REPORT

Detailed Site Investigation (DSI) at Brymer Road, Rotokauri

for Brymer Farms Limited

Rev 2 - 30/07/2021






BTW COMPANY

SURVEYING | ENGINEERING | PLANNING & ENVIRONMENT

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Reviewed

Report Author

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30/07/2021
Date

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Date

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SUITABLY QUALIFIED AND EXPERIENCED PERSON STATEMENT

Report Reviewer Statement

Dave Bolger holds a Bachelor of Science (Physical Geography and Environmental Science) from Massey University (1996). Dave is a Certified Environmental Practitioner (CEnvP) EIANZ Certification No.870. Dave has also completed the BOHS IP404 Air Monitoring, Clearance and Reoccupation following the Removal of Asbestos.

Dave has over 18 years of environmental experience throughout New Zealand and manages the Environment Team for BTW Company. Dave's area of expertise is in contaminated land investigations and site remediation. Dave has presented evidence in the Environment Court for hydrocarbon remediation. Dave has been involved with over 80 contaminated land projects throughout New Zealand and has an extensive knowledge of the regulatory framework for Resource Management.

Report Author Statement

Dean Sandwell holds a Bachelor of Science (2004) and a Master of Science (2006) from Waikato University, focussing on experimental design, environmental and analytical chemistry, physical oceanography, marine ecology and soil science.

Dean has over 14 years of environmental research experience in New Zealand and overseas and is the Environment Team Leader for BTW Company in the Waikato. Dean has a diverse background in environmental research and monitoring. Working across multi-disciplinary fields, specifically, marine, freshwater, climate, soils, geo-chemistry, and eco-hydrology. Dean has a proven track record in environmental research, experimental design, instrumentation, and statistical data analysis. In addition to using a wide range of instrumentation (e.g., dataloggers, ADVs, ADCPs, pressure sensors, water quality sensors, CTD profilers, meteorological sensors, greenhouse gas sensors and flux systems, GPS / GNSS, 3D scanning, echosounders) Dean has developed a number of novel environmental monitoring solutions. These solutions range from soil climate and water quality logging in Antarctica, to CO_2 and climate monitoring in Niue cave systems.

SUMMARY

BTW Company Limited (BTW) was engaged by Brymer Farms Limited (the client) to undertake a Detailed Site Investigation (DSI) to support the proposed residential development of 765,044 m^2 (76.5044 ha) of pastoral agriculture land, located between Brymer Road, Rotokauri and Whatawhata Road, State Highway 23, Hamilton (the site). At the time of writing, no site development plan has been developed.

The broad objective of the DSI is to establish whether or not the site would be identified on the Hazardous Activities and Industries List (HAIL) based on current and / or historical land-use; and assess the likelihood of any identified HAIL activities, or pieces of land, presenting a risk to human health should the proposed site be developed for residential purposes. As part of the risk assessment any measured concentrations of potential soil contaminants are compared to the Ministry for Environment (MfE) National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NESCS). The NESCS provides residential soil contaminant standards (SCS) and soil guideline values (SGV) for contaminants based on several exposure scenarios. Specifically, residential 25% produce, residential 10% produce, high-density residential, recreational and commercial / industrial worker. As the site development plan is yet to be developed, the findings of this investigation are compared to the range of exposure scenarios.

The site is located in an area of low rolling ignimbrite hills and alluvial plains. The historical and present land-use at the site is pastoral farming. Across the site a number of potential pieces of land were identified and evaluated for risk to human health and ecological receptors. Specifically, the HAIL activities addressed were fertiliser storage and application, historic stockyards with potential historical livestock dipping and spray race operations, storage of agrichemicals and fuel, adjacent orchard / arable cropping and sport turf activities, and uncontrolled demolition of buildings potentially containing asbestos materials, and buildings in a deteriorated state with potentially Asbestos Containing Materials (ACM). The potential for soil contamination from lead-based paints and offal pit and septic tank waste disposal to land are also addressed.

A site wide contaminant of concern is cadmium due to the potential of soil accumulation from fertiliser application and bulk storage. Anecdotal information suggests that fertiliser has been applied across the site but has not, and is not, stored in bulk at the site. A systematic sampling plan across the site was developed using sample numbers derived from the variability in cadmium data from adjacent investigations. Cadmium concentrations from site soils sampled ranged from 0.2 – 0.71 mg/kg, with a median of 0.305 mg/kg. The calculated 95% UCL[1] for cadmium at the site is 0.416 mg/kg. The SCS and SGV for cadmium at the most stringent scenario (i.e., residential 25% produce scenario) is 0.8 mg/kg. **Therefore, at the site, the risk of cadmium in soil to effect human health is highly unlikely as all cadmium concentrations are well below the most stringent SCS of 0.8 mg/kg.**

Pre-1980 sheep dipping and spray race sites present a risk to human health due to historical use of persistent and toxic chemicals such as arsenic and the organochlorines dichloro-diphenyl-trichloroethane (DDT), lindane, dieