soil contaminant guideline value for a residential dwelling with no produce pathway is 110 mg/kg (soil pH 5) [9].
- The 95% UCL value calculated on all systematic samples for cadmium excluding duplicates and depth samples returned a value of 1.74mg/kg, well below the applicable guideline value.
- Sample 2350 returned a result of 3.2mg/kg just above guideline value.
- Sample 2355 returned a result of 7.4mg/kg more than twice the guideline value.
- Considering the returned lab results for cadmium compared to the applicable guideline value and the 95% UCL value for cadmium, a review of samples 2350 and 2355 was undertaken. Sample 2350, while elevated, is not considered to indicate the presence of cadmium contamination (the concentration is at a level where it is unlikely or reasonably unlikely to have, an adverse effect on human health and the environment). Sample 2355, at more than twice the guideline value does however, qualify as cadmium contamination in soil (Contaminated Land Management Guidelines No.5, (2021) 7.4.2).

5.6 CADMIUM HOTSPOT CHARACTERISATION AROUND LOCATION SAMPLE 2355

- Sampling undertaken on 24 June 2023, identified an area of cadmium contamination located within the stock yards on 159 Awakino Road, in the vicinity of historic aerodrome.
- Depth sampling undertaken on the same date indicated the contamination was confined to the surface as samples collected at 0.3m bgl and 0.5m bgl were not contaminated by cadmium (samples 2359 & 2360).
- Delineation to the south and east of the location of sample site 2355 was provided by systematic samples 2340 and 2345. Delineation to north and west has not been established although the boundary to the property is located less than 20m to the north-west.
- The source of the cadmium is likely to result from historic fertiliser storage (cadmium is a by-product of phosphate rock fertilisers such as superphosphate).

[9] Table 54, Ministry for the Environment, Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health, 2011.

6. RISK TO OTHER RECEPTORS

6.1 WATER SAMPLING

Due to the potential of contamination from the neighbouring capped landfill, water samples were collected as indicators of potential contaminants through the priority pathway provided by permitted discharge from a wetland area used to treat leachate down gradient of the landfill (Appendix D 8).

Three surface water samples were collected from a drain that originated north-west of the Site then flowed past the base of the landfill and across the northern part of the Site. The drain is located away from the location of the proposed plan change and down hydraulic gradient.

Locations of water sampling sites are shown in Appendix A 2.

- Water samples were collected as per the plan.
- Water temperature, pH and conductivity measurements were taken insitu.
- Samples were collected for analysis in bottles supplied by the laboratory.

6.2 FIELD OBSERVATIONS

The Site was heavily water-logged at the time of the Site visit. It was impossible to tell visually if any leachate from the landfill was present in the surface water within the drain (or in the soils). No odours were noted.

6.3 BASIS FOR GUIDELINE VALUES

Comparative analysis of the three surface water samples was undertaken to establish if any parameter was grossly different between upstream and downstream of the landfill.

Water quality results were compared to ANZECC 2000 guideline values for major ions and metals and compared to discharge permit allowable values[6] with results tabled in Table 4.

6.4 WATER QUALITY RESULTS

- All results were compliant with ANZECC guidelines for recreational use and for livestock drinking water.
- All results were compliant with resource consent compliance values except for the concentration of lead and zinc in the water (Table 4). However, the concentration of lead and zinc were elevated in the water samples taken above the landfill leachate discharge point and as such the source of lead and zinc in the drain is not directly attributable to landfill leachate.

Table 4 – Water quality results

24/06/2023	pH	conductivity	TN	NO3N	Cl	NO2N	DRP	phenols	TKN	TP	COD	SO4	As	Cd	Cr	Cu	Ni	Pb	Zn
				nitrate		nitrite													
Sample		mS/m	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3	gO2/m3	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3
2363 (upstream, at entry to site)	5.8	262	1.04	0.25	29	0.003	0.01	<0.02	0.78	0.107	45	53	<0.021	<0.0011	<0.011	<0.011	<0.011	0.083	0.056
2364 (30m down gradient leachate outfall point)	5.8	302	1.12	0.26	31	0.004	0.004	<0.02	0.86	0.066	32	64	<0.021	<0.0011	<0.011	<0.011	0.12	0.007	0.056
2365 (downstream at exit of site)	5.8	311	1.29	0.46	29	0.004	0.005	<0.02	0.82	0.059	29	71	<0.021	<0.0011	<0.011	<0.011	0.018	0.035	0.086
Kaipara District Council Discharge Permit 4433													0.360	0.002	0.016	0.009		0.034	0.018
^Anzecc 2000 Recreation Water Quality (g/m3)	6.5 - 8.5			10	400	1		0.002				400	0.050	0.005	0.05	1	0.1	0.05	5
^Anzecc 2000 Livestock Drinking Water Quality (g/m3)				>400		>30						>1000	0.500	0.01	1	1 (cattle)	1	NA	20

7. SOIL DISTURBANCE

Soil Regulation 8(3) of the NESCS does allow for relatively small-scale soil disturbance that may occur on land, such as minor landscaping, foundation excavations, and replacement of underground services, to occur without the need for resource consent (MfE 2011). Providing the requirements around controlling exposure and disposal are met, the disturbance and removal of lower volumes of soil is considered a low-risk activity.

The NESCS requires that:

a) Controls are in place to minimise people's contact (for example, in dust or water) with the soil and kept in place until soil is reinstated.

b) Soil reinstated to erosion resistant state within 1 month (for example, foundations laid, access metalled, grass sown or garden mulched).

c) Integrity of soil containing structures are not compromised.

d) Soil taken to authorised facility regulation 8(3e). The closest authorised facility is Puwera Landfill.

e) Soil disturbed is less than 25m^3 (in-situ volume) per 500m^2 of land per year (not including samples for lab testing).

f) Soil removed is less than 5m^3 (in-situ volume) per 500m^2 of land per year.

g) Activity duration less than 2 months.

For this Site:

- No earthworks would be required for the private plan change.
- Earthworks required for future subdivision or builds are unknown at this time.
- Regulation 8(3) is only applicable within any identified 'piece of land'.

8. RISK ASSESSMENT

The NESCS identifies contaminants as a problem when the contaminants are at a concentration and a place where they have, or are reasonably likely to have, an adverse effect on human health and the environment (NESCS 2012). The NESCS 2012 further states that a key decider under the NESCS is whether, under the intended land-use, the exposure to soil is reasonably likely to harm human health.

8.1 CONCEPTUAL SITE MODEL

A Conceptual Site Model (CSM) was developed and shown in Appendix B.

The CSM for 159 & 163 Awakino Road, Dargaville was based on a review of available title information, aerial photographs, the site history, council records, a site inspection and soil sampling results.

Land use on area of investigation at 159 & 163 Awakino Road, Dargaville comprises:

a)	**Pre ~1953**	Pastoral	-	NA
b)	**1953 - 1981**	Pastoral and aerodrome, proximate to landfill.	-	Consider fertiliser and pesticide use A10. Fuel for planes F1. Leaching from landfill H.
c)	**1981 - present**	Pastoral, proximate to landfill	-	Consider fertiliser and pesticide use A10. Leaching from landfill H. Leaching from stored CCA treated timber I.

8.1 PATHWAYS

The current and potential future pathways and/or receptors identified include direct dermal contact with chemicals in soil through play or contact with soil during maintenance, crop or animal uptake of chemicals from soil leading to ingestion, accidental ingestion, and dermal contact or dust inhalation associated with earthworks (Appendix B). Receptors include both children and adults.

- Soils on site are dense clays with strong binding affinity for heavy metals. Metal COI's in the soil are judged as not highly mobile and, if present in soil, would have undergone minimal migration from source.

- OCP's have low solubility and high persistence with some, such as DDT, historically mixed with fertiliser or lime making possible their presence in an historic crop dressing aerodrome operational during the 1950's and 1960's. OCP's accumulate through the food chain. However, the presence of OCPs was not identified in sampling results.

- Hydrocarbons associated with historic fuel storage in aerodrome area was considered likely. Avgas (Aviation gasoline, a light carbon chain fuel) is highly volatile and on this site was judged to more likely volatilise into the air[10] than move into groundwater due to dense clays (impermeability barrier) on site. It is thought that after more than 40 years any Avgas residues that may potentially been spilt to soil will no longer be present (note: no documentation or eye-

[10] As has been noted by the report reviewer during three years of specialist hydrocarbon spill response/assessments.

witness was found to confirm if underground fuel tank has been removed, if it is still present then hydrocarbons may also still be present).

- The drain down gradient of the landfill was identified as the main priority pathway on Site, however this drain is not located within the bounds of the proposed plan change area and is down hydraulic gradient from that location.

8.2 CONTAMINANT CHARACTERISATION

This DSI was undertaken to identify any elevated COI within the soil on Lots 1 & 2 DP 553122 & Lot 2 DP 116318. Soil sampling across the Lot returned results well within the applicable Residential 10% scenario land use for all analytes except for cadmium in a discrete area within stock yards on Lot 2 DP553122 (159 Awakino Road).

- The likely source of the cadmium hotspot was from fertiliser.
- The area of the cadmium contamination is confined to surface soil (less than 0.3m depth). The size of the contamination is only partially laterally characterised, with clear margins identified to the east and south, but not to the north and west. This area is labelled as the Control Area.
- Further characterisation could not be carried out due to time constraints as per the requested report submission date (see report limitations).

8.3 RISK SUMMARY

The risk to human health at 159 & 163 Awakino Road, Dargaville, (Lots 1 & 2 DP 553122 & Lot 2 DP 116318) is assessed in the context of the proposed site use; that of residential land use.

- Soils disturbance volumes associated with the plan change are minimal.
- The concentrations of COI are well below the applicable guideline values for all COI except for cadmium in a small hotspot (Control Area), located within stock yards on 159 Awakino Road, Dargaville.
- The volume of contaminated soil around the hotspot (the Control area) has not been fully characterised but is confined to surface soils.
- The concentration of elevated cadmium within the Control Area, although elevated above the Residential 10% guideline value was well below the Residential guideline value if considering the limiting pathway of produce consumption. If the produce pathway/scenario is removed, the guideline value is 110mg/kg. Contact with soils poses minimal risk.
- The location of the elevated cadmium in the Control Area is currently within the existing stock yards and as such it is highly unlikely that the produce pathway would be complete.
- The likelihood that any contaminant poses a risk to any receptors over the wider Lot excluding the Control Area is low.
- Given the small volume and kind of soil contamination on Site within the Control Area it is recommended that if appropriate management or remediation and validation is undertaken, any risk associated with the cadmium contamination will be mitigated.
- It was not confirmed if an underground fuel tank remains on Site.

9. DISCUSSION

This DSI was undertaken to determine if soil on Lots 1 & 2 DP 553122 & Lot 2 DP 116318 is contaminated, and information contained within this report is considered appropriate to the nature of the proposed activity, the level of certainty and availability of information about the past use of the land, the contaminants present (or potentially present), and the level of risk posed.

The information collated in this DSI indicates the following results:

- The land has a history of pastoral use with part of the site used as an aerodrome.
- A capped, former landfill is located on the Site boundary.
- The Site is not listed on the NRC Selected Land Use Register.
- The HAIL categories identified were: *A1 – Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds and F 1 - Airports including fuel storage, workshops, washdown areas, or fire practice areas.* These were confined to within the Piece of Land on Lot 2 DP 553122 (Appendix A 3 & A 4).
- The Piece of Land identified as HAIL site under category A 1 and F 1, comprises ~8500m^2. As such 425m^3 of soil disturbance is permitted and 85m^3 of soil removal is permitted per year to meet the requirements of Section 6 above (regulation 8(3)). Earthworks outside the Piece of land are not covered by regulation 8(3).
- Earthworks disturbance volumes as part of the proposed plan change will be minimal.
- A total of sixty-three soil samples were collected on the Site, including samples collected within the area of proposed plan change and also outside the area to better inform the conceptual site model and address potential KDC concerns regarding the landfill. As per the identified contaminants of interest, metals, pesticides and hydrocarbons were analysed by Hill Laboratories.
- The applicable standard is Residential - Standard residential lot, for single dwelling sites with gardens, including homegrown produce consumption (10 per cent) (NES 2012).
- The soil chemistry analyses showed all soil results below the applicable standard except for cadmium in one soil sample collected within the present-day stock yards on Lot 2 DP 553122 (159 Awakino Road).
- The area of cadmium contamination was partially characterised. Contamination was confined to the surface soils (<0.3m depth) with lateral clearance extent identified to the east and south but not to the north and west.
- The location of the partially characterised hotspot (identified as a Control Area) is indicated in Appendix A 3 & A 4.
- The aerodrome ceased operating in about 1981. It could not be verified that the below-ground fuel tank that was present beside the Barr Brothers Aviation shed has been removed.

- A review of the conceptual site model shows there is source contamination as a cadmium hotspot in a Control Area. The source – receptor – pathway linkages is complete within this area.

- A review of the conceptual site model shows there is no source contamination on the remainder of the Site and as such the source – receptor – pathway linkages is incomplete.

- There was no evidence in soil samples collected along boundary and down gradient of landfill that lateral leaching has occurred[11].

- Three water samples were collected to indicated potential contamination from landfill leachate. The landfill leachate discharge point and drain are not located in the area of the proposed plan change.

- There was no evidence in surface water samples collected above and below landfill discharge point that leaching is negatively impacting surface water quality.

- Pursuant to regulation 10(2)(b) – *soil contamination exceeds the applicable standard in regulation 7* within the identified Control Area.

- Pursuant to regulation 10(3)(b) – *given the small volume and kind of soil contamination on site it is recommended that the piece of land is suitable for the activity (plan change with subsequent subdivision and future residential build) if appropriate remediation and validation is undertaken within the Control Area.*

[11] Four locations sampled to maximum depth of 1m.

10. CONCLUSIONS

A study of the history of the land, including sampling and analysis of the soils, on 159 & 163 Awakino Road, Dargaville (Lots 1 & 2 DP 553122 & Lot 2 DP 116318) was undertaken in June and July 2023.

- The data set is appropriate for statistical calculations as per Contaminated Land Management Guideline No.5 (2021) Appendix G.
- All reported concentrations are below the applicable guideline values aside from cadmium in one sample.
- The cadmium hotspot was partially characterised and assigned as a Control Area. Time constraints meant the Control Area around the hotspot was not delineated on two sides.
- Pursuant to regulation 10(2)(b) – *soil contamination exceeds the applicable standard in regulation 7 within the Control Area.*
- As per regulation 9 (3)(b) – *it is demonstrated that soil contamination does not exceed the applicable standard in NESCS regulation 7 outside the Control Area.*
- Pursuant to regulation 10(3)(b) – *given the small volume and kind of soil contamination on site it is recommended that the piece of land is suitable for the activity (proposed plan change with likely subsequent subdivision and change in land use) as* ***restricted discretionary consent*** *if appropriate remediation and validation[12] of soil within the Control Area is undertaken.*
- Preparation of a Remediation Action Plan (RAP) and Site Management Plan (SMP) by a suitably qualified and experienced practitioner will be required before remediation of soils from within the cadmium Control Area can be carried out. A Site Validation Plan will be required following the remediation and/or management to ensure the soils are suitable for the proposed residential land use.

[12] Remediation and validation is a requirement for sub-division or change in land use under NESCS, but not necessarily for plan change purposes (see clause 5(6) of the NESCS and Section 2.1.2, point 5 of the Ministry for the Environment's 2012 User's Guide to the NESCS).

11. REPORT LIMITATIONS

This DSI and RAP report was carried out to characterise soil chemistry on 159 & 163 Awakino Road, Dargaville (Lots 1 & 2 DP 553122 & Lot 2 DP 116318) for private plan change in area including that shown in Appendix A 4.

Due to time constraints directed by the notification by the KCD of a requirement for a DSI, and the date given for the KDC hearing panel, a full desktop study could not be carried out before the Site visit was carried out. As such KDC property files were not available before the Site visit, although information in NRC files had been reviewed. As such the approximate location of the underground fuel tank in the aerodrome area was not known at time of Site visit. No visible sign of fuel storage was identified during the Site visit and as such, no samples were collected for hydrocarbons in this area.

Investigation into possible leachate from landfill was restricted to four locations along the boundary with the landfill or downgradient of the landfill. Samples were collected to maximum depth of 1.0 m with no water samples collected from within bore holes. It is understood that the NRC monitor the closed landfill and that no monitoring bores are present. Some reported results of testing undertaken by the NRC on leachate from the landfill is shown in Appendix D 6, more detailed information can be obtained from the NRC.

Water from the drain which flows past the foot of the landfill was sampled as an indicator of water quality at that time only.

The laboratory test results provide an approximation of the concentration of the analytes tested in the soil and are subject to the limitations inherent to the laboratory techniques used.

The information in this document is based on publicly available documents which were presumed to be accurate.

With time the site conditions and applicable environmental standards may change and as such the report conclusions may not apply at a future date.

NZ Environmental Management will not be held liable for any future discovery of isolated hot spots or discharge unknown at the time of sampling, such as buried drums of chemicals.

12. SQEP CERTIFICATE OF REPORT

DETAILED SITE INVESTIGATION CERTIFYING STATEMENT

I, Heather Windsor of NZ Environmental Management Ltd, certify that:

This Detailed Site Investigation meets the requirements of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (the NESCS) because it has been:

- done by a suitably qualified and experienced practitioner, and
- done in accordance with the current edition of Contaminated Land Management Guidelines No 5 – Site investigation and analysis of soils, and
- reported on in accordance with the current edition of Contaminated Land Management Guidelines No 1 – Reporting on contaminated sites in New Zealand, and
- the report is certified by a suitably qualified and experienced practitioner.

This detailed site investigation concludes that:

For changing the land use (regulation 5(6)) of the NESCS contamination does exceed the applicable standard in Regulation 7 of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations.

Evidence of the qualifications and experience of the suitably qualified and experienced practitioner(s) who have done this investigation and certified this report is appended to this detailed site investigation report (Appendix J).

Signed and dated:  DATE 10 July 2023

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14. GLOSSARY

Area of Interest — An area or target within the piece of land identified as having hazardous substances on or in it at elevated levels or above background. Reported concentrations are below the soil contaminant standards for the applicable land use scenario with in-situ soils unlikely to pose a risk to human health. May require further investigation, management, or remediation for more conservative land use scenarios (largely applicable to soil removal offsite).

Area of Investigation — Location within a Piece of Land upon which there is a proposed change in land use.

Control Area — An investigated and defined area of contaminated soil on a piece of land, with hazardous substances in or on it that are above the soil contaminant standards for the applicable land use scenario and where the contaminants are reasonably likely to have adverse effects on the human health. The control area is reported as an area requiring remediation or management.

COI — Contaminants of interest

CSM — Conceptual Site Model

DSI — Detailed Site Investigation

KDC — Kaipara District Council

HAIL — Hazardous Activities and Industries List

mg/kg — Milligrams per kilogram

NES — National Environmental Standard

NESCS — Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011

NRC — Northland Regional Council

OCP — Organochlorine Pesticides

Piece of Land — The NESCS applies to any “piece of land” on which an activity or industry described in the current edition of the Hazardous Activities and Industries List (HAIL) is being undertaken, has been undertaken or is more likely than not to have been undertaken (see regulation 5(7)).

PSI — Preliminary Site Investigation

ppb — Parts per billion

RAP — Remediation Action Plan

SVR — Site Validation Report

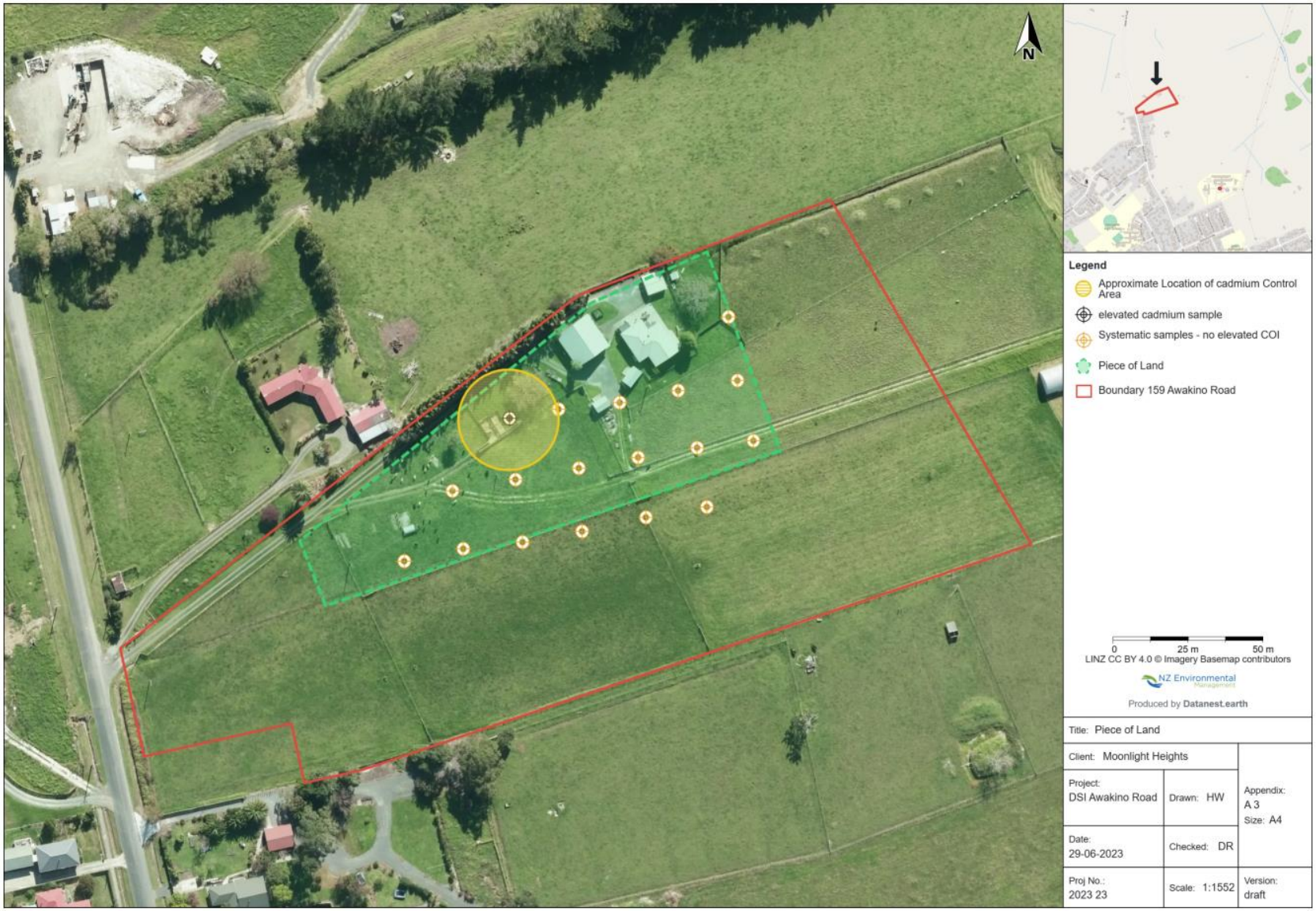
Target Area — An area or target within the piece of land identified as potentially having hazardous activities or industries resulting in contaminants to be present at elevated levels or above background.

UCL — Upper Confidence Limit

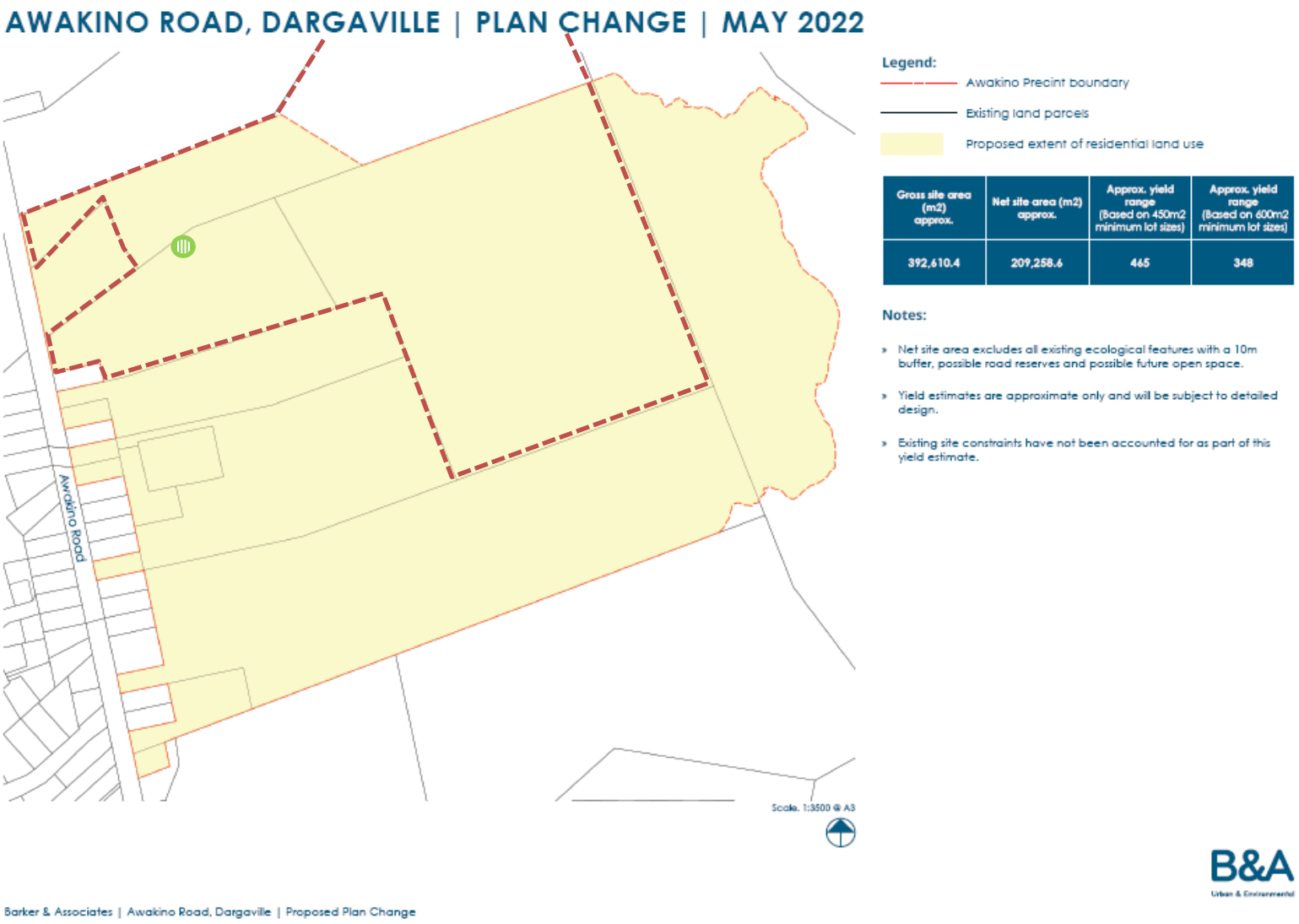
APPENDIX A
Figures

A 1 – Soil Sample Locations

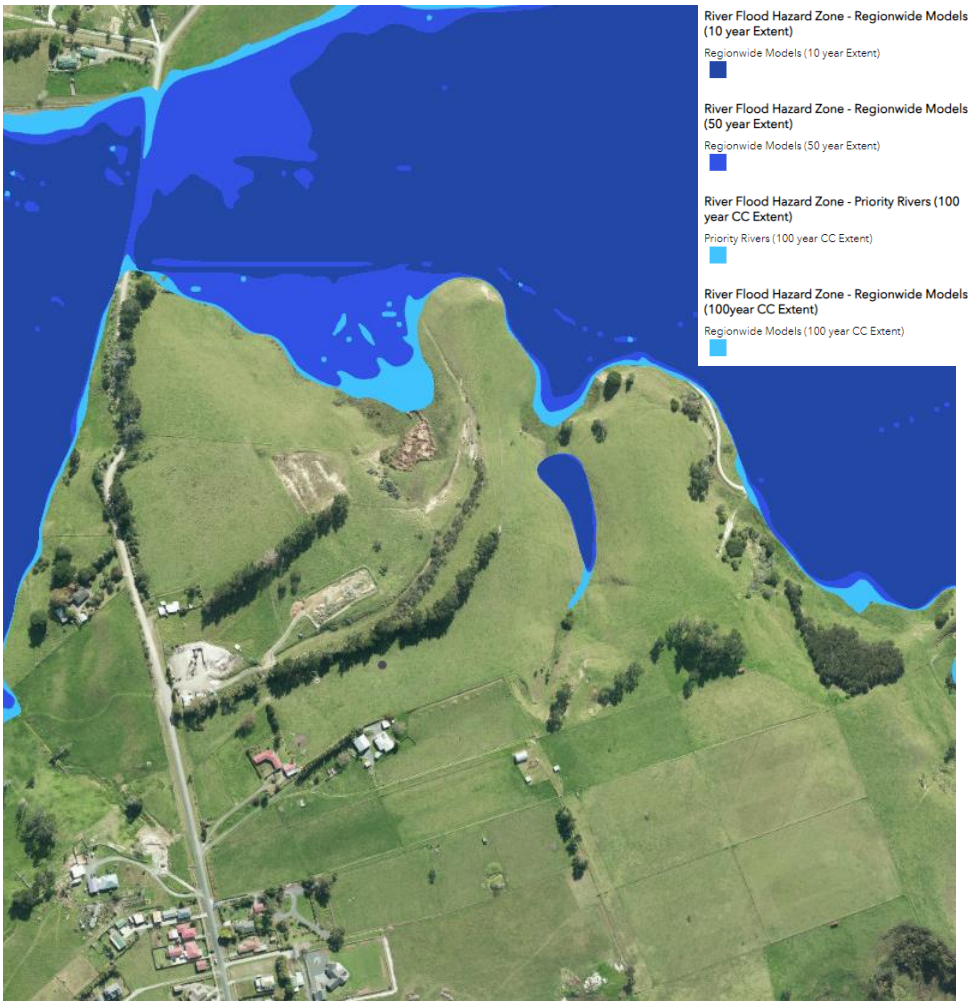
A 2 – Water sample locations with flow direction around proximity of landfill indicated.



A 3 – Location of cadmium hotspot within Piece of land with likely approximate of Control Area outlined.

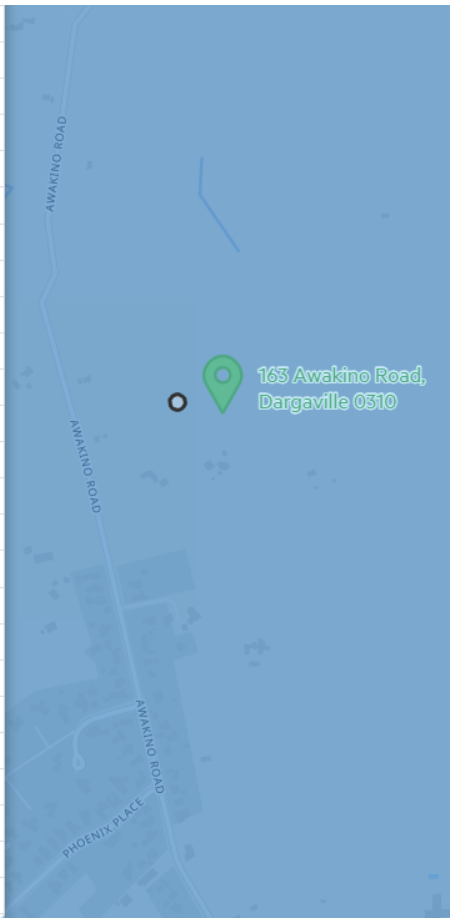


A 4 – Area of proposed private plan change – with area covered by this investigation dotted (includes area outside boundary). Partially characterised Control Area indicated by



A 5 – NRC flood map

Chemical4	mudstone Pakihi
Chemical4a	MudStnPakihi
Area_km2	35539.672049
As_n	87
As_Medpred	2.38
As_U95pred	9.97
Cd_n	11
Cd_Medpred	0.065
Cd_U95pred	0.33
Cu_n	37
Cu_Medpred	11.23
Cu_U95pred	48.14
Cr_n	106
Cr_Medpred	11.76
Cr_U95pred	56.88
Pb_n	106
Pb_Medpred	7.11
Pb_U95pred	25.83
Ni_n	100
Ni_Medpred	6.24
Ni_U95pred	35.15
Zn_n	11
Zn_Medpred	23.61
Zn_U95pred	97.97
ORIG_FID	44

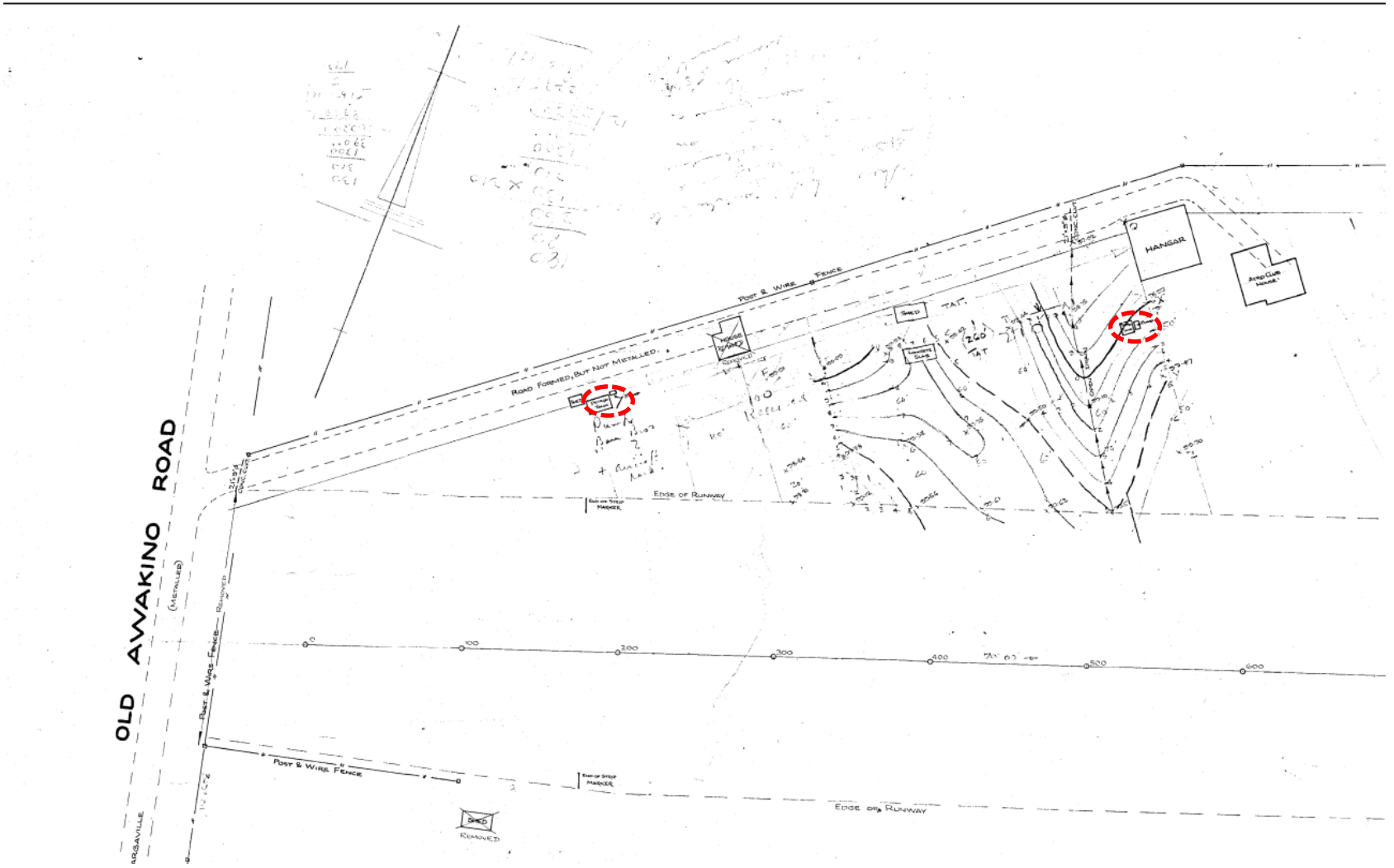


A 6 – Predicted Background Soil Concentrations – Mudstone

Element (Total Recoverable)	Non-Volcanic Range	Volcanic Range
Arsenic (As)	0.4 – 12	
Barium (Ba)	8 – 350	
Boron (B)	2 - 45	<2 – 260
Cadmium (Cd)	< 0.1 – 0.65	
Chromium (Cr)	2 – 55	3 – 125*
Cobalt (Co)	0.2 – 35	10 – 170
Copper (Cu)	1 – 45	20 – 90
Lead (Pb)	< 1.5 – 65*	
Magnesium (Mg)	470 – 10,300	190 – 76,600
Manganese (Mn)	10 – 2,500*	
Mercury (Hg)	<0.03 – 0.45	
Nickel (Ni)	0.9 – 35	4 – 320
Nitrogen (total, N)	300 – 8,500	
Phosphorus (P)	75 – 1,220	245 – 3,730
Potassium (K)	220 – 3,660	
Sulphur (S)	85 – 2,300	
Tin (Sn)	< 0.7 – 4*	
Vanadium (V)	8 – 160*	15 – 370
Zinc (Zn)	9 – 180	54 – 1,160
Total Organic Carbon (TOC)	0.6 – 14%	

Notes:
1. Background ranges for major elements (N, P, S, TOC) include statistical outlier and extreme values outside the non-outlier volcanic soil range. All other elements do not include values obtained that were statistical outliers or extremes outside the non-outlier volcanic soil range.
2. *Work suggests special cases have been found to apply for Ti Point Basalts (Cr), Mt Smart Volcanics (Pb, Sn), Franklin Basalts (Sn), and Awhitu-type Mineral Sands (Mn, V) and as such these lithologies need to be considered individually.

A 7 –Background Soil Concentrations –Soil in Auckland Region (Table 3 from ARC technical publication No. 153, October 2001.

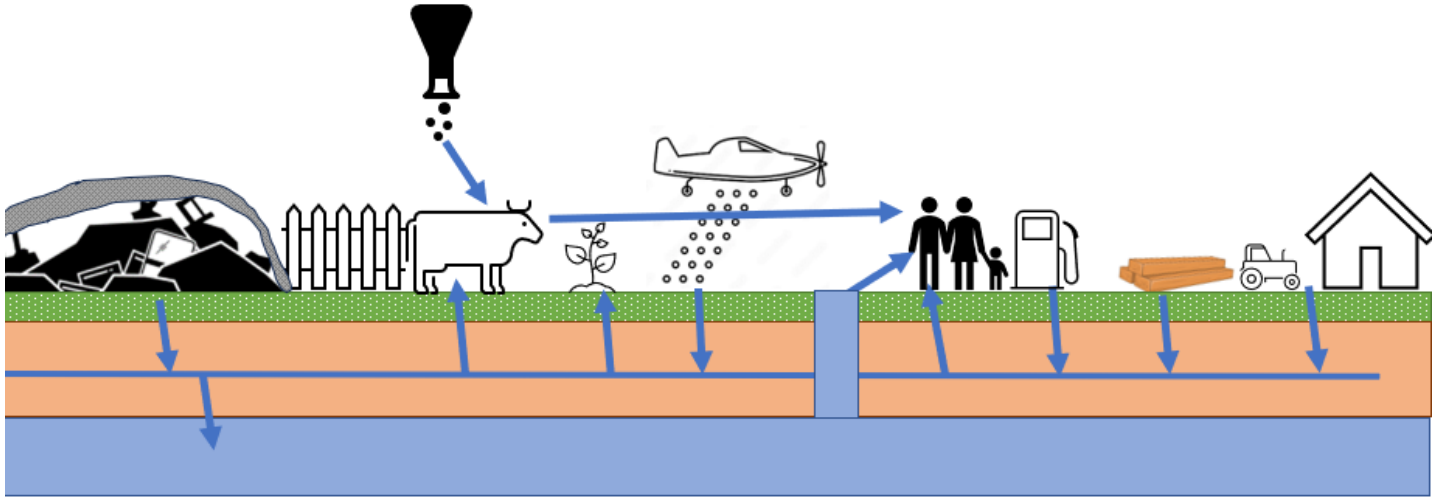


A 8 – Approximate location of Mobil fuel tank at Barr Brothers and above ground fuel storage area at aeroclub

APPENDIX B
Conceptual Site Model

Conceptual Model contemporary & historic land-use (pre-Investigation)

159 &163 Awakino Road



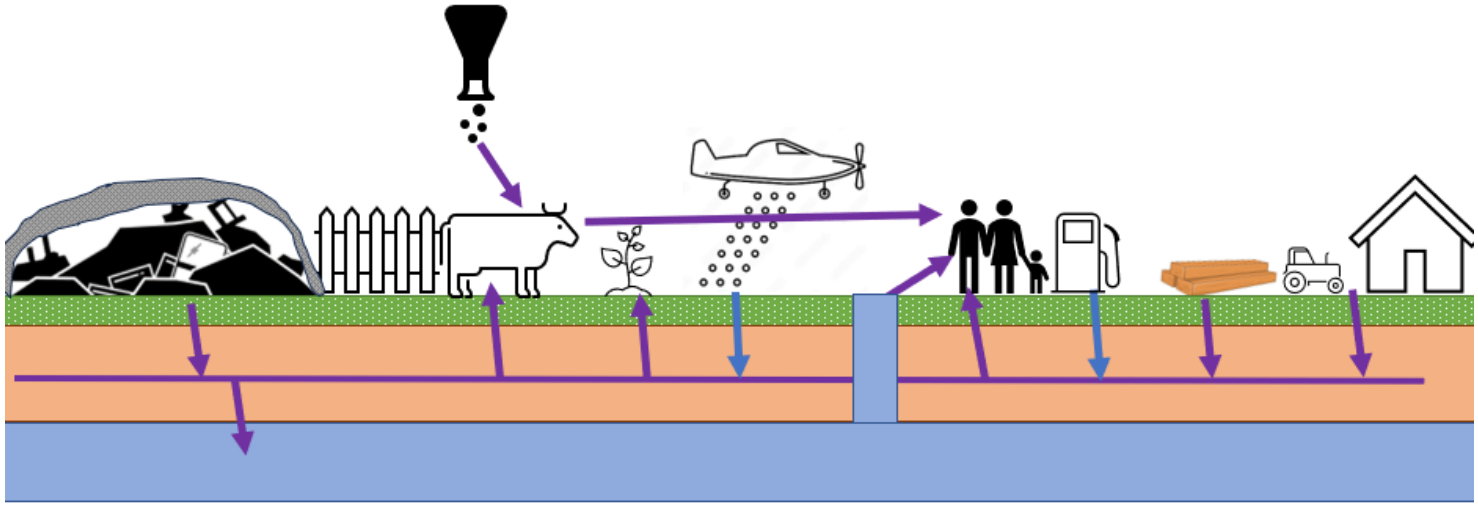
• Leaching to soil, ground and surface water from neighbouring covered landfill	• Potentially complete
• Leaching to soil from uncovered stored CCA timber	• Potentially complete
• Leaching of COI to soil from stockpiled fertiliser in aerodrome area	• Potentially complete
• Accidental discharge to ground from aeroplane fuel in historic aerodrome area or from farm equipment	• Potentially complete
• Use of fertiliser, pesticide, and herbicide in contemporary farming practice	• Potentially complete

Potentially Complete pathway

Incomplete pathway

Conceptual Model contemporary & historic land-use (post-Investigation)

159 &163 Awakino Road



• Leaching to soil, ground and surface water from neighbouring covered landfill	• Incomplete
• Leaching to soil from uncovered stored CCA timber	• Incomplete
• Leaching of COI to soil from stockpiled fertiliser in aerodrome area	• Potentially complete
• Accidental discharge to ground from aeroplane fuel in historic aerodrome area or from farm equipment	• Potentially complete
• Use of fertiliser, pesticide, and herbicide in contemporary farming practice	• Incomplete

Potentially Complete pathway

Incomplete pathway

APPENDIX C
Property Titles

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **959134**
Land Registration District **North Auckland**
Date Issued 27 November 2020

Prior References
810688

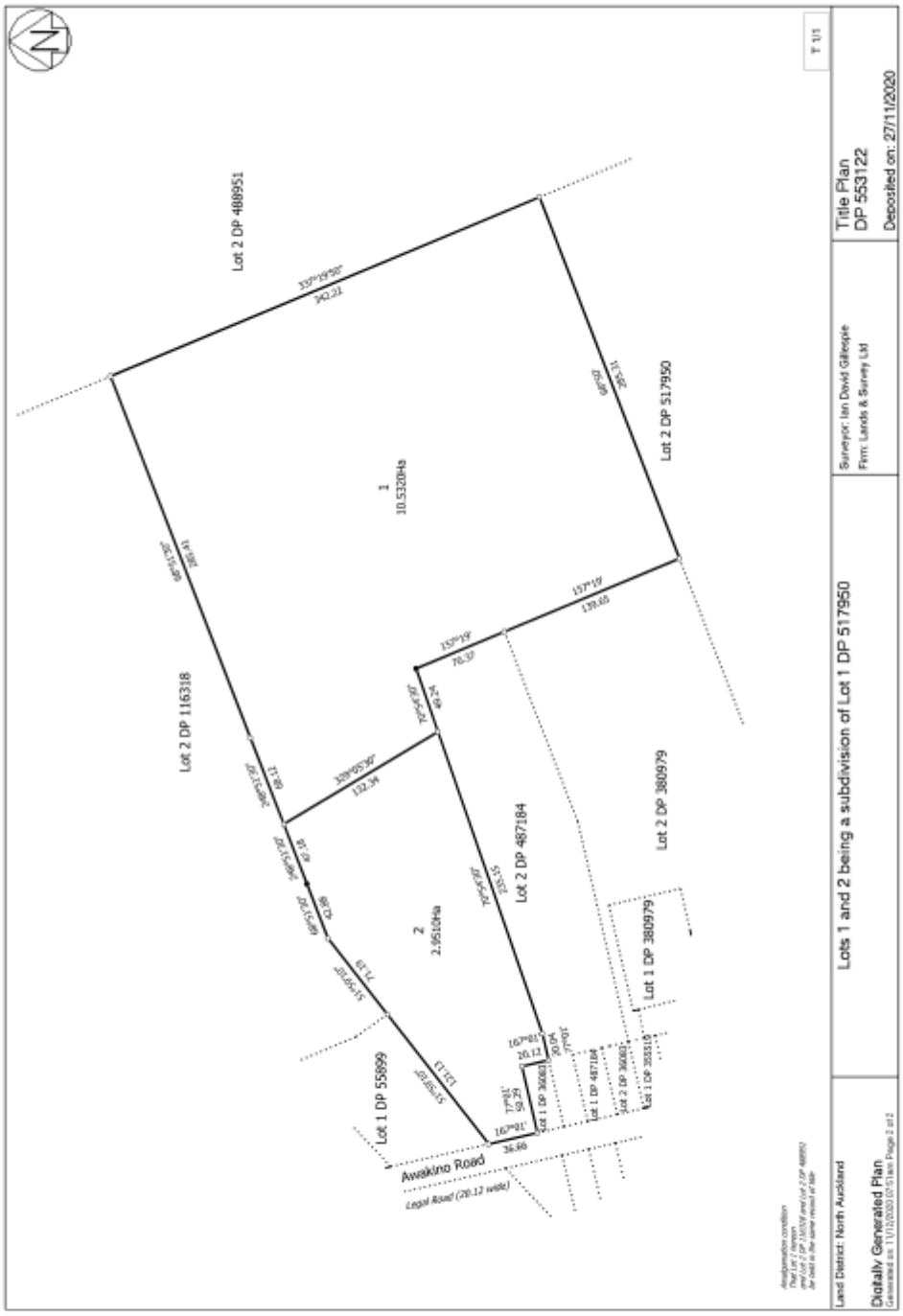
Estate Fee Simple
Area 2.9510 hectares more or less
Legal Description Lot 2 Deposited Plan 553122
Registered Owners
Moonlight Heights Limited

Interests

Transaction ID 1235189
Client Reference

Search Copy Dated 27/06/23 3:26 pm, Page 1 of 2
Register Only

Identifier **959134**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **959135**

Land Registration District **North Auckland**

Date Issued 27 November 2020

Prior References
702318 810688

Estate Fee Simple

Area 57.3795 hectares more or less

Legal Description Lot 1 Deposited Plan 553122 and Lot 2 Deposited Plan 116318 and Lot 2 Deposited Plan 488951

Registered Owners
Craig Paul Williamson, Rachael Winifred Williamson and De Bruin Trustees Limited

Interests

Subject to Section 59 Land Act 1948 (affects part of Lot 2 DP 488951 formerly Section 37 Block XIII Maungaru SD contained in CT 33A/140)

B404361.1 Compensation Certificate pursuant to Section 19 Public Works Act 1981 by the Minister of Works - 19.4.1985 at 2.05 pm(Affects part of Lot 2 DP 488951 formerly Lot 1 DP 192822)

Subject to a electricity right (in gross) over part of Lot 2 DP 488951 marked C and D on DP 488951 in favour of Northpower Limited created by Transfer C470809.1 - 15.4.1993 at 11.56 am

Subject to a right of way easement over part of Lot 2 DP 488951 marked C, E, G and H on DP 488951 created by Easement Instrument 5499366.7 - 25.2.2003 at 9:00 am

The easement created by Easement Instrument 5499366.7 is subject to Section 243 (a) Resource Management Act 1991

9639285.3 Consent Notice pursuant to Section 221 Resource Management Act 1991 - 11.2.2014 at 9:51 am(Affects Lot 2 DP 488951)

Subject to Section 241(2) Resource Management Act 1991 (affects DP 488951)

10154617.5 Consent Notice pursuant to Section 221 Resource Management Act 1991 - 24.11.2015 at 3:51 pm(Affects Lot 2 DP 488951)

Appurtenant to Lot 2 DP 488951 is a right of way, right to convey electricity, telecommunications and computer media created by Easement Instrument 10154617.6 - 24.11.2015 at 3:51 pm

The easements created by Easement Instrument 10154617.6 are subject to Section 243 (a) Resource Management Act 1991

Subject to a right (in gross) to convey electricity, telecommunications and computer media over part of Lot 2 DP 488951 marked H, J, C and D on DP 48851 in favour of Northpower Limited created by Easement Instrument 10154617.8 - 24.11.2015 at 3:51 pm

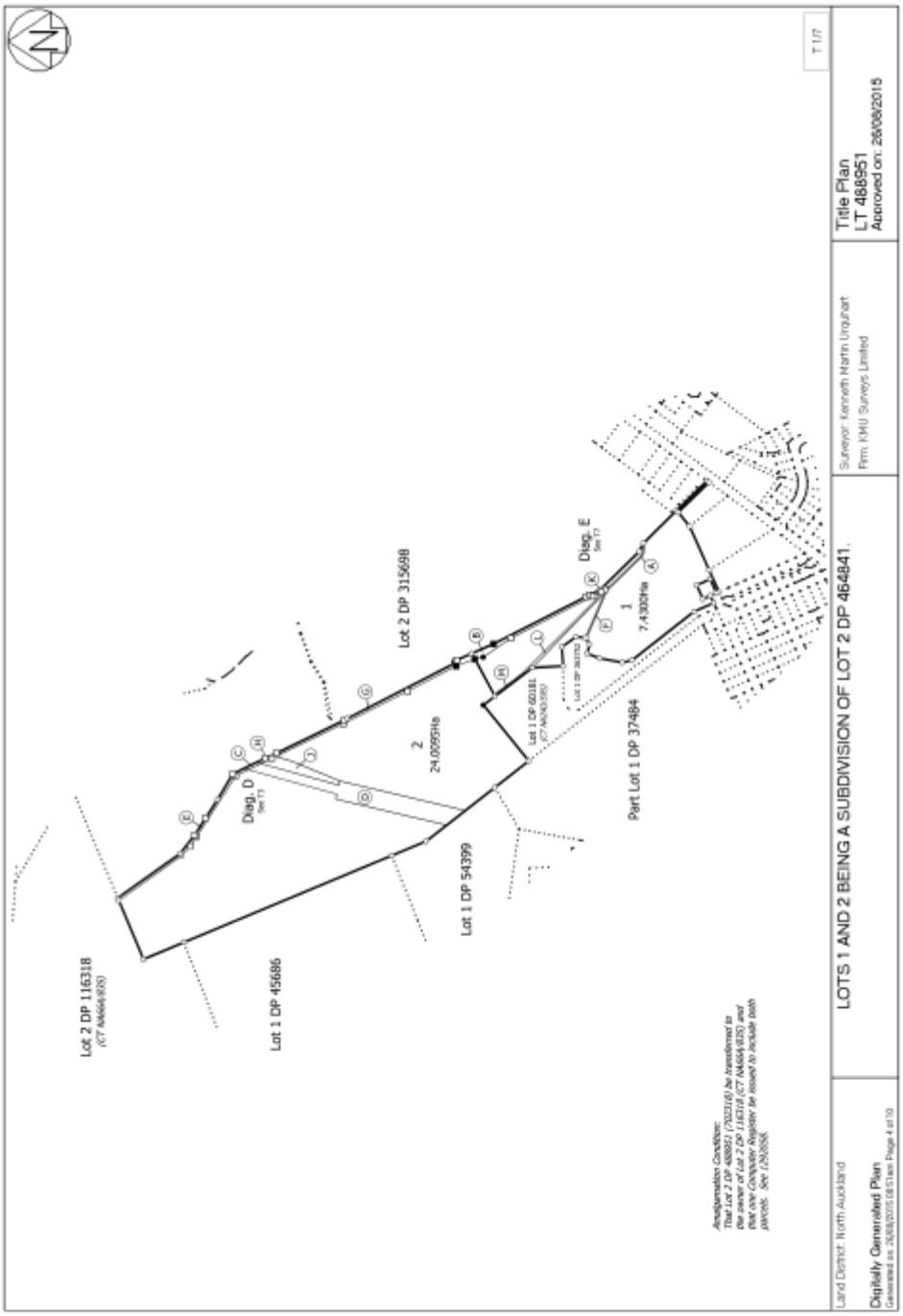
Some of the easements created by Easement Instrument 10154617.8 are subject to Section 243 (a) Resource Management Act 1991(See DP 488951)

Subject to Section 241(2) Resource Management Act 1991 (affects DP 553122)

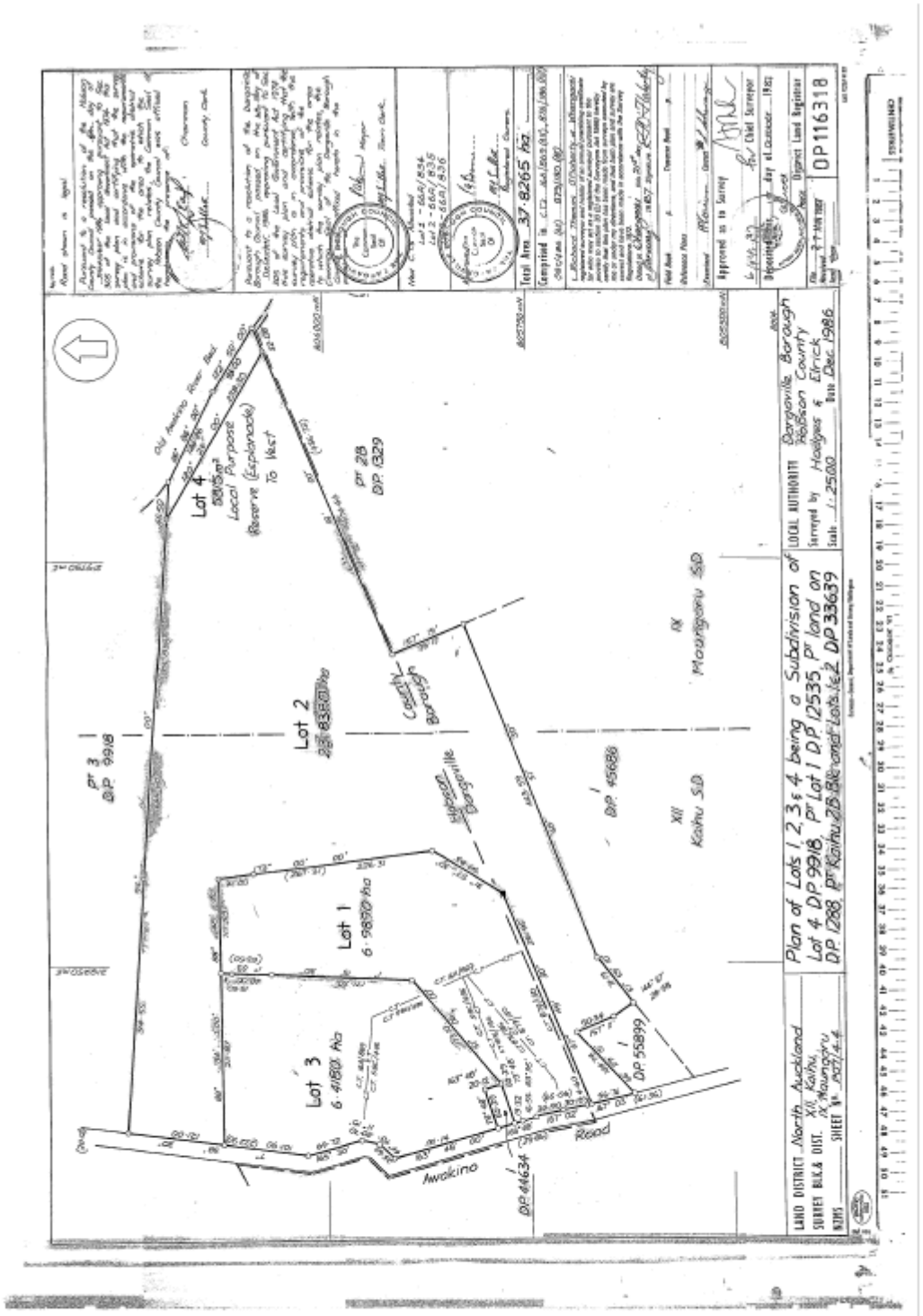
Identifier **959135**

11860626.6 Mortgage to Rabobank New Zealand Limited - 27.11.2020 at 1:45 pm

Identifier **959135**



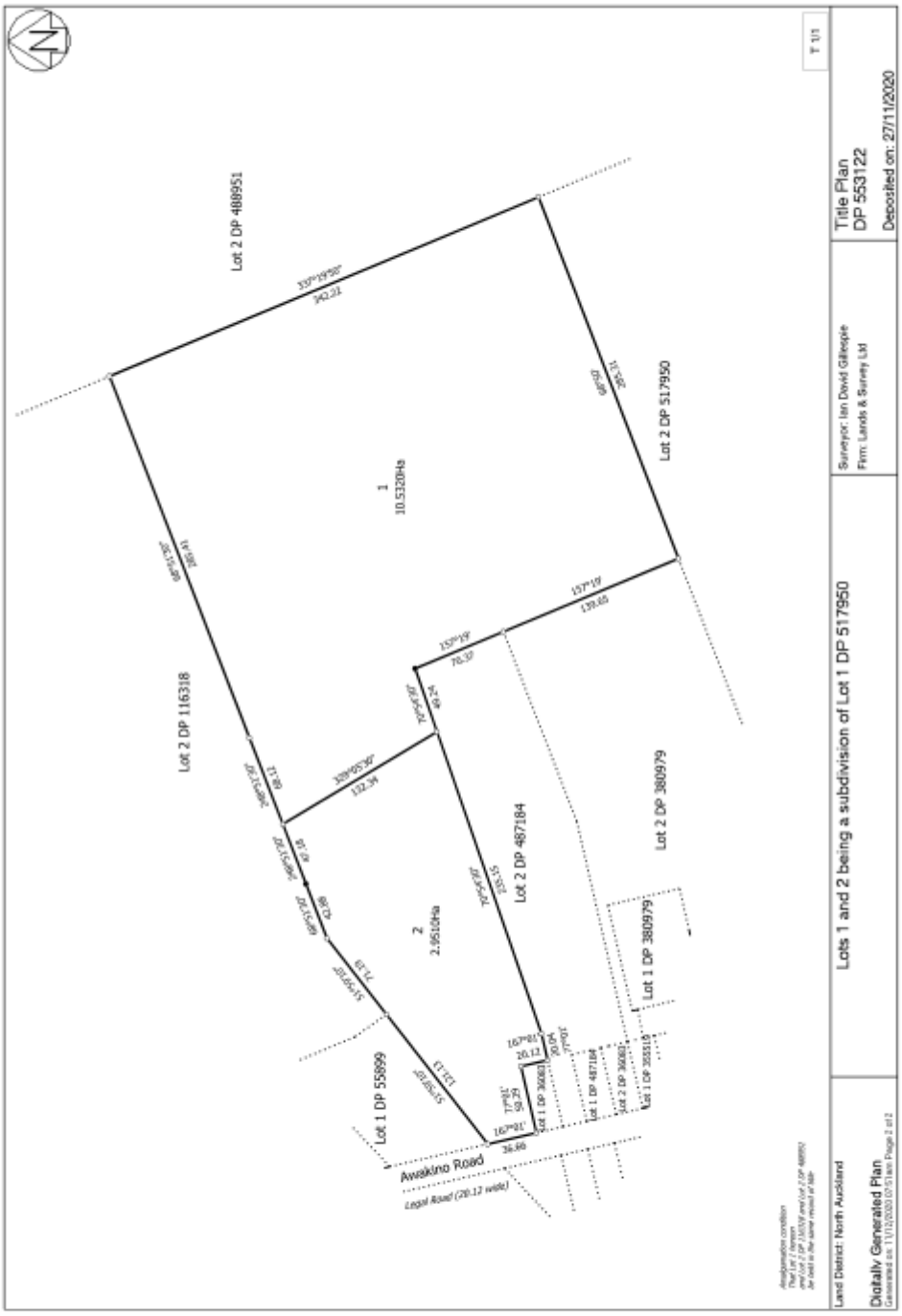
Identifier **959135**



Transaction ID 1235304
Client Reference

Search Copy Dated 27/06/23 3:34 pm, Page 4 of 5
Register Only

Identifier **959135**



APPENDIX D
NRC Selected Land Use Register & Property File Review (Ref# REQ.616613)

Regarding your site query for **Lot 1 DP 553122 and Lot 2 DP 116318 (163 Awakino Road, Dargaville):**

The properties that you have enquired about are not listed on the NRC Selected Land-use Register (SLR) for any current or historical Hazardous Activities and Industries List (HAIL) activities. Please note that the SLR is not a comprehensive list of all sites that have a HAIL land use history. It is a live record and therefore continually being updated.

There are no environmental incidents or resource consents recorded on the properties.

NRC has aerial images of the site for the following years that can be provided upon request – 1993, 2004, 2009 and 2015.

Please note, as per Rule C.6.8.1 of the Proposed Regional Plan for Northland, copies of site investigation reports, where land disturbance has occurred, must be provided to the regional council within three months of completion of the investigation.

Reports can be sent to contamination@nrc.govt.nz.

If I can be of any further assistance, please do not hesitate to contact me.

Regards
Nicola

Nicola Bull
Compliance Specialist - Waste Management
P 09 470 1210 (extension 9123)
M 0274 343 674

Northland REGIONAL COUNCIL
Te Kaunihera ā rohe o Te Taitokerau

D 1 – 163 Awakino Road

Regarding your site query for **Lot 2 DP 553122 (159 Awakino road, Dargaville):**

The property that you have enquired about is not listed on the NRC Selected Land-use Register (SLR) for any current or historical Hazardous Activities and Industries List (HAIL) activities. Please note that the SLR is not a comprehensive list of all sites that have a HAIL land use history. It is a live record and therefore continually being updated.

There are no environmental incidents, resource consents or bores recorded on the property.

NRC has aerial images of the site for the following years that can be provided upon request – 1993, 2004 and 2015.

Please note, as per Rule C.6.8.1 of the Proposed Regional Plan for Northland, copies of site investigation reports, where land disturbance has occurred, must be provided to the regional council within three months of completion of the investigation.

Reports can be sent to contamination@nrc.govt.nz.

If I can be of any further assistance, please do not hesitate to contact me.

Regards
Nicola

Nicola Bull
Compliance Specialist - Waste Management
P 09 470 1210 (extension 9123)
M 0274 343 674

Northland REGIONAL COUNCIL
Te Kaunihera ā rohe o Te Taitokerau

D 2 – 159 Awakino Road

Regarding your site query for Lot 1 DP 116318 (199 Awakino Road, Dargaville):

The property that you have enquired about is listed on the NRC Selected Land-use Register (SLR) for any current or historical Hazardous Activities and Industries List (HAIL) activities as follows:

Site ID: SLU.803220
Site Name: Closed landfill and waste transfer station - Awakino Road, Dargaville
Site Description: 199 Awakino Road, Dargaville. Site is the location of the closed Dargaville landfill, which closed in 2004, and the Dargaville waste transfer station, which is still operational as of 2021. The site is consented and monitored under REG.004433.01.
Site Classification: Verified HAIL: Risk not quantified.
HAIL Categories: G3. Landfill sites
G6. Waste recycling or waste or wastewater treatment

Filenotes:

“A resource consent to discharge contaminants associated with landfilling from a site in Hokianga Road Dargaville was granted in 1988 (4433). The landfill is sited in the head of gully above farmland. The contract to operate the landfill was renewed by Vuletich Operational Services in 1998. Over the last six months the landfill has been managed to a much higher standard, with good compaction levels and an adequate amount of cover material being used. The site closed in 2004. Last data entry 12 November 2007. Category V site”.

There are 7 environmental incidents recorded on the property as detailed in the attached spreadsheet. There are also 4 environmental incidents recorded on the adjacent property that relate to the waste transfer station, so I have included these also. If you require any further information on any of these please let me know.

There are no bores recorded on the property. There are 4 resource consents recorded on the property relating to the closed landfill and waste transfer station (AUT.004433.01.01, AUT.004433.02.02, AUT.004433.03.01 and AUT.004433.04.01).

NRC has aerial images of the site for the following years that can be provided upon request – 2004 and 2015.

Please note, as per Rule C.6.8.1 of the Proposed Regional Plan for Northland, copies of site investigation reports, where land disturbance has occurred, must be provided to the regional council within three months of completion of the investigation.

Reports can be sent to contamination@nrc.govt.nz.

If I can be of any further assistance, please do not hesitate to contact me.

Regards
Nicola

Nicola Bull
Compliance Specialist - Waste Management
P 09 470 1210 (extension 9123)
M 0274 343 674

Northland REGIONAL COUNCIL
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D 3 – Neighbouring Landfill (not on theSite)

Incidents logged on Lot 1 DP 116318 (199 Awakino Road)

Reference number	Date	Subject	Description	Further information from file
REQ.413675	19/03/2006	Odour	Odour nuisance caused by nearby refuse transfer station.	Offensive odour from transfer station confirmed. Abatement notice issued.
REQ.413727	31/03/2006	Hazardous substances spills and refuse	Rats coming from the transfer station.	Site cleaned up and baits stations installed.
REQ.416348	4/01/2008	Odour	Odour from transfer station.	Odour nuisance not confirmed.
REQ.573652	27/04/2014	Burning and smoke nuisance	Smoke nuisance @ Dargaville	Site confirmed that they do burn, but try to do it when wind is blowing away from local
REQ.578924	21/11/2015	Burning and smoke nuisance	Smoke nuisance @ Awakino Rd, Dargaville	Site confirmed that they do burn, but try to do it when wind is blowing away from local
REQ.580577	12/05/2016	Burning and smoke nuisance	Smoke nuisance @ Dargaville	Site burning trees, wood and paper.
REQ.611277	18/03/2022	Other landuse incident	Concerns regarding waste transfer station @ Awakino Rd, Dargaville	Concerns mainly relate to noise and vibration due to truck movements. Requestor was also aware that the site required resource consent, but did not have one.

Incidents logged on Lot 3 DP 116318

Reference number	Date	Subject	Description	Further information from file
REQ.400646	28/10/1994	Hazardous substances spills and refuse	Non-compliance of conditions of consent (KDC - 4433).	KDC requested to comply with consent relating to leachate and the covering of refuse.
REQ.406294	21/06/2001	Odour	Odour from dumpsite.	Odour issue due to transfer station operation. Refuse is removed regularly.
REQ.413612	7/03/2006	Hazardous substances spills and refuse	The landfill is operating at just barely daylight making a terrible noise.	Noise complaints are not a NRC matter.
REQ.414141	28/07/2006	Odour	Odour nuisance.	Odour nuisance not confirmed.

D 4 – Incidents against neighbouring landfill (not on the Site)

I have been unable to find any further information regarding REQ.400646. The only note on file is 'KDC requested to comply with consent relating to leachate and the covering of refuse.' I did find a copy of the 1994 consent, which I have attached for you (along with the current consent FYI).

With regard to monitoring, this is undertaken annually. I have attached a spreadsheet with some historic results.

The sample sites are 105146 (Dargaville Landfill at upstream 50 mtrs in Boundary Drain), 105147 (Dargaville Landfill at Wetland outlet to drain), 105148 (Dargaville Landfill at downstream 30 mtrs of wetland outlet):

Hope this helps,

Ngā mihi

Heather Giles
Environmental Monitoring Officer – Waste Management
P 09 470 1210 ext 9212
M 027 615 3952

Northland REGIONAL COUNCIL
Te Kaunihera ā rohe o Te Taitokerau

D 5 – Landfill monitoring sites

Site ID	Site Name	Sample ID	Date	Arsenic Total g/m3	Cadmium Total g/m3	Chromium Total g/m3	Copper Total g/m3	Lead Total g/m3	Zinc Total g/m3	Conductivity at 25 deg C (uS/cm) us/cm	pH pH	Temperature degC
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20130062	8/01/2013	0.0016	<0.000050000	0.00097	0.0014	0.00024	0.018			19.6
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20132428	13/06/2013	0.00091	0.00033	0.0026	0.0093	0.00032	0.29			
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20135357	9/12/2013	0.0011	0.00021	0.0016	0.0064	0.00031	0.19			23
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20142206	28/05/2014	0.0012	0.00017	0.0013	0.0064	0.00018	0.2			7.9
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20144804	24/11/2014	0.0007	0.00019	0.0013	0.006	0.00049	0.16			20.3
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20152204	6/05/2015	0.00074	<0.000050000	0.0013	0.0024	0.00017	0.071			18.4
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20155560	2/12/2015	0.00082	0.000069000	0.0016	0.003	0.00013	0.067			21.3
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20155563	2/12/2015									
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20162034	26/04/2016	0.0049	0.000050000	0.004	0.0072	0.0034	0.045			17.4
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20165427	10/11/2016	0.00064	0.00012	0.0015	0.0043	0.00029	0.12			21.3
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20173098	8/06/2017	0.00072	0.000094000	0.0016	0.0032	0.0002	0.065			14
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20181879	22/03/2018	0.00091	<0.000050000	0.0015	0.0013	0.00013	0.02			19.5
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20192678	23/05/2019	0.0014	<0.00005	0.002	0.002	0.00045	0.018		6.4	15
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20212803	13/05/2021	0.0013	<0.00005	0.0013	0.0031	0.00015	0.042		5	14.7
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20221873	22/03/2022	0.0015	0.000097	0.0012	0.003	0.00012	0.12	375.2	4.7	20.3
105146	Dargaville Landfill at upstream 50 mtrs in Boundary Drain	20231881	3/04/2023	0.0019	<0.00005	0.0014	0.0024	0.00044	0.02	246.6	5.8	17.7
105147	Dargaville Landfill at Wetland outlet to drain	20130060	8/01/2013	0.0016	<0.000050000	0.0018	0.00094	<0.0001	0.017			19.4
105147	Dargaville Landfill at Wetland outlet to drain	20132426	13/06/2013	0.0009	0.00039	0.0026	0.0094	0.0003	0.29			
105147	Dargaville Landfill at Wetland outlet to drain	20135355	9/12/2013	0.00081	0.00017	0.0014	0.0058	0.00027	0.17			20.8
105147	Dargaville Landfill at Wetland outlet to drain	20142204	28/05/2014	0.0013	0.00018	0.001	0.0064	0.00023	0.21			7.3
105147	Dargaville Landfill at Wetland outlet to drain	20144802	24/11/2014	0.0008	0.0002	0.0014	0.0066	0.00049	0.19			20.9
105147	Dargaville Landfill at Wetland outlet to drain	20152202	6/05/2015	0.00053	0.000096000	0.00096	0.0026	0.00011	0.12			17.7
105147	Dargaville Landfill at Wetland outlet to drain	20155558	2/12/2015	0.079	0.0032	0.1	0.18	0.42	1.6			21.5
105147	Dargaville Landfill at Wetland outlet to drain	20155561	2/12/2015									
105147	Dargaville Landfill at Wetland outlet to drain	20162032	26/04/2016	0.0012	<0.000050000	0.00096	0.0013	0.00024	0.0092			17.4
105147	Dargaville Landfill at Wetland outlet to drain	20165425	10/11/2016	0.0012	0.000056000	0.002	0.0033	0.00069	0.024			22.8
105147	Dargaville Landfill at Wetland outlet to drain	20173096	8/06/2017	0.0013	0.000062000	0.002	0.0031	0.00067	0.028			15.1
105147	Dargaville Landfill at Wetland outlet to drain	20181877	22/03/2018	0.0083	<0.0005	<0.005	<0.002	<0.001	<0.01			18.9
105147	Dargaville Landfill at Wetland outlet to drain	20192676	23/05/2019	0.0023	<0.0005	<0.005	<0.002	<0.001	0.018		7.4	13.7
105147	Dargaville Landfill at Wetland outlet to drain	20212801	13/05/2021	0.0027	<0.00025	<0.0025	0.0011	<0.0005	<0.005		7.4	13.4
105147	Dargaville Landfill at Wetland outlet to drain	20221871	22/03/2022	0.003	<0.00005	0.0017	0.026	0.00038	0.026	878	7.2	18.5
105147	Dargaville Landfill at Wetland outlet to drain	20231883	3/04/2023	0.0048	<0.00005	0.0012	<0.0002	<0.0001	<0.001	1120	7.3	16.1
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20130061	8/01/2013	0.0013	<0.000050000	0.00097	0.001	<0.0001	0.014			19.2
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20132427	13/06/2013	0.00095	0.00028	0.0026	0.0081	0.00027	0.24			
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20135356	9/12/2013	0.00093	0.00021	0.0013	0.0057	0.00021	0.17			20.4
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20142205	28/05/2014	0.0012	0.00021	0.0013	0.007	0.00025	0.19			7.8
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20144803	24/11/2014	0.00078	0.00022	0.0013	0.0063	0.00046	0.18			20.6
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20152203	6/05/2015	0.00063	0.000071000	0.00097	0.0026	0.00014	0.085			16.9
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20155559	2/12/2015	0.0013	0.000088000	0.0025	0.0047	0.00069	0.079			22.7
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20155562	2/12/2015									
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20162033	26/04/2016	0.0021	<0.000050000	0.0018	0.0021	0.00056	0.0096			16.8
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20165426	10/11/2016	0.0008	0.00016	0.0018	0.0053	0.00036	0.13			21.6
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20173097	8/06/2017	0.00083	0.0001	0.0017	0.0035	0.00023	0.074			14.9
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20181878	22/03/2018	0.0016	<0.000050000	0.0014	0.0014	0.00017	0.023			20
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20192677	23/05/2019	0.00078	<0.00005	0.0015	0.0014	0.00013	0.01		6.8	14.7
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20212802	13/05/2021	0.001	0.000069	0.001	0.0034	<0.0001	0.077		4.9	14.8
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20221872	22/03/2022	0.0013	0.000098	0.0011	0.0031	0.0001	0.12	380	5	20.3
105148	Dargaville Landfill at downstream 30 mtrs of wetland outlet	20231882	3/04/2023	0.0017	<0.00005	0.0011	0.0019	0.00019	0.024	278.3	6.2	17.5

D 6 – Water quality results 2013 – 2023 (partial data file only shown)

File: 4433
01 and 02
Replacement

Document Date: 14.09.2017

Resource Consent

Pursuant to the Resource Management Act 1991, the Northland Regional Council (hereinafter called "the Council") does hereby grant a Resource Consent to:

KAIPARA DISTRICT COUNCIL, PRIVATE BAG 1001 DARGAVILLE 0340

To undertake the following activities associated with a closed landfill at Awakino Road, Dargaville, on Lot 1 DP 116318, at or about location co-ordinates 1678431E 6024445N:

Note: All location co-ordinates in this document refer to Geodetic Datum 2000, New Zealand Transverse Mercator Projection.

AUT.004433.01.02 Discharge contaminants to land.

AUT.004433.02.02 Discharge contaminants to water.

Subject to the following conditions:

1 All exposed refuse protruding through the existing landfill cover shall be removed or reburied within three months of the date of commencement of this consent.

2 The landfill shall be capped with a minimum of 450mm compacted semipermeable clay or soil layer and a 100mm topsoil layer within two years of the date of commencement of this consent. The capping layers shall generally conform with the existing land contour and the topsoil layer scarified to promote vegetation growth.

3 The landfill topsoil layer shall be maintained so that there is:

(a) No erosion, cracking, or subsidence; and

(b) A minimum of 90 percent grass cover at all times.

4 The landfill leachate and stormwater drainage systems shall remain separated at all times and shall be adequately maintained so that they operate effectively at all times.

5 The Consent Holder, or its authorised agent, shall undertake surface water quality monitoring at least once each year between 1 March and 31 May at the following sites in the unnamed tributary along the northern boundary of the landfill:

RC AUGUST 2016 (REVISION 14) A4483269

(a) 50 meters upstream of the discharge point from the leachate treatment wetland into the unnamed tributary; and

(b) At the discharge point from the leachate treatment wetland into the unnamed tributary; and

(c) 30 meters downstream from the discharge point from the leachate treatment wetland into the unnamed tributary.

6 The water quality determinands to be monitored in accordance with Condition 5 shall be:

(i) Temperature

(ii) pH

(iii) Conductivity

(iv) Ammoniacal Nitrogen

(v) Total Arsenic

(vi) Total Cadmium

(vii) Total Chromium

(viii) Total Copper

(ix) Total Lead

(x) Total Zinc

For "Total" metal concentration measurements, the whole unfiltered sample shall be used for the analysis.

7 The Consent Holder shall provide and maintain safe and easy access to NRC sampling sites 105146, 105147 and 105148.

8 The Consent Holder shall forward to the Northland Regional Council by 1 July each year, and also immediately on written request by the Northland Regional Council, a written report detailing:

(a) The date and results of the required water quality monitoring; and

(b) The inspection and maintenance undertaken of the landfill cap and the leachate and stormwater systems during the preceding year, being 1 June to 31 May.

Reporting of the results of the water quality monitoring shall expressly consider and address any long-term trends in measured surface water contaminant levels.

9 The Consent Holder shall, for the purposes of adequately monitoring the consent as required under Section 35 of the Resource Management Act 1991, on becoming aware of any contaminant associated with the Consent Holder's operations escaping otherwise than in conformity with this consent:

(a) Immediately take such action, or execute such work as may be necessary, to stop and/or contain such escape; and

RC AUGUST 2016 (REVISION 14) A948269

(b) Immediately notify the Northland Regional Council by telephone of an escape of contaminant; and

(c) Take all reasonable steps to remedy or mitigate any adverse effects on the environment resulting from the escape; and

(d) Report to the Northland Regional Council in writing within one week on the cause of the escape of the contaminant and the steps taken or being taken to effectively control or prevent such escape.

For telephone notification during Northland Regional Council opening hours the Northland Regional Council's assigned monitoring officer for these consents shall be contacted. If that person cannot be spoken to directly, or it is outside of Northland Regional Council opening hours, then the Environmental Emergency Hotline shall be contacted.

10 The Northland Regional Council may, in accordance with Section 128 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions annually during the month of November for any one or more of the following purposes:

(a) To deal with any adverse effects on the environment that may arise from the exercise of the consent and which it is appropriate to deal with at a later stage; or

(b) To require the adoption of the best practicable option to remove or reduce any adverse effect on the environment; or

(c) To address any significant issues identified through the actions required under Condition 8 or 9.

The Consent Holder shall meet all reasonable costs of any such review.

EXPIRY DATE: 1 SEPTEMBER 2052

This consent is granted this Fourteenth day of September 2017 under delegated authority from the Council by:

Stuart Savill
Consents Manager

RC AUGUST 2016 (REVISION 14) A648266

D 7 – Current Discharge Consent for landfill

NORTHLAND REGIONAL COUNCIL

DUPLICATE

DISCHARGE PERMIT 4433

NORTHLAND REGIONAL COUNCIL

Pursuant to the Resource Management Act 1991, the Northland Regional Council (hereinafter called "the Council") does hereby grant a Resource Consent to:

KAIPARA DISTRICT COUNCIL, PRIVATE BAG 1001, DARGAVILLE

To discharge up to 5 cubic metres of leachate per day from a refuse landfill at Dargaville after treatment in a natural wetland to ground and an unnamed tributary of Awakino River on Map Reference P07:890-866 subject to the following conditions:

1 To reduce infiltration and subsequent leaching of any contaminants from the landfill site the following practices shall be fully complied with:

(i) Refuse deposited at the landfill shall be covered at appropriate intervals so as to minimise

(a) Windblown litter.
(b) Smell.
(c) Vermin and birds.
(d) Infiltration and subsequent leaching of contaminants.

Notwithstanding the above, the refuse shall be covered at not less than two-weekly intervals during the months of November to February, and not less than four-weekly intervals during the months of March to October.

(ii) The surface of the landfill site shall be sloped to facilitate surface runoff and to prevent ponding of surface water.

(iii) Bunds and stormwater drains of adequate dimensions shall be constructed at the site as shown on Kaipara District Council Drawing No G10001 1 to prevent stormwater runoff entering the site from adjacent catchment areas.

(iv) The existing stormwater diversion (bypass) system shown on Kaipara District Council Drawing No G10001 1 shall be extended at least 20 metres beyond the existing tip face and any future tipping areas.

2 To reduce the impact of runoff and leachate from the landfill site on the receiving waters, a 100 cubic metre detention pond and 2 x 80 metre trench planted with wetland species shall be constructed at the northern end of the site in the area shown on Kaipara District Council Drawing No G10001.

3 The concentrations of the metals specified below shall not at any time, as a result of this discharge exceed the following limits in the receiving waters at the downstream sampling site shown on Kaipara District Council Drawing G10001 1.

Metal	Limits in milligrams per cubic metre
Arsenic (III)	360
Cadmium	2
Chromium (VI)	16
Copper	9
Lead	34
Zinc	180

Methods of analysis for these metals shall be in accordance with procedures recommended by the United States Protection Agency.

4 The Consent Holder shall provide and maintain easy access to and an easily accessible sampling point at the downstream sampling site and at the outlet of the holding pond.

5 Monitoring of the impact of the discharge shall be carried out in accordance with Schedule 1 (attached).

6 Any works relating to this consent shall be adequately maintained and any additional work, which in the opinion of the Council is necessary for the efficient operation of the works, shall be done within the period stated in written notice by the Council.

7 In the event of any adverse effect on the environment which may arise from the exercise of the consent, but which was not anticipated or foreseen at the date of issue of this consent, the Council reserves the right to review annually the conditions herein in terms of Section 128 of the Act.

8 The Consent Holder shall pay all Crown charges and all charges set by Council under Section 36 of the Resource Management Act 1991.

9 In addition to the circumstances specified in the Resource Management Act 1991 (including amendments) relating to expiry, cancellation or lapsing, this consent may, at the entire discretion of Council, be revoked if the Consent Holder fails to make payment within 30 days after the due date, of any sum of money relating to this consent which is owed to the Council by the Consent Holder.

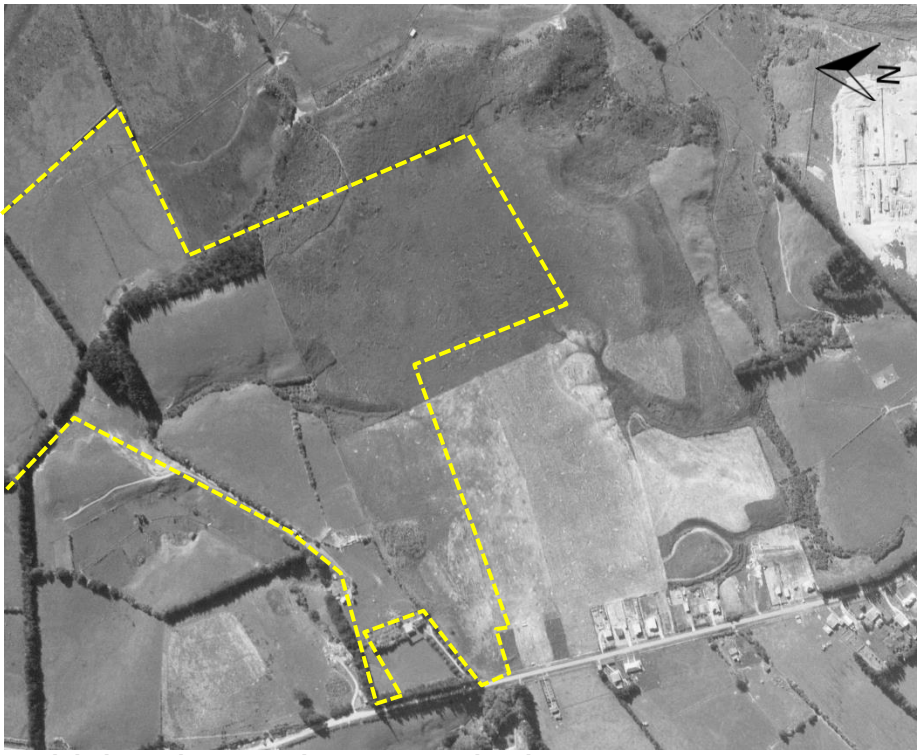
EXPIRY DATE: 30 June 2003

ISSUED at Whangarei this Tenth of November 1994

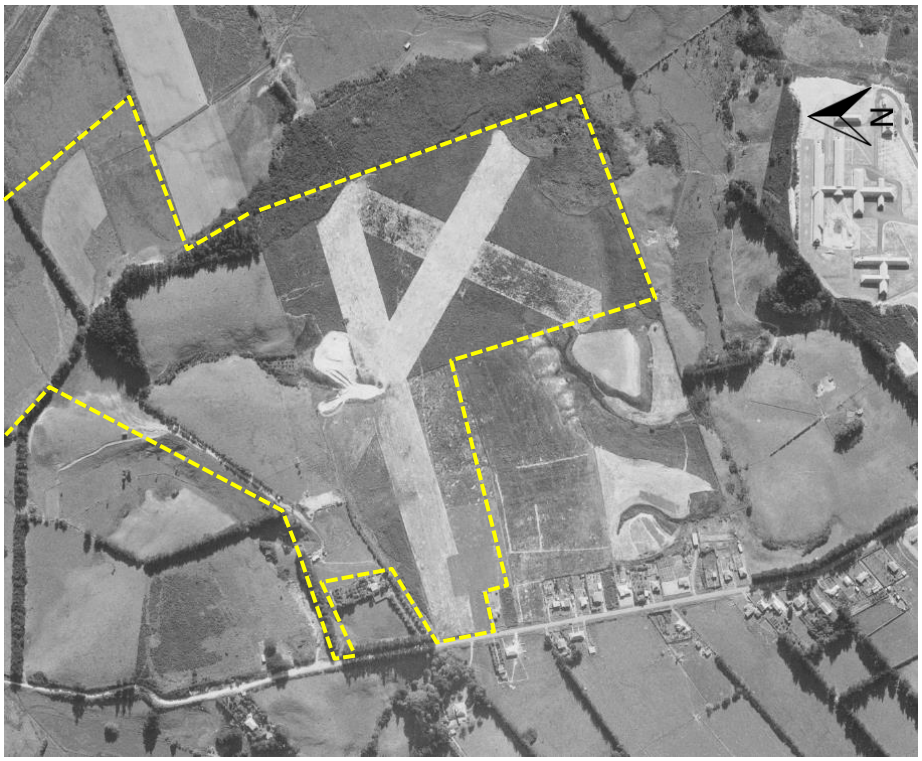
_____ **Consents Manager**

D 8 – Discharge Permit 1994

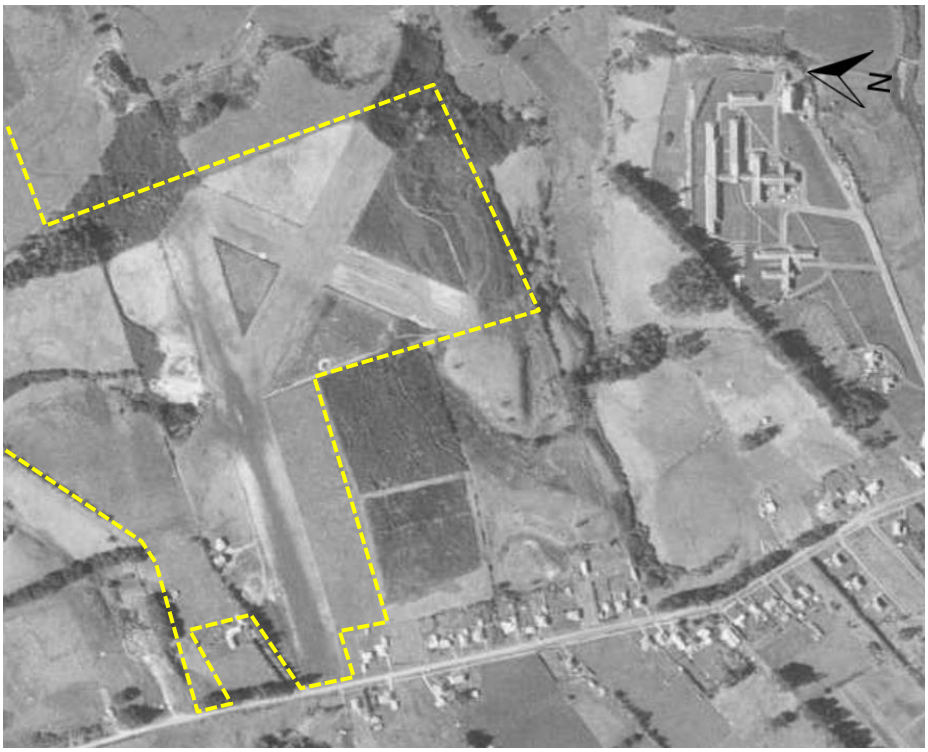
APPENDIX E
Aerial Photographs



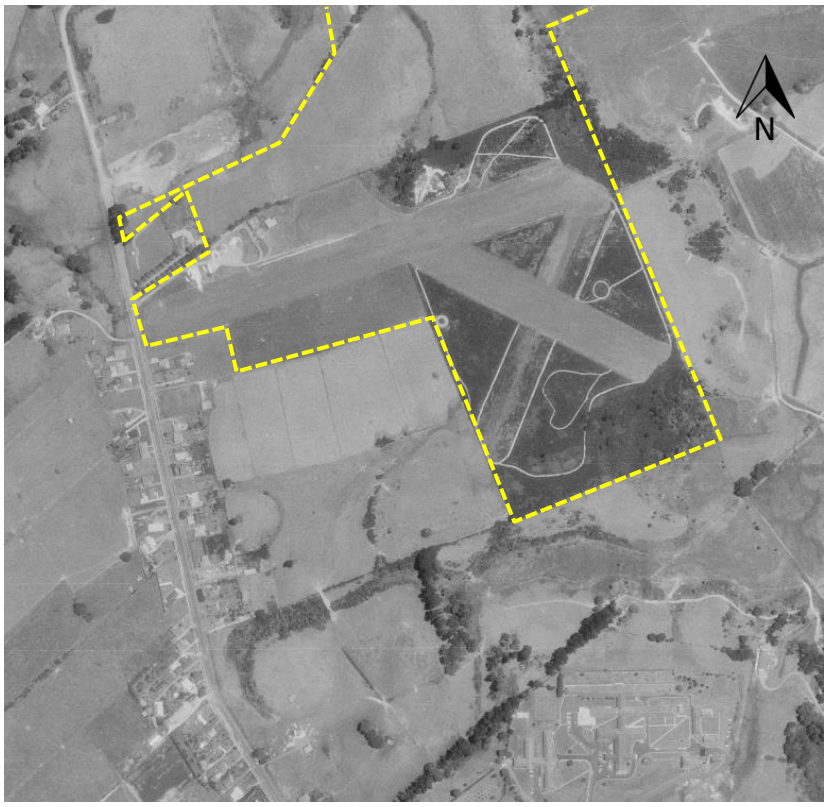
E 1 Aerial view taken 1952 (Source Retrolens)



E 2 Aerial view taken 1957 (Source Retrolens)



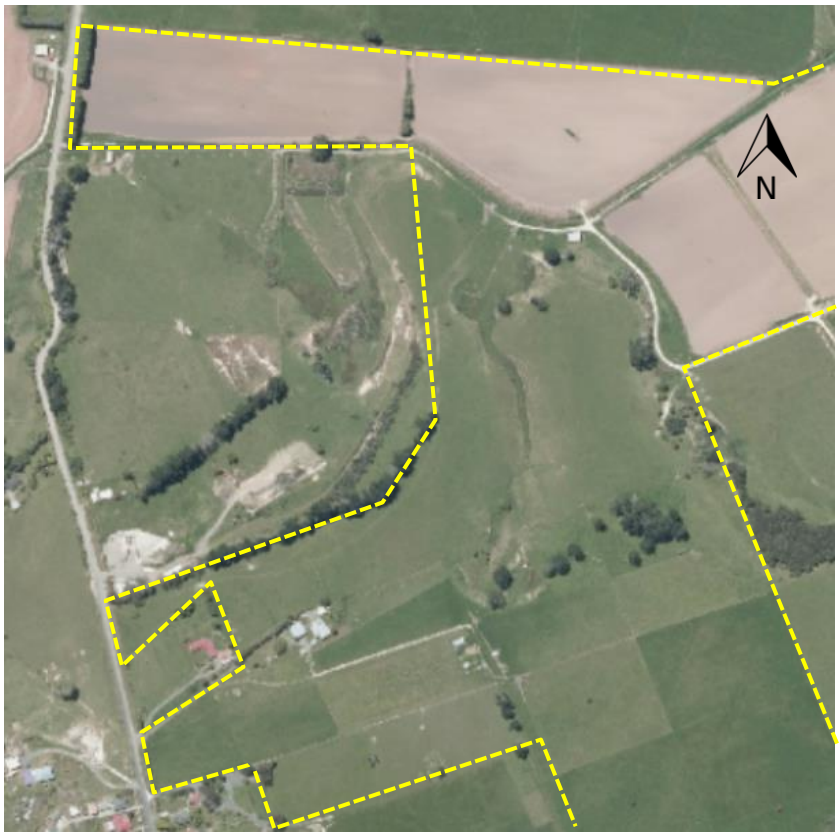
E 3 Aerial view taken 1966 (Source Retrolens)



E 4 Aerial view taken 1979 (Source Retrolens)

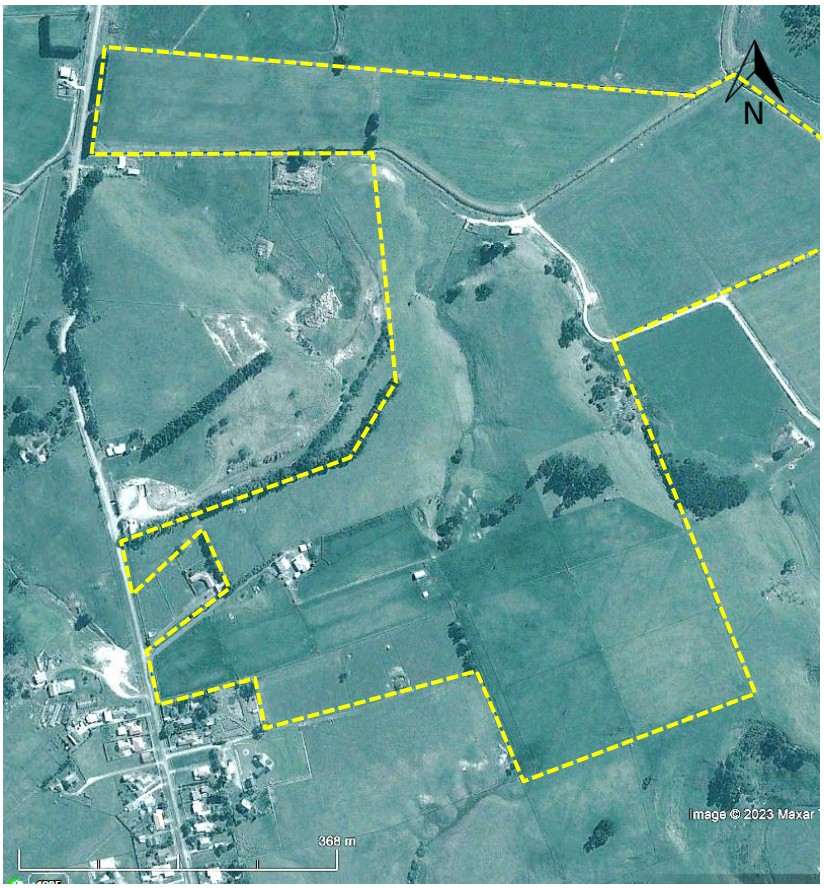
E 5 Aerial view taken 1984 (Source Retrolens)

E 6 Aerial view taken 1996 (Source Retrolens)



E 7 Aerial view taken 2000 (Source LRIS)

E 8 Aerial view taken 2003 (Source Google Earth)



E 9 Aerial view taken 2011 (Source Google Earth)

E 10 Aerial view taken 2018 (Source Google Earth)

E 11 Aerial view taken 2022 showing indicative drainage patterns and contemporary land use (Source Google Earth)

Year of photograph	Landuse on Area of Investigation	HAIL category considered
1952	Pasture, landfill not identifiable	
1957	Pasure, Air strip present. Landfill not identifiable but may be present	I
1966	Pasure, Air strip present, no hangers. Landfill not identifiable but may be present	I
1979	Pasture, Air strip present, Hangers present . Landfill present	F1, H, A 10
1996	Pasture, air strip no longer present, hanger part of residential land use. Landfill possibly capped.	H, I, A 10
2003	Pasture, air strip no longer present, hanger part of residential land use. Half round tractor shed now on airstrip area. Landfill capped and revegetated, recycling centre operational.	H, I, A 10
2005	Pasture, air strip no longer present, hanger part of residential land use. Half round tractor shed now on airstrip area. Landfill capped and revegetated, recycling centre operational.	H, I, A 10
2011	Pasture, air strip no longer present, hanger part of residential land use. Half round tractor shed now on airstrip area and shed north of location of present residence by stream. Landfill capped and revegetated, recycling centre operational.	H, I, A 10
2014	Pasture, air strip no longer present, hanger part of residential land use. Half round tractor shed now on airstrip area. Landfill capped and revegetated, recycling centre operational.	H, I, A 10
2017	Pasture, air strip no longer present, hanger part of residential land use. Half round tractor shed now on airstrip area. Landfill capped and revegetated, recycling centre operational. Possible recent Lime application in airfield area.	H, I, A 10
2018	Pasture, air strip no longer present, hanger part of residential land use. Half round tractor shed now on airstrip area. Landfill capped and revegetated, recycling centre operational. New main residence and pond.	H, I, A 10
2020	Pasture, air strip no longer present, hanger part of residential land use. Half round tractor shed now on airstrip area. Landfill capped and revegetated, recycling centre operational. New main residence.	H, I, A 10
2022	Pasture, air strip no longer present, hanger part of residential land use. Half round tractor shed now on airstrip area. Landfill capped and revegetated, recycling centre operational. New main residence.	H, I, A 10

E 12 Summary of aerial photographs

APPENDIX F
Contemporary Site Photographs

Plate no. F1	**Date: 24/6/23**
Description: Entrance to neighbouring Resource Recovery Park.	

Plate no. F2	**Date: 24/6/23**
Description: Capped landfill area through trees to north of driveway to 163 Awakino Road.	

Plate no. F3	**Date: 24/6/23**
Description: Old hanger building aerodrome area (concrete floor).	

Plate no. F4	**Date: 24/6/23**
Description: Stock yards in location of old aerodrome operation. Looking south-west. Runway to left of power lines. Historic above ground fuel storage area likely in foreground.	

Plate no. F5	**Date: 24/6/23**
Description: Tractor shed, and animal shelter sheds located on old runway.	

Plate no. F6	**Date: 24/6/23**
Description: Looking south-east across historic runway area.	

Plate no. F7	**Date: 24/6/23**
Description: Tractor shed with uncovered storage of CCA treated fence posts and gates.	

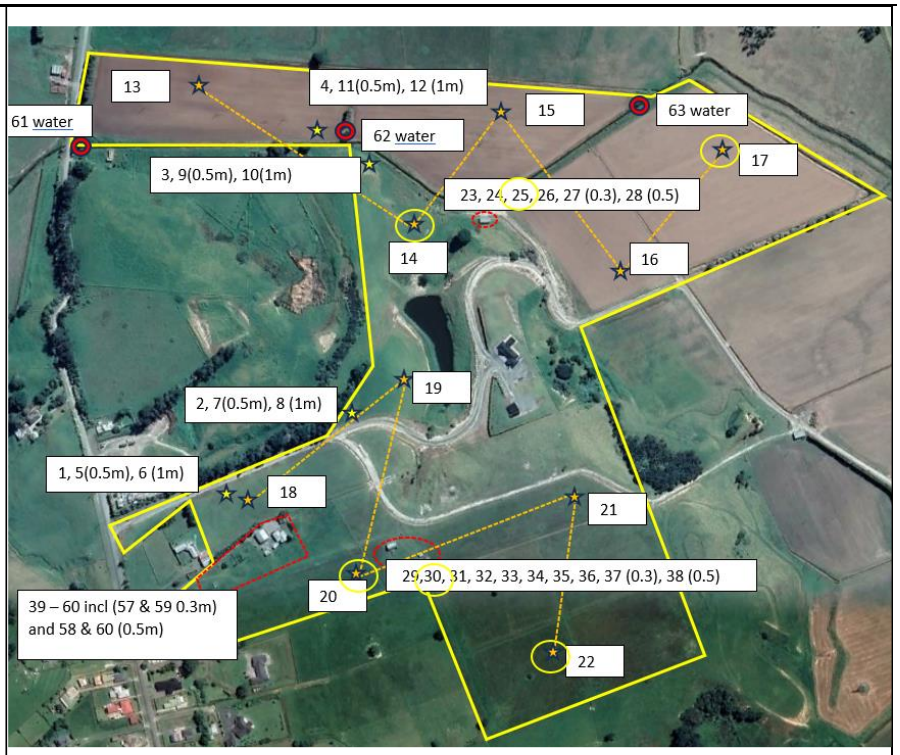
Plate no. F8	**Date: 24/6/23**
Description: Shed in north of Site near drain. (Not located on area of proposed plan change)	

Plate no. F9	**Date: 24/6/23**
Description: Drain located in north-west of site with Kumara paddocks in background (currently in pasture). Any discharge from landfill enters this drain after treatment in wetland.	

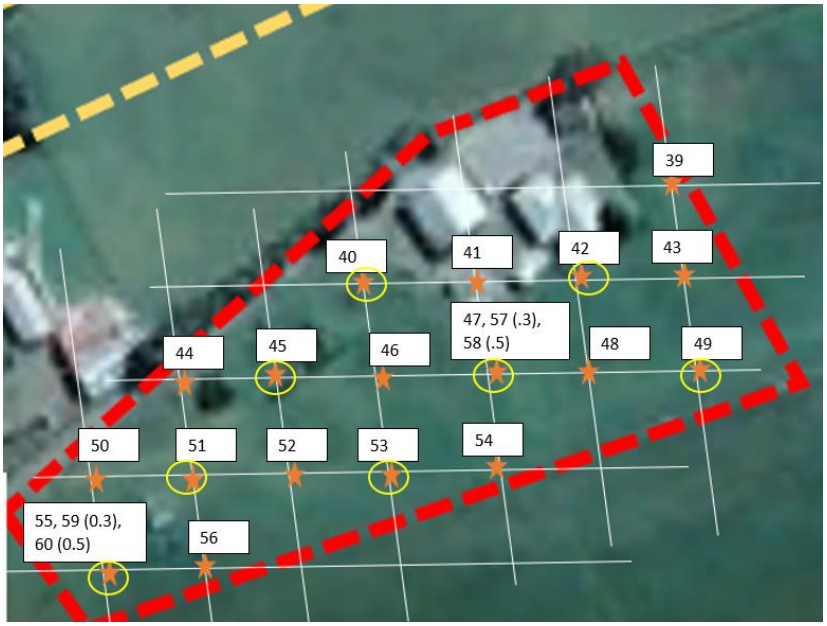
F 10: Location map of photo points (base image Google Earth)

APPENDIX G
Sampling and Analysis Plan

Sampling and Analysis Plan - Job # 2323 23		Date: 24/6/23	
Site Location:	Address:	Grid Reference:	
	159 & 163 Awakino Road, Dargaville	-35.922377° 173.867928°	
Objectives:	Investigation Objectives: To identify any COI present on site resulting from HAIL activity (as possible within restricted time period available).		
	Sampling Objectives: Target area of known HAIL landuse, or areas with potential contamination from accidental discharge (and general site conditions). Characterise if possible.		
Site History:	Pastoral farming, beef and ex-dairy. Some kumara growing. Located next to landfill. Area of historic aerodrome including runway and hanger buildings.		
Current Landuse:	Pastoral farming and kumara growing (on flat)		
Intended Landuse:	Residential		
CSM Summary: Refer CSM:	Source	Pathway	Receptor
	leaching from landfill, fuel or fertiliser from aerodrome, leaching from farm landuse such as storing CCA treated timber outside.	dermal, accidental ingestion, produce ingestion, dust inhalation	adult and child, resident and worker
Media investgated:	soil and water		
Analytes:	Heavy metals, OCP's, TPH, PAH		
Reference Background Concentration:	Cavanagh, J E, 2016. User Guide: Background soil concentrations and soil guidelinevalues for the protection of ecological receptors (Eco-SGVs) –Consultation Draft		
	https://lris.scinfo.org.nz/layer/48470-pbc-predicted-background-soil-concentrations-new-zealand/		
Sampling Pattern:	Stratefied		
Sample Depths:	Predominanty surface samples 0-15cm. Along boundary with landfill surface. 0.5 & 1m samples. Around sheds and in aerodrome area include 0.3m and 0.5m samples		
Composites:	Composites in target areas for heavy metals and OCP's. Systematic samples not composited. Hydrocrbons not composited.		
Sampling Method & Equipment:	shovel/auger/hand post hole borer		
	Additional detail: Post hole borer used for samples collected along boundary with landfill to 0.8m with 1.0m samples collected using hand auger. Other depth samples (0.3m and 0.5m) collected using hand auger.		
Decontamination:	Spade/auger/post hole borer:		
	As per section 5.3 Contaminated land management guidelines No 5, 2021		

Soil Investigation Design Plan:- Whole of Site	

Number of samples - statistical spacial sampling:	$G = \frac{R}{0.59}$ (1) $N = \frac{A}{G^2}$ (2) *	G=	12m / 0.59		N=	7500 / 413.65	Number of sampling points= 18

Quality Assurance/Quality Control:	Two duplicates, 2 samples at 0.3m depth, 2 samples at 0.5m depth
Soil Investigation Design Plan - Aerodrome area (systematic sampling)	
Sampling preferred order:	Numeric in systematic area

Lab Details:	Name of Lab: Hills	Containers required:PSoil250, Glass300	Analysis required: HM, OCP, TPH, PAH	Other:
Courier Details:	Name of Courier:Aramex	Date sent: 26/6/23	Container used: 2 x polybox	Track Number:

APPENDIX H
Laboratory Results and Chain of Custody Documentation

Hill Labs

ANALYSIS REQUEST

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

0508 HILL LAB (44 555 22)
+64 7 858 2000
mail@hill-labs.co.nz
www.hill-labs.co.nz

Job No: 331 0992
Date Recv: 28-Jun-23 09:56
Received by: Arneka Phillips

CHAIN OF CUSTODY RECORD

Quote No 124814

Primary Contact Heather Windsor 293087
Submitted By Heather Windsor 293087
Client Name NZ Environmental Management Limited 293085
Address 350 Kerikeri Road, Kerikeri 0230

Phone Mobile 021 075 1959
Email
Charge To NZ Environmental Management Limited 293085
Client Reference Dargaville
Order No

Results To — Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.
☑ Email Primary Contact ☐ Email Submitter ☐ Email Client
☐ Email Other
☐ Other
Dates of testing are not routinely included in the Certificates of Analysis. Please inform the laboratory if you would like this information reported.

ADDITIONAL INFORMATION / KNOWN HAZARDS
Hold extra bottles please.

Sent to Hill Labs — Date & Time: 24/9/23
☐ Tick if you require COC to be emailed back — Name: Heather Windsor — Signature:

Received at Hill Labs — Date & Time: — Name: — Signature:

Condition ☐ Room Temp ☐ Chilled ☐ Frozen — Temp: 11.4
☐ Sample & Analysis details checked
Signature:

Priority ☐ Low ☐ Normal ☑ High
☐ Urgent (ASAP, extra charge applies, please contact lab first)
NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 5 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types
Soil (Soil), Surface Water (SW)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	2339	24/6/23	Soil	Heavy metals.
2	2340			
3	2341			
4	2342			
5	2343			
6	2344			
7	2345			
8	2346			
9	2347			
10	2348			

Hill Labs

ANALYSIS REQUEST

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

0508 HILL LAB (44 555 22)
+64 7 858 2000
mail@hill-labs.co.nz
www.hill-labs.co.nz

Office use only (Job No)

CHAIN OF CUSTODY RECORD

Quote No 124814

Primary Contact Heather Windsor 293087
Submitted By Heather Windsor 293087
Client Name NZ Environmental Management Limited 293085
Address 350 Kerikeri Road, Kerikeri 0230

Phone Mobile 021 075 1959
Email
Charge To NZ Environmental Management Limited 293085
Client Reference Dargaville
Order No

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☑ Email Primary Contact ☐ Email Submitter ☐ Email Client
☐ Email Other
☐ Other
Dates of testing are not routinely included in the Certificates of Analysis. Please inform the laboratory if you would like this information reported.

ADDITIONAL INFORMATION / KNOWN HAZARDS

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☐ Tick if you require COC to be emailed back — Name: Heather Windsor — Signature:

Received at Hill Labs — Date & Time: — Name: — Signature:

Condition ☐ Room Temp ☐ Chilled ☐ Frozen — Temp:
☐ Sample & Analysis details checked
Signature:

Priority ☐ Low ☐ Normal ☑ High
☐ Urgent (ASAP, extra charge applies, please contact lab first)
NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 5 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types
Soil (Soil), Surface Water (SW)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
11	2349	24/6/23	Soil	Heavy metals
12	2350			
13	2351			
14	2352			
15	2353			
16	2354			
17	2355			
18	2356			
19	2357			
20	2358			

Hill Labs

ANALYSIS REQUEST

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
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Client Reference Dargaville
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☑ Email Primary Contact ☐ Email Submitter ☐ Email Client
☐ Email Other
☐ Other
Dates of testing are not routinely included in the Certificates of Analysis. Please inform the laboratory if you would like this information reported.

CHAIN OF CUSTODY RECORD

Sent to Hill Labs — Date & Time: 24/9/23
☐ Tick if you require COC to be emailed back — Name: Heather Windsor
Signature:

Received at Hill Labs — Date & Time:
Name:
Signature:

Condition ☐ Room Temp ☐ Chilled ☐ Frozen — Temp:
☐ Sample & Analysis details checked
Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

Priority ☐ Low ☐ Normal ☑ High
☐ Urgent (ASAP, extra charge applies, please contact lab first)
NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 5 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types
Soil (Sol), Surface Water (SW)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
21	2359	24/6/23	Soil	heavy metals
22	2360			
23	2361			
24	6362			
25	2301			
26	2302			
27	2303			
28	2304			
29	2305			
30	2306			

Hill Labs

ANALYSIS REQUEST

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
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Quote No 124814

Primary Contact Heather Windsor 293087
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Phone Mobile 021 075 1959
Email
Charge To NZ Environmental Management Limited 293085
Client Reference Dargaville
Order No

Results To — Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.
☑ Email Primary Contact ☐ Email Submitter ☐ Email Client
☐ Email Other
☐ Other
Dates of testing are not routinely included in the Certificates of Analysis. Please inform the laboratory if you would like this information reported.

CHAIN OF CUSTODY RECORD

Sent to Hill Labs — Date & Time: 24/9/23
☐ Tick if you require COC to be emailed back — Name: Heather Windsor
Signature:

Received at Hill Labs — Date & Time:
Name:
Signature:

Condition ☐ Room Temp ☐ Chilled ☐ Frozen — Temp:
☐ Sample & Analysis details checked
Signature:

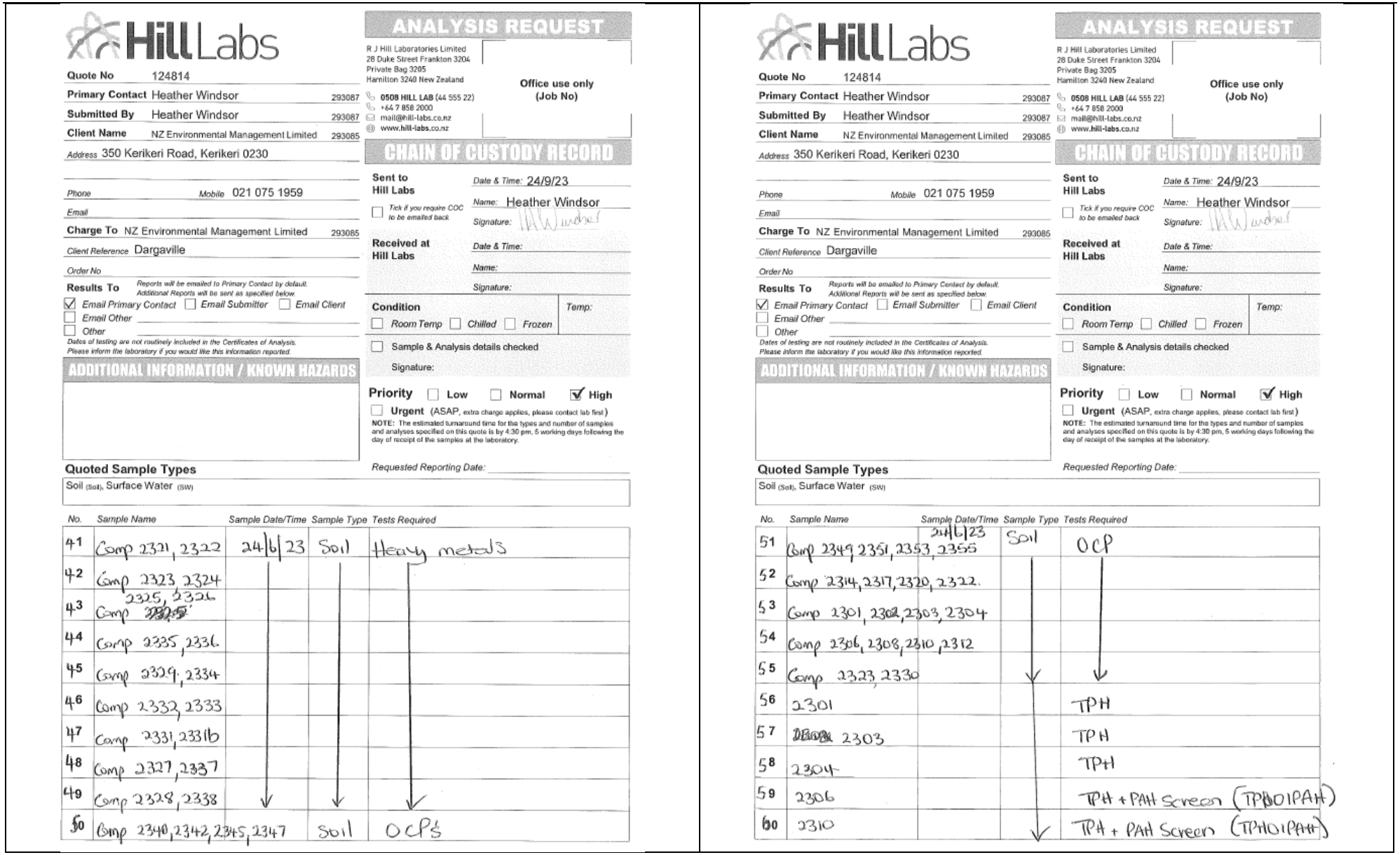
ADDITIONAL INFORMATION / KNOWN HAZARDS

Priority ☐ Low ☐ Normal ☑ High
☐ Urgent (ASAP, extra charge applies, please contact lab first)
NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 5 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types
Soil (Sol), Surface Water (SW)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
31	2307	24/6/23	Soil	Heavy metals
32	2308			
33	2309			
34	2310			
35	2311			
36	2312			
37	Comp 2313, 2315			
38	Comp 2316, 2317			
39	Comp 2314, 2319			
40	Comp 2318, 2320			



HillLabs

ANALYSIS REQUEST

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

0508 HILL LAB (44 555 22)
+64 7 858 2000
mail@hill-labs.co.nz
www.hill-labs.co.nz

Office use only (Job No)

Quote No 124814

Primary Contact Heather Windsor 293087

Submitted By Heather Windsor 293087

Client Name NZ Environmental Management Limited 293085

Address 350 Kerikeri Road, Kerikeri 0230

Phone Mobile 021 075 1959

Email

Charge To NZ Environmental Management Limited 293085

Client Reference Dargaville

Order No

Results To Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.
☑ Email Primary Contact ☐ Email Submitter ☐ Email Client
☐ Email Other
☐ Other
Dates of testing are not routinely included in the Certificates of Analysis. Please inform the laboratory if you would like this information reported.

CHAIN OF CUSTODY RECORD

Sent to Hill Labs
Date & Time: 24/9/23
Tick if you require COC to be emailed back
Name: Heather Windsor
Signature:

Received at Hill Labs
Date & Time:
Name:
Signature:

Condition ☐ Room Temp ☐ Chilled ☐ Frozen Temp:

☐ Sample & Analysis details checked
Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

Priority ☐ Low ☐ Normal ☑ High
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NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 5 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types
Soil (Soil), Surface Water (SW)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
41	Comp 2321, 2322	24/6/23	Soil	Heavy metals
42	Comp 2323, 2324			
43	Comp 2325, 2326			
44	Comp 2335, 2336			
45	Comp 2329, 2334			
46	Comp 2332, 2333			
47	Comp 2331, 2316			
48	Comp 2327, 2337			
49	Comp 2328, 2338			
50	Comp 2340, 2342, 2345, 2347		Soil	OCPs

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Requested Reporting Date:

Quoted Sample Types
Soil (Soil), Surface Water (SW)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
51	Comp 2349, 2351, 2353, 2355	24/6/23	Soil	OCP
52	Comp 2314, 2317, 2320, 2322			
53	Comp 2301, 2302, 2303, 2304			
54	Comp 2306, 2308, 2310, 2312			
55	Comp 2323, 2330			
56	2301			TPH
57	2303			TPH
58	2304			TPH
59	2306			TPH + PAH Screen (TPH01PAH)
60	2310			TPH + PAH Screen (TPH01PAH)

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☐ Email Other
☐ Other
Dates of testing are not routinely included in the Certificates of Analysis. Please inform the laboratory if you would like this information reported.

ADDITIONAL INFORMATION / KNOWN HAZARDS

CHAIN OF CUSTODY RECORD

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Date & Time: 24/9/23
Name: Heather Windsor
Signature:

Received at Hill Labs
Date & Time:
Name:
Signature:

Condition ☐ Room Temp ☐ Chilled ☐ Frozen Temp:
☐ Sample & Analysis details checked
Signature:

Priority ☐ Low ☐ Normal ☑ High
☐ Urgent (ASAP, extra charge applies, please contact lab first)
NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 5 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types
Soil (Sol), Surface Water (SW)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
61	2312	24/6/24	Soil	TPH + PAH Screen (TPH&PAH)
62	2363		Surface water	As per quote
63	2364			"
64	2365			"
5				
6				
7				
8				
9				
10				

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Job Information Summary

Client:	NZ Environmental Management Limited	Lab No:	3310992
Contact:	Heather Windsor	Date Registered:	28-Jun-2023 1:00 pm
	C/- NZ Environmental Management Limited	Priority:	High
	350 Kerikeri Road	Quote No:	124814
	Kerikeri 0230	Order No:	
		Client Reference:	Dargaville
		Add. Client Ref:	
		Submitted By:	Heather Windsor
		Charge To:	NZ Environmental Management Limited
		Target Date:	05-Jul-2023 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	2301 24-Jun-2023	Soil	GSoil300, GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level; Total Petroleum Hydrocarbons in Soil
2	2302 24-Jun-2023	Soil	GSoil300, GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level
3	2303 24-Jun-2023	Soil	GSoil300, GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level; Total Petroleum Hydrocarbons in Soil
4	2304 24-Jun-2023	Soil	GSoil300, GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level; Total Petroleum Hydrocarbons in Soil
5	2305 24-Jun-2023	Soil	GSoil300, GSoil300, PSoil250	Heavy Metals, Screen Level
6	2306 24-Jun-2023	Soil	GSoil300, GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level; TPH Oil Industry Profile + PAHscreen
7	2307 24-Jun-2023	Soil	GSoil300, GSoil300, PSoil250	Heavy Metals, Screen Level
8	2308 24-Jun-2023	Soil	GSoil300, GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level
9	2309 24-Jun-2023	Soil	GSoil300, GSoil300, PSoil250	Heavy Metals, Screen Level
10	2310 24-Jun-2023	Soil	GSoil300, GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level; TPH Oil Industry Profile + PAHscreen
11	2311 24-Jun-2023	Soil	GSoil300, GSoil300, PSoil250	Heavy Metals, Screen Level
12	2312 24-Jun-2023	Soil	GSoil300, GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level; TPH Oil Industry Profile + PAHscreen
13	2313 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
14	2314 24-Jun-2023	Soil	GSoil300, PSoil250	Composite Environmental Solid Samples; Composite Environmental Solid Samples
15	2315 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
16	2316 24-Jun-2023	Soil	cPSoil	Composite Environmental Solid Samples
17	2317 24-Jun-2023	Soil	GSoil300, PSoil250	Composite Environmental Solid Samples; Composite Environmental Solid Samples
18	2318 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
19	2319 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
20	2320 24-Jun-2023	Soil	GSoil300, PSoil250	Composite Environmental Solid Samples; Composite Environmental Solid Samples
21	2321 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
22	2322 24-Jun-2023	Soil	GSoil300, PSoil250	Composite Environmental Solid Samples; Composite Environmental Solid Samples

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
23	2323 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples; Composite Environmental Solid Samples
24	2324 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
25	2325 24-Jun-2023	Soil	GSoil300, PSoil250	Composite Environmental Solid Samples
26	2326 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
27	2327 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
28	2328 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
29	2329 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
30	2330 24-Jun-2023	Soil	GSoil300, PSoil250	Composite Environmental Solid Samples
31	2331 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
32	2331b 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
33	2332 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
34	2333 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
35	2334 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
36	2335 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
37	2336 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
38	2337 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
39	2338 24-Jun-2023	Soil	PSoil250	Composite Environmental Solid Samples
40	2339 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
41	2340 24-Jun-2023	Soil	GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level
42	2341 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
43	2342 24-Jun-2023	Soil	GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level
44	2343 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
45	2344 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
46	2345 24-Jun-2023	Soil	GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level
47	2346 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
48	2347 24-Jun-2023	Soil	GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level
49	2348 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
50	2349 24-Jun-2023	Soil	GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level
51	2350 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
52	2351 24-Jun-2023	Soil	GSoil300, cPSoil	Composite Environmental Solid Samples; Heavy Metals, Screen Level
53	2352 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
54	2353 24-Jun-2023	Soil	PSoil250, GSoil300	Heavy Metals, Screen Level; Composite Environmental Solid Samples
55	2354 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
56	2355 24-Jun-2023	Soil	GSoil300, PSoil250	Composite Environmental Solid Samples; Heavy Metals, Screen Level
57	2356 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
58	2357 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
59	2358 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
60	2359 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
61	2360 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
62	2361 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
63	2362 24-Jun-2023	Soil	PSoil250	Heavy Metals, Screen Level
64	2363 24-Jun-2023	Surface Water	cUP500, S100, N100	Nitrate-N; Total Nitrogen; Chemical Oxygen Demand (COD), screen level; Total Phenols; Chloride; Total Ammoniacal-N; Dissolved Reactive Phosphorus; Sulphate; Total Kjeldahl Nitrogen (TKN); Total Phosphorus; Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
65	2364 24-Jun-2023	Surface Water	cUP500, S100, N100	Nitrate-N; Total Nitrogen; Chemical Oxygen Demand (COD), screen level; Total Phenols; Chloride; Total Ammoniacal-N; Dissolved Reactive Phosphorus; Sulphate; Total Kjeldahl Nitrogen (TKN); Total Phosphorus; Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn
66	2365 24-Jun-2023	Surface Water	cUP500, S100, N100	Nitrate-N; Total Nitrogen; Chemical Oxygen Demand (COD), screen level; Total Phenols; Chloride; Total Ammoniacal-N; Dissolved Reactive Phosphorus; Sulphate; Total Kjeldahl Nitrogen (TKN); Total Phosphorus; Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn
67	Composite of 2313 and 2315	Soil	OrgComp	Heavy Metals, Screen Level
68	Composite of 2316 and 2317	Soil	OrgComp	Heavy Metals, Screen Level
69	Composite of 2314 and 2319	Soil	OrgComp	Heavy Metals, Screen Level
70	Composite of 2318 and 2320	Soil	OrgComp	Heavy Metals, Screen Level
71	Composite of 2321 and 2322	Soil	OrgComp	Heavy Metals, Screen Level
72	Composite of 2323 and 2324	Soil	OrgComp	Heavy Metals, Screen Level
73	Composite of 2325 and 2326	Soil	OrgComp	Heavy Metals, Screen Level
74	Composite of 2335 and 2336	Soil	OrgComp	Heavy Metals, Screen Level
75	Composite of 2329 and 2334	Soil	OrgComp	Heavy Metals, Screen Level
76	Composite of 2332 and 2333	Soil	OrgComp	Heavy Metals, Screen Level
77	Composite of 2331 and 2331b	Soil	OrgComp	Heavy Metals, Screen Level
78	Composite of 2327 and 2337	Soil	OrgComp	Heavy Metals, Screen Level
79	Composite of 2328 and 2338	Soil	OrgComp	Heavy Metals, Screen Level
80	Composite of 2340, 2342, 2345 and 2347	Soil	OrgComp	Organochlorine Pesticides Screening in Soil
81	Composite of 2349, 2351, 2353 and 2355	Soil	OrgComp	Organochlorine Pesticides Screening in Soil
82	Composite of 2314, 2317, 2320 and 2322	Soil	OrgComp	Organochlorine Pesticides Screening in Soil
83	Composite of 2301, 2302, 2303 and 2304	Soil	OrgComp	Organochlorine Pesticides Screening in Soil
84	Composite of 2306, 2308, 2310 and 2312	Soil	OrgComp	Organochlorine Pesticides Screening in Soil
85	Composite of 2323 and 2330	Soil	OrgComp	Organochlorine Pesticides Screening in Soil

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 Labs, 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%.	-	1-12, 40-63, 67-79
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	6, 10, 12
Dry Matter	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, 3-4, 6, 10, 12, 80-85
Composite Environmental Solid Samples	Individual sample fractions mixed together to form a composite fraction.	-	1-4, 6, 8, 10, 12-39, 41, 43, 46, 48, 50, 52, 54, 56

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
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	6, 10, 12
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	6, 10, 12
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS/MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.010 - 70 mg/kg dry wt	6, 10, 12
Heavy Metals, Screen Level	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 - 4 mg/kg dry wt	1-12, 40-63, 67-79
Organochlorine Pesticides Screening in Soil	Sonication extraction, GC-ECD analysis. Tested on as received sample. In-house based on US EPA 8081.	0.010 - 0.06 mg/kg dry wt	80-85
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	1, 3-4, 6, 10, 12
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1, 3-4, 6, 10, 12
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1, 3-4, 6, 10, 12
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1, 3-4, 6, 10, 12
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1, 3-4, 6, 10, 12

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	64-66
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	64-66
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	64-66
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m³ is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m³, the Default Detection Limit for Total Nitrogen will be 0.11 g/m³. In-house calculation.	0.05 g/m³	64-66
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	64-66
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m³	64-66
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	64-66
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	64-66
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-Norg D (modified) 4500 NH3 F (modified) 23rd ed. 2017.	0.10 g/m³	64-66
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) 23rd ed. 2017.	0.004 g/m³	64-66
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) 23rd ed. 2017.	0.002 g/m³	64-66

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	64-66
Chemical Oxygen Demand (COD), screen level	Dichromate/sulphuric acid digestion, colorimetry. Screen Level method. APHA 5220 D 23rd ed. 2017.	25 g O_2/m³	64-66
Total Phenols	In-line distillation, segmented flow colorimetry. NB: Does not detect 4-methylphenol. APHA 5530 B & D (modified) 23rd ed. 2017 & Skalar Method I497-001 (modified).	0.02 g/m³	64-66
Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23rd ed. 2017.	0.0011 - 0.021 g/m³	64-66

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Certificate of Analysis

Client:	NZ Environmental Management Limited	**Lab No:**	3310992 SPv2
Contact:	Heather Windsor	**Date Received:**	28-Jun-2023
	C/- NZ Environmental Management Limited	**Date Reported:**	10-Jul-2023
	350 Kerikeri Road	**Quote No:**	124814
	Kerikeri 0230	**Order No:**	
		Client Reference:	Dargaville
		Submitted By:	Heather Windsor

Sample Type: Soil

		Sample Name:	2301 24-Jun-2023	2302 24-Jun-2023	2303 24-Jun-2023	2304 24-Jun-2023	2305 24-Jun-2023
		Lab Number:	3310992.1	3310992.2	3310992.3	3310992.4	3310992.5
Individual Tests							
Dry Matter	g/100g as rcvd		74	-	45	49	-
Heavy Metals, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		< 2	< 2	3	3	< 2
Total Recoverable Cadmium	mg/kg dry wt		0.12	0.20	0.25	0.11	< 0.10
Total Recoverable Chromium	mg/kg dry wt		5	5	11	21	4
Total Recoverable Copper	mg/kg dry wt		7	5	14	13	5
Total Recoverable Lead	mg/kg dry wt		8.9	4.5	16.9	9.1	9.1
Total Recoverable Nickel	mg/kg dry wt		3	< 2	6	8	< 2
Total Recoverable Zinc	mg/kg dry wt		21	14	75	51	37
Total Petroleum Hydrocarbons in Soil							
C7 - C9	mg/kg dry wt		< 20	-	< 40	< 30	-
C10 - C14	mg/kg dry wt		< 20	-	< 30	< 30	-
C15 - C36	mg/kg dry wt		< 40	-	< 60	< 50	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt		< 80	-	< 120	< 100	-

		Sample Name:	2306 24-Jun-2023	2307 24-Jun-2023	2308 24-Jun-2023	2309 24-Jun-2023	2310 24-Jun-2023
		Lab Number:	3310992.6	3310992.7	3310992.8	3310992.9	3310992.10
Individual Tests							
Dry Matter	g/100g as rcvd		73	-	-	-	51
Heavy Metals, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		< 2	5	2	3	11
Total Recoverable Cadmium	mg/kg dry wt		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt		6	11	15	23	29
Total Recoverable Copper	mg/kg dry wt		4	7	10	8	12
Total Recoverable Lead	mg/kg dry wt		8.8	7.8	10.8	10.5	8.5
Total Recoverable Nickel	mg/kg dry wt		< 2	2	4	5	9
Total Recoverable Zinc	mg/kg dry wt		18	7	12	25	39
Polycyclic Aromatic Hydrocarbons Screening in Soil*							
Total of Reported PAHs in Soil	mg/kg dry wt		< 0.4	-	-	-	< 0.5
1-Methylnaphthalene	mg/kg dry wt		< 0.014	-	-	-	< 0.02
2-Methylnaphthalene	mg/kg dry wt		< 0.014	-	-	-	< 0.02
Acenaphthylene	mg/kg dry wt		< 0.014	-	-	-	< 0.02
Acenaphthene	mg/kg dry wt		< 0.014	-	-	-	< 0.02
Anthracene	mg/kg dry wt		< 0.014	-	-	-	< 0.02
Benzo[a]anthracene	mg/kg dry wt		< 0.014	-	-	-	< 0.02
Benzo[a]pyrene (BAP)	mg/kg dry wt		< 0.014	-	-	-	< 0.02
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt		< 0.033	-	-	-	< 0.047

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Sample Type: Soil						
Sample Name:		2306 24-Jun-2023	2307 24-Jun-2023	2308 24-Jun-2023	2309 24-Jun-2023	2310 24-Jun-2023
Lab Number:		3310992.6	3310992.7	3310992.8	3310992.9	3310992.10
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.033	-	-	-	< 0.047
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.014	-	-	-	< 0.02
Benzo[e]pyrene	mg/kg dry wt	< 0.014	-	-	-	< 0.02
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.014	-	-	-	< 0.02
Benzo[k]fluoranthene	mg/kg dry wt	< 0.014	-	-	-	< 0.02
Chrysene	mg/kg dry wt	< 0.014	-	-	-	< 0.02
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.014	-	-	-	< 0.02
Fluoranthene	mg/kg dry wt	< 0.014	-	-	-	< 0.02
Fluorene	mg/kg dry wt	< 0.014	-	-	-	< 0.02
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.014	-	-	-	< 0.02
Naphthalene	mg/kg dry wt	< 0.07	-	-	-	< 0.10
Perylene	mg/kg dry wt	< 0.014	-	-	-	< 0.02
Phenanthrene	mg/kg dry wt	< 0.014	-	-	-	< 0.02
Pyrene	mg/kg dry wt	< 0.014	-	-	-	< 0.02
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	-	-	-	< 30
C10 - C14	mg/kg dry wt	< 20	-	-	-	< 30
C15 - C36	mg/kg dry wt	< 40	-	-	-	< 50
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 80	-	-	-	< 100

Sample Name:		2311 24-Jun-2023	2312 24-Jun-2023	2330 24-Jun-2023	2339 24-Jun-2023	2340 24-Jun-2023
Lab Number:		3310992.11	3310992.12	3310992.30	3310992.40	3310992.41
Individual Tests						
Dry Matter	g/100g as rcvd	-	74	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	3	< 2	< 2	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	0.18	0.17	0.63
Total Recoverable Chromium	mg/kg dry wt	22	13	3	3	22
Total Recoverable Copper	mg/kg dry wt	9	7	5	8	50
Total Recoverable Lead	mg/kg dry wt	9.0	5.7	2.3	4.7	16.6
Total Recoverable Nickel	mg/kg dry wt	5	2	< 2	< 2	13
Total Recoverable Zinc	mg/kg dry wt	20	9	8	16	58
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	-	< 0.4	-	-	-
1-Methylnaphthalene	mg/kg dry wt	-	< 0.014	-	-	-
2-Methylnaphthalene	mg/kg dry wt	-	< 0.014	-	-	-
Acenaphthylene	mg/kg dry wt	-	< 0.014	-	-	-
Acenaphthene	mg/kg dry wt	-	< 0.014	-	-	-
Anthracene	mg/kg dry wt	-	< 0.014	-	-	-
Benzo[a]anthracene	mg/kg dry wt	-	< 0.014	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	< 0.014	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	-	< 0.033	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	-	< 0.033	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	< 0.014	-	-	-
Benzo[e]pyrene	mg/kg dry wt	-	< 0.014	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	< 0.014	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	-	< 0.014	-	-	-
Chrysene	mg/kg dry wt	-	< 0.014	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	< 0.014	-	-	-
Fluoranthene	mg/kg dry wt	-	< 0.014	-	-	-
Fluorene	mg/kg dry wt	-	< 0.014	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	< 0.014	-	-	-

Sample Type: Soil						
	Sample Name:	2311 24-Jun-2023	2312 24-Jun-2023	2330 24-Jun-2023	2339 24-Jun-2023	2340 24-Jun-2023
	Lab Number:	3310992.11	3310992.12	3310992.30	3310992.40	3310992.41
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Naphthalene	mg/kg dry wt	-	< 0.07	-	-	-
Perylene	mg/kg dry wt	-	< 0.014	-	-	-
Phenanthrene	mg/kg dry wt	-	< 0.014	-	-	-
Pyrene	mg/kg dry wt	-	< 0.014	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	< 20	-	-	-
C10 - C14	mg/kg dry wt	-	< 20	-	-	-
C15 - C36	mg/kg dry wt	-	< 40	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	< 80	-	-	-

	Sample Name:	2341 24-Jun-2023	2342 24-Jun-2023	2343 24-Jun-2023	2344 24-Jun-2023	2345 24-Jun-2023
	Lab Number:	3310992.42	3310992.43	3310992.44	3310992.45	3310992.46
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	< 2	< 2	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	0.32	0.11	0.32	0.57	1.70
Total Recoverable Chromium	mg/kg dry wt	44	62	4	23	56
Total Recoverable Copper	mg/kg dry wt	47	23	15	52	69
Total Recoverable Lead	mg/kg dry wt	16.0	4.8	6.3	10.1	19.9
Total Recoverable Nickel	mg/kg dry wt	28	45	< 2	34	25
Total Recoverable Zinc	mg/kg dry wt	146	25	8	71	72

	Sample Name:	2346 24-Jun-2023	2347 24-Jun-2023	2348 24-Jun-2023	2349 24-Jun-2023	2350 24-Jun-2023
	Lab Number:	3310992.47	3310992.48	3310992.49	3310992.50	3310992.51
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	3	2	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.32	0.29	0.11	3.2
Total Recoverable Chromium	mg/kg dry wt	2 [#1]	26	12	22	18
Total Recoverable Copper	mg/kg dry wt	5	49	17	24	37
Total Recoverable Lead	mg/kg dry wt	1.8	10.9	6.7	4.8	11.3
Total Recoverable Nickel	mg/kg dry wt	< 2	18	8	24	8
Total Recoverable Zinc	mg/kg dry wt	< 4	98	39	26	50

	Sample Name:	2351 24-Jun-2023	2352 24-Jun-2023	2353 24-Jun-2023	2354 24-Jun-2023	2355 24-Jun-2023
	Lab Number:	3310992.52	3310992.53	3310992.54	3310992.55	3310992.56
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	< 2	18
Total Recoverable Cadmium	mg/kg dry wt	2.1	0.11	0.10	0.21	7.4
Total Recoverable Chromium	mg/kg dry wt	7	5	62	55	55
Total Recoverable Copper	mg/kg dry wt	17	3	32	34	106
Total Recoverable Lead	mg/kg dry wt	22	2.0	4.9	7.0	102
Total Recoverable Nickel	mg/kg dry wt	4	< 2	35	32	25
Total Recoverable Zinc	mg/kg dry wt	134	< 4	29	54	220

	Sample Name:	2356 24-Jun-2023	2357 24-Jun-2023	2358 24-Jun-2023	2359 24-Jun-2023	2360 24-Jun-2023
	Lab Number:	3310992.57	3310992.58	3310992.59	3310992.60	3310992.61
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	< 2	2
Total Recoverable Cadmium	mg/kg dry wt	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	< 2	4	< 2	10	15
Total Recoverable Copper	mg/kg dry wt	< 2	< 2	< 2	7	8
Total Recoverable Lead	mg/kg dry wt	1.8	1.3	2.6	4.0	4.4
Total Recoverable Nickel	mg/kg dry wt	< 2	< 2	< 2	4	6
Total Recoverable Zinc	mg/kg dry wt	< 4	< 4	< 4	4	7

	Sample Name:	2361 24-Jun-2023	2362 24-Jun-2023	Composite of 2313 and 2315	Composite of 2316 and 2317	Composite of 2314 and 2319
	Lab Number:	3310992.62	3310992.63	3310992.67	3310992.68	3310992.69

Sample Type: Soil						
	Sample Name:	2361 24-Jun-2023	2362 24-Jun-2023	Composite of 2313 and 2315	Composite of 2316 and 2317	Composite of 2314 and 2319
	Lab Number:	3310992.62	3310992.63	3310992.67	3310992.68	3310992.69
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	2	8	9	< 2
Total Recoverable Cadmium	mg/kg dry wt	2.1	0.28	0.23	0.20	0.26
Total Recoverable Chromium	mg/kg dry wt	9	10	20	20	3
Total Recoverable Copper	mg/kg dry wt	16	16	16	18	4
Total Recoverable Lead	mg/kg dry wt	23	5.9	9.3	9.6	3.0
Total Recoverable Nickel	mg/kg dry wt	7	8	6	6	< 2
Total Recoverable Zinc	mg/kg dry wt	136	34	37	39	9

	Sample Name:	Composite of 2318 and 2320	Composite of 2321 and 2322	Composite of 2323 and 2324	Composite of 2325 and 2326	Composite of 2335 and 2336
	Lab Number:	3310992.70	3310992.71	3310992.72	3310992.73	3310992.74
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	8	7	< 2
Total Recoverable Cadmium	mg/kg dry wt	0.17	< 0.10	0.13	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	2	< 2	17	19	< 2
Total Recoverable Copper	mg/kg dry wt	3	< 2	25	16	2
Total Recoverable Lead	mg/kg dry wt	5.4	1.1	8.0	7.4	1.9
Total Recoverable Nickel	mg/kg dry wt	< 2	< 2	11	5	< 2
Total Recoverable Zinc	mg/kg dry wt	9	< 4	56	40	< 4

	Sample Name:	Composite of 2329 and 2334	Composite of 2332 and 2333	Composite of 2331 and 2331b	Composite of 2327 and 2337	Composite of 2328 and 2338
	Lab Number:	3310992.75	3310992.76	3310992.77	3310992.78	3310992.79
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	3	4
Total Recoverable Cadmium	mg/kg dry wt	0.16	0.13	0.17	0.11	< 0.10
Total Recoverable Chromium	mg/kg dry wt	6	< 2	7	8	13
Total Recoverable Copper	mg/kg dry wt	8	3	16	5	7
Total Recoverable Lead	mg/kg dry wt	3.0	2.3	3.5	4.1	6.9
Total Recoverable Nickel	mg/kg dry wt	4	< 2	8	3	5
Total Recoverable Zinc	mg/kg dry wt	22	6	36	12	29

	Sample Name:	Composite of 2340, 2342, 2345 and 2347	Composite of 2349, 2351, 2353 and 2355	Composite of 2314, 2317, 2320 and 2322	Composite of 2301, 2302, 2303 and 2304	Composite of 2306, 2308, 2310 and 2312
	Lab Number:	3310992.80	3310992.81	3310992.82	3310992.83	3310992.84
Individual Tests						
Dry Matter	g/100g as rcvd	51	68	69	58	66
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
alpha-BHC	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
beta-BHC	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
delta-BHC	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
gamma-BHC (Lindane)	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
cis-Chlordane	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
trans-Chlordane	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
2,4'-DDD	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
4,4'-DDD	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
2,4'-DDE	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
4,4'-DDE	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
2,4'-DDT	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
4,4'-DDT	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
Total DDT Isomers	mg/kg dry wt	< 0.12	< 0.09	< 0.09	< 0.10	< 0.09
Dieldrin	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
Endosulfan I	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
Endosulfan II	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
Endosulfan sulphate	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
Endrin	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015

Sample Type: Soil						
Sample Name:		Composite of 2340, 2342, 2345 and 2347	Composite of 2349, 2351, 2353 and 2355	Composite of 2314, 2317, 2320 and 2322	Composite of 2301, 2302, 2303 and 2304	Composite of 2306, 2308, 2310 and 2312
Lab Number:		3310992.80	3310992.81	3310992.82	3310992.83	3310992.84
Organochlorine Pesticides Screening in Soil						
Endrin aldehyde	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
Endrin ketone	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
Heptachlor	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
Heptachlor epoxide	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
Hexachlorobenzene	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015
Methoxychlor	mg/kg dry wt	< 0.019	< 0.014	< 0.015	< 0.017	< 0.015

Sample Name:		Composite of 2323 and 2330
Lab Number:		3310992.85
Individual Tests		
Dry Matter	g/100g as rcvd	68
Organochlorine Pesticides Screening in Soil		
Aldrin	mg/kg dry wt	< 0.015
alpha-BHC	mg/kg dry wt	< 0.015
beta-BHC	mg/kg dry wt	< 0.015
delta-BHC	mg/kg dry wt	< 0.015
gamma-BHC (Lindane)	mg/kg dry wt	< 0.015
cis-Chlordane	mg/kg dry wt	< 0.015
trans-Chlordane	mg/kg dry wt	< 0.015
2,4'-DDD	mg/kg dry wt	< 0.015
4,4'-DDD	mg/kg dry wt	< 0.015
2,4'-DDE	mg/kg dry wt	< 0.015
4,4'-DDE	mg/kg dry wt	< 0.015
2,4'-DDT	mg/kg dry wt	< 0.015
4,4'-DDT	mg/kg dry wt	< 0.015
Total DDT Isomers	mg/kg dry wt	< 0.09
Dieldrin	mg/kg dry wt	< 0.015
Endosulfan I	mg/kg dry wt	< 0.015
Endosulfan II	mg/kg dry wt	< 0.015
Endosulfan sulphate	mg/kg dry wt	< 0.015
Endrin	mg/kg dry wt	< 0.015
Endrin aldehyde	mg/kg dry wt	< 0.015
Endrin ketone	mg/kg dry wt	< 0.015
Heptachlor	mg/kg dry wt	< 0.015
Heptachlor epoxide	mg/kg dry wt	< 0.015
Hexachlorobenzene	mg/kg dry wt	< 0.015
Methoxychlor	mg/kg dry wt	< 0.015

Sample Type: Aqueous				
Sample Name:		2363 24-Jun-2023	2364 24-Jun-2023	2365 24-Jun-2023
Lab Number:		3310992.64	3310992.65	3310992.66
Individual Tests				
Chloride	g/m³	29	31	29
Total Nitrogen	g/m³	1.04	1.12	1.29
Total Ammoniacal-N	g/m³	0.057	0.171	0.132
Nitrite-N	g/m³	0.003	0.004	0.004
Nitrate-N	g/m³	0.25	0.26	0.46
Nitrate-N + Nitrite-N	g/m³	0.26	0.26	0.47
Total Kjeldahl Nitrogen (TKN)	g/m³	0.78	0.86	0.82
Dissolved Reactive Phosphorus	g/m³	0.010	0.004	0.005
Total Phosphorus	g/m³	0.107	0.066	0.059
Sulphate	g/m³	53	64	71
Chemical Oxygen Demand (COD)	g O_2/m³	45	32	29
Total Phenols	g/m³	< 0.02	< 0.02	< 0.02

Sample Type: Aqueous				
Sample Name:		2363 24-Jun-2023	2364 24-Jun-2023	2365 24-Jun-2023
Lab Number:		3310992.64	3310992.65	3310992.66
Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn				
Total Arsenic	g/m³	< 0.021	< 0.021	< 0.021
Total Cadmium	g/m³	< 0.0011	< 0.0011	< 0.0011
Total Chromium	g/m³	< 0.011	< 0.011	< 0.011
Total Copper	g/m³	< 0.011	< 0.011	< 0.011
Total Lead	g/m³	0.083	0.0070	0.035
Total Nickel	g/m³	< 0.011	0.012	0.018
Total Zinc	g/m³	0.056	0.056	0.086

Analyst's Comments

#1 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample.

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 Labs, 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%.	-	1-12, 30, 40-63, 67-79
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	6, 10, 12
Dry Matter	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, 3-4, 6, 10, 12, 80-85
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-4, 6, 8, 10, 12-39, 41, 43, 46, 48, 50, 52, 54, 56
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	6, 10, 12
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	6, 10, 12
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS/MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.010 - 70 mg/kg dry wt	6, 10, 12
Heavy Metals, Screen Level	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 - 4 mg/kg dry wt	1-12, 30, 40-63, 67-79
Organochlorine Pesticides Screening in Soil	Sonication extraction, GC-ECD analysis. Tested on as received sample. In-house based on US EPA 8081.	0.010 - 0.06 mg/kg dry wt	80-85
Total Petroleum Hydrocarbons in Soil			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1, 3-4, 6, 10, 12
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1, 3-4, 6, 10, 12
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1, 3-4, 6, 10, 12
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1, 3-4, 6, 10, 12

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	64-66
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	64-66
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	64-66
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m³ is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m³, the Default Detection Limit for Total Nitrogen will be 0.11 g/m³. In-house calculation.	0.05 g/m³	64-66
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	64-66
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m³	64-66
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	64-66
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	64-66
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-Norg D (modified) 4500 NH3 F (modified) 23rd ed. 2017.	0.10 g/m³	64-66
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) 23rd ed. 2017.	0.004 g/m³	64-66
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) 23rd ed. 2017.	0.002 g/m³	64-66
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	64-66
Chemical Oxygen Demand (COD), screen level	Dichromate/sulphuric acid digestion, colorimetry. Screen Level method. APHA 5220 D 23rd ed. 2017.	25 g O_2/m³	64-66
Total Phenols	In-line distillation, segmented flow colorimetry. NB: Does not detect 4-methylphenol. APHA 5530 B & D (modified) 23rd ed. 2017 & Skalar Method I497-001 (modified).	0.02 g/m³	64-66
Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23rd ed. 2017.	0.0011 - 0.021 g/m³	64-66

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 28-Jun-2023 and 10-Jul-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.

Kim Harrison MSc
Client Services Manager - Environmental

APPENDIX I
Reference Tables

Soil samples 24/6/2023			Location	
Site	Location	Description	Latitude	Longitude
2301	On side of driveway, @165m from road next to recycling centre	Dark brown silty CLAY topsoil	-35.921805°	173.869494°
2302	On boundary with old landfill to NW of pond wall	Dark brown silty CLAY topsoil	-35.919675°	173.871250°
2303	Beside drain north property down gradient landfill	Dark brown/black silty CLAY topsoil	-35.918695°	173.871926°
2304	Beside drain north property down gradient landfill, 100m west of sample 2303	Dark brown CLAY topsoil	-35.918303°	173.871042°
2305	Depth sample 0.5m under 2301	Yellow/grey CLAY	-35.921805°	173.869494°
2306	Depth sample 1.0m under 2301	Yellow/grey CLAY + black material + glass	-35.921805°	173.869494°
2307	Depth sample 0.5m under 2302	Yellow/grey CLAY	-35.919675°	173.871250°
2308	Depth sample 1.0m under 2302	Yellow/grey CLAY	-35.919675°	173.871250°
2309	Depth sample 0.5m under 2303	Yellow/grey CLAY	-35.918695°	173.871926°
2310	Depth sample 1.0m under 2303	Yellow/grey CLAY	-35.918695°	173.871926°
2311	Depth sample 0.5m under 2304	Yellow/grey CLAY	-35.918303°	173.871042°
2312	Depth sample 1.0m under 2304	Yellow/grey CLAY	-35.918303°	173.871042°
2313	In pasture north-west of property, kumara field	Brown CLAY topsoil with red mottles	-35.917681°	173.868949°
2314	In pasture north west of pond	Brown CLAY topsoil saturated	-35.919174°	173.871676°
2315	In pasture north of pond, kumara field	Brown CLAY topsoil with yellow mottles	-35.918175°	173.873222°
2316	In pasture east of house, kumara field	Brown CLAY topsoil	-35.919555°	173.874811°
2317	In pasture north-east of house, kumara field	yellow CLAY topsoil with red mottles, newly regrassed	-35.918383°	173.875616°
2318	In pasture on hill on east side of driveway	Light brown / grey CLAY topsoil	-35.921975°	173.869905°
2319	In pasture on hill west of pont	Light brown / grey CLAY topsoil	-35.920897°	173.871478°
2320	In pasture by tree 50m west of half round tractor shed, ex airstrip	Light brown / grey CLAY topsoil	-35.922890°	173.871086°
2321	In pasture 60m soth-eat of railway carrage in ex-airstrip area	Brown / grey CLAY topsoil saturated	-35.922081°	173.874479°
2322	In poasture 150m sout of railway carrage in ex-airstrip area	Brown / grey CLAY topsoil saturated	-35.923126°	173.874159°
2323	On north side of open shed north of pond	Dark brown silty CLAY topsoil	-35.918942°	173.872849°
2324	On east side of open shed north of pond	Mixed brown and yellow CLAY topsoil (disturbed)	-35.919020°	173.872956°
2325	On west side of open shed north of pond	Dark brown CLAY topsoil	-35.919019°	173.872757°
2326	On south side of open shed north of pond	Light brown CLAY with yellow mottles, dense	-35.919058°	173.872840°
2327	Depth sample 0.3m below location of 2323	Yellow brown CLAY	-35.918942°	173.872849°
2328	Depth sample 0.5m below location of 2323	Yellow brown CLAY	-35.918942°	173.872849°
2329	north side of half round tractor shed	Brown grey CLAY topsoil	-35.922572°	173.871584°
2330	east side of half round tractor shed outside main doors	Grey brown CLAY topsoil	-35.922593°	173.871682°
2331	west side of half round tractor shed next to stacked used fence posts	Brown grey CLAY topsoil	-35.922693°	173.871643°
2331b	west side of half round tractor shed next to stacked used fence posts. Most southern	Grey CLAY topsoil	-35.922732°	173.871637°

I 1 Location and descriptions of soil samples

Soil samples 24/6/2023			Location	
Site	Location	Description	Latitude	Longitude
2332	south east side of half round tractor shed 2m from shed by stored timber gates	Brown grey CLAY topsoil	-35.922654°	173.871673°
2333	south east corner of half round tractor shed most west extreme of timber post pile	Grey brown CLAY topsoil	-35.922693°	173.871559°
2334	In opening of animal southern shelter shed	Grey brown CLAY topsoil	-35.922796°	173.871722°
2335	north-west of animal northern shelter shed	Grey brown CLAY topsoil	-35.922687°	173.871958°
2336	In opening of animal northern shelter shed	Grey brown CLAY topsoil	-35.922691°	173.872031°
2337	Depth sample 0.3m below location of 2331	Yellow brown CLAY topsoil	-35.922693°	173.871643°
2338	Depth sample 0.5m below location of 2331	Grey brown CLAY topsoil	-35.922693°	173.871643°
2339	North-east end of house airport hanger area	Brown grey CLAY topsoil	-35.922448°	173.870390°
2340	Grid,between yards and gate. Airport hanger area	Dark brown CLAy topssoil, saturated	-35.922724°	173.869762°
2341	In gate area. Grid. Airport hanger area	Brown silty CLAY topsoil with 10% medium sub-angular gravels, saturated	-35.922704°	173.869988°
2342	Between 2341 and 2343 Grid. Airport hanger area	Brown grey CLAY topsoil with red mottles	-35.922668°	173.870204°
2343	Grid 20m south of 2339. Grid. Airport hanger area	Brown grey CLAY topsoil	-35.922638°	173.870423°
2344	Between pigshelter and yards.Grid. Airport hanger area	Grey brown CLAY with 50% grey rock medium to large angular gravels	-35.922968°	173.869370°
2345	South of yards. Grid. Airport hanger area	Dark brown CLAY topsoil with 5% large sub-angular gravels, saturated	-35.922934°	173.869603°
2346	South-east of yards.Grid. Airport hanger area	Grey brown CLAY topsoil	-35.922900°	173.869837°
2347	20m south of 2341 gate site.Grid. Airport hanger area	Dark brown CLAY topsoil	-35.922868°	173.870056°
2348	20m east of 2347. Grid. Airport hanger area	Dark brown CLAY topsoil	-35.922839°	173.870274°
2349	20m east of 2438 and south of 2343. Grid. Airport hanger area	Grey brown CLAY with red mottles	-35.922818°	173.870482°
2350	South-west of pig shelter. Grid. Airport hanger area	Dark brown CLAY topsoil near pigsty	-35.923178°	173.869192°
2351	20m south of 2344. Grid. Airport hanger area	Dark brown Grey CLAY saturated	-35.923141°	173.869410°
2352	20m east of 2351, edge of old runway. Grid. Airport hanger area	Light brown CLAY topsoil saturated	-35.923121°	173.869629°
2353	Grid. Airport hanger area	Grey brown CLAY topsoil with red mottles and <5% medium sub-angular gravels	-35.923089°	173.869849°
2354	20m east of 2353 edge fo runway. Grid. Airport hanger area	Brown Grey CLAY topsoil with 20% small sub-angular gravels	-35.923047°	173.870085°
2355	In stockyards. Grid. Airport hanger area	Dark brown CLAY topsoil wit 5% small sub-angular gravels	-35.922751°	173.869581°
2356	20m east of 2356 Grid. Airport hanger area	Grey brown CLAY topsoil	-35.923016°	173.870310°
2357	Depth sample 0.3m under location of 2347	White CLAY topsoil with 10% medium sub-angular gravels	-35.922868°	173.870056°
2358	Depth sample 0.5m under location of 2347	Yellow CLAY topsoil with 10% medium sub-angular gravels	-35.922868°	173.870056°
2359	Depth sample 0.3m under location of 2355	Yellow grey CLAY	-35.922751°	173.869581°
2360	Depth sample 0.5m under location of 2355	Yellow grey CLAY	-35.922751°	173.869581°
2361	Duplicate of 2351	Dark brown Grey CLAY saturated	-35.923141°	173.869410°
2362	Duplicate of 2348	Dark brown CLAY topsoil	-35.922839°	173.870274°

I 1 Location and descriptions of soil samples (continued)

NZ Environmental Management	Borehole Log	Project: PSI/DSI Dargaville
		Job #: 2023 23
		Date: 24/6/23
		Sample #:2303
		Drilling method: Hand Auger
		Auger Diameter:7.5cm

Location: Near drain down gradient landfill					
Latitide: -35.918695°	**Longitude:** 173.871926°				
Soil Description:	**Moisture:**	**Depth (m)**	**Soil Type:**		**water table:**
Dark brown silty CLAY	Moist	0.0	Topsoil		
Dark brown silty CLAY	Moist	0.1	Topsoil		
Dark brown silty CLAY	Moist	0.2	Topsoil		
Dark brown silty CLAY	Moist	0.3	Topsoil		
Dark brown silty CLAY	Moist	0.4	Topsoil		
Dark brown silty CLAY	Moist	0.5	Topsoil		
Yellow CLAY with red mottles	Moist	0.6	CLAY		
Yellow CLAY with red mottles	Moist	0.7	CLAY		
Yellow CLAY with red mottles	Moist	0.8	CLAY		Encountered
Yellow CLAY with red mottles	Moist	0.9	CLAY		Encountered
Yellow CLAY with red mottles	Moist	1.0	CLAY		Encountered
		1.1			
		1.2			
		1.3			
		1.4			
		1.5			
			Logged by:		HW
Soil Type key: TS (topsoil), F (fill), Cl (clay) St (silt),Sd (sand), P (peat), R (rock)					

I 2 Soil Log description sample site 2303

NZ Environmental Management	Borehole Log	Project: PSI/DSI Dargaville Job #: 2023 23 Date: 24/6/23 Sample #:2355 Drilling method: Hand Auger Auger Diameter:7.5cm		
Location: In stockyards old aerodrome area				
Latitide: -35.922751°	**Longitude:** 173.869581°			

Soil Description:	Moisture:	Depth (m)	Soil Type:		water table:
Dark brown CLAY	Moist	0.00	Topsoil		
Dark brown CLAY	Moist	0.05	Topsoil		
Grey CLAY	Moist	0.10	CLAY		
Grey CLAY	Moist	0.15	CLAY		
Brown/Grey CLAY with green mottles	Moist	0.20	CLAY		
Brown/Grey CLAY with green mottles	Moist	0.25	CLAY		
Brown / grey CLAY	Moist	0.30	CLAY		
Grey CLAY	Moist	0.35	CLAY		
Grey CLAY	Moist	0.40	CLAY		
Grey CLAY	Moist	0.45	CLAY		
Grey CLAY	Moist	0.50	CLAY		not encountered
			Logged by:		HW
Soil Type key: TS (topsoil), F (fill), Cl (clay) St (silt),Sd (sand), P (peat), R (rock)					

I 3 Soil Log description sample site 2355

I 4 KDC Property file summary

Certificate of Title	From	Registered Owners	Occupation	Area
NA1569/60	11/07/1958	The charman, councillors and inhabitants of the county of Hobson and the Mayor,councillors and citizens of the borough of Dargaville		17.6544 ha
	20/07/1981	Phillip Norman Vallance	Farm manager	
	1/11/1988	Martin Daniel Glynn & Frances Lillian Glynn	Retired farmer and wife	
	6/10/2000	Frances Lillian Glynn		
	4/06/2004	Selwyn Charles Pulman, Carolyn Alice Pulman and KCA Trustees Ltd		
810688	24/04/2018	Selwyn Charles Pulman, Carolyn Alice Pulman and KCA Trustees Ltd		13.4840ha
959134	27/11/2020	Selwyn Charles Pulman, Carolyn Alice Pulman and KCA Trustees Ltd		2.9510 ha
	1/04/2022	Moonlight Heights Ltd		
Certificate of Title	**From**	**Registered Owners**	**Occupation**	**Area**
NA16A/869	16/07/1969	Malcolm Finlay	Farmer	32.7476 ha
	5/12/1977	Kaimara farms Ltd		
	27/05/1986	Dargaville Borough Council		
NA66A/835	1/10/1987	Glen Burns Smith and Vivien Lorraine Smith		23.838
	29/08/1991	Muray William Flett	Company director	
	26/09/1995	Glen Burns Smith and Vivien Lorraine Smith	Market gardener	
	10/07/2002	Peter William Douglas, Raewyn Diane Douglas & Ean Innes Brown		
	25/06/2010	Peter William Douglas, Raewyn Diane Douglas and Brian Thomas Henderson		
617813	11/02/2014	Peter William Douglas, Raewyn Diane Douglas and Brian Thomas Henderson		31.4317 ha
	17/04/2014	Peter William Douglas, Raewyn Diane Douglas and Mt Eden Trust Company Limited		
702318	24/11/2015	Peter William Douglas, Raewyn Diane Douglas and Brian Thomas Henderson		46.8475 ha
	13/01/2016	Craig Paul Williamson, Rachael Winifred Williamson and De Bruin Trustees Limited		

I 5 Title History

Property

Valuation No	0101009305 : GIS
Location	163 Awakino Road, Dargaville
Legal Description	LOT 2 DP 488951 LOT 2 DP 116318 LOT 1 DP 553122
Area (Hectares) Rates	57.3795

21/07/20 RESOURCE CONSENT 200038 : Proposed subdivision for two rural lots and amalgamate the balance lot at Lot 1 DP 517950 and Lot 2 DP 116318. Created DP 553122. : Section 224 Issued 28/10/20 (Found on related property: 0095004400)

Planning/Resource Management

RESOURCE CONSENT 200018 : Proposed boundary adjustment for two rural lots to alter the boundary and amalgamate the balance lot with Lot 2 DP 116318 Non complying boundary adjustment at Lot 1 DP 517950 and Lot 2 DP 116318 : Withdrawn 14/02/20
(Found on related property: 0095004400)

6/07/18 BUILDING CONSENT 180326 : New 4 bedroom, 2 bathrooms dwelling & double garage : Code Compliance Cert Issued 26/07/19

Building

18/07/96 BUILDING CONSENT 960380 : IMPLEMENT SHED : Code Compliance Certificate issued 23/07/96

Licences

No information located

Sewer and Drainage

No information located

Land and Building Classifications

No information located

Transport

No information located

Special Land Features

No information located

Swimming Pools

No information located

Other

I 6 Property file summary 163 Awakino road

Property

Valuation No	0095004400 : GIS
Location	159 Awakino Road, Dargaville
Legal Description	LOT 2 DP 553122
Area (Hectares) Rates	2.9510

Planning/Resource Management

21/07/20	RESOURCE CONSENT 200038 : Proposed subdivision for two rural lots and amalgamate the balance lot at Lot 1 DP 517950 and Lot 2 DP 116318. Created DP 553122. : Section 224 Issued 28/10/20
16/01/18	RESOURCE CONSENT 170431 : proposed boundary adjustment between Lot 1 DP 45686 and PT Lot 15 DP 36803. Created DP 517950 : Section 224 Issued 16/02/18 (Found on related property: 0095003301)
19/12/08	RESOURCE CONSENT 080160 : Subdivide Lot 1 DP 45686 and Lot 2 DP 380979 into Two Lots : Decision Notified 28/11/08
	RESOURCE CONSENT 200018 : Proposed boundary adjustment for two rural lots to alter the boundary and amalgamate the balance lot with Lot 2 DP 116318 Non complying boundary adjustment at Lot 1 DP 517950 and Lot 2 DP 116318 : Withdrawn 14/02/20

Building

23/12/10	BUILDING CONSENT 100730 : Additions to Dwelling : Code Compliance Certificate issued 26/05/11
5/04/02	BUILDING CONSENT 020216 : HEWITSON INDUSTRIES LADY KITCHENER : Code Compliance Certificate issued 18/06/02
28/03/02	BUILDING CONSENT 020197 : CONSERVATORY INTO EXISTING DWELLING : Code Compliance Certificate issued 18/06/02
7/03/00	BUILDING CONSENT 001107 : FARM STORAGE BUILDING : Code Compliance Certificate issued 1/05/00
29/05/98	BUILDING CONSENT 980304 : TRANSPORTABLE SLEEPOUTS/STORAGE ROOMS : Code Compliance Certificate issued 19/01/00
23/12/97	BUILDING CONSENT 970774 : CONSERVATORY : Code Compliance Certificate issued 25/02/98
13/10/88	BUILDING PERMIT F 074456 GARAGE
28/02/64	BUILDING PERMIT A 42959 ALTER/ADD TO AERODROME ADMINISTRATION BUILDING
	BUILDING PERMIT UNDATED ADD TO HANGAR

Licences

No information located

Sewer and Drainage

No information located

Land and Building Classifications

No information located

Transport

No information located

Special Land Features

No information located

Swimming Pools

No information located

Other

I 6 continued Property file summary 159 Awakino road

Property

Valuation No	0101009300 : GIS
Location	199 Awakino Road, Dargaville
Legal Description	LOTS 1 3 4 DP 116318 BLK XII KAIHU SD BL K IX MAUNGARU SD-LOT 4 DP 116318 ESP RES-TNA
Owner	Kaipara District Council :
Owner Address	Private Bag 1001 Dargaville 0340
Area (Hectares) Rates	13.9886

Planning/Resource Management

RESOURCE CONSENT 951209 : SUBDIVISION INTO 2 LOTS - REFUSE TIP SITE : Section 306(LGA) Certificate Issued 30/07/87

Building

24/11/88 BUILDING PERMIT G 006415 DOG POUND

9/07/82 BUILDING PERMIT A 14721 WORKSHOP/RECYCLING DEPOT

Licences

1/07/22 Health OT0003 : Kaipara Refuse Limited : Dargaville Resource & Recovery Park : Licence Issued 21/07/22

Sewer and Drainage

No information located

Land and Building Classifications

No information located

Transport

No information located

Special Land Features

HAZARD SITE SLU.803215 G3. Landfill sites

Swimming Pools

No information located

Other

No information located

I 6 continued Property file summary Landfill site

Nonparametric UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/ Time of Computation	ProUCL 5.2 7/ 07/ 2023 11:11:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C0

General Statistics

Total Number of Observations	18	Number of Distinct Observations	12
		Number of Missing Observations	1
Minimum	0.1	Mean	0.992
Maximum	7.4	Median	0.305
SD	1.812	Std. Error of Mean	0.427
Coefficient of Variation	1.826	Skewness	2.991
Mean of logged Data	-1.006	SD of logged Data	1.329

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.735	95% Adjusted-CLT UCL (Chen-1995)	2.017
		95% Modified-t UCL (Johnson-1978)	1.785

Nonparametric Distribution Free UCLs

95% CLT UCL	1.695	95% BCA Bootstrap UCL	2.003
95% Standard Bootstrap UCL	1.667	95% Bootstrap-t UCL	2.919
95% Hall's Bootstrap UCL	4.084	95% Percentile Bootstrap UCL	1.777
90% Chebyshev(Mean, Sd) UCL	2.274	95% Chebyshev(Mean, Sd) UCL	2.854
97.5% Chebyshev(Mean, Sd) UCL	3.66	99% Chebyshev(Mean, Sd) UCL	5.242

Suggested UCL to Use

95% Student's-t UCL	1.735		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

I 7 ProUCL statistical summary of cadmium results

Polycyclic aromatic hydrocarbon	Potency equivalency factors
Benz(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Benzo(j)fluoranthene	0.1
Benzo(k)fluoranthene	0.1
Benzo(a)pyrene	1.0
Chrysene	0.01
Dibenz(a,h)anthracene	1.0
Fluoranthene	0.01
Indeno(1,2,3-c,d)pyrene	0.1

I 8 PEFs for use in assessing potential carcinogenicity of PAH mixtures (Source WHO, 1998)

APPENDIX J
Statement of Qualification as a SQEP

As per the NESCS User Guide Suitably Qualified and Experienced Practitioner requirements Heather Windsor holds a Bachelor of Science degree. She has over 10 years experience investigating and reporting on contaminated land and is a Certified Environmental Practioner (CEnvP).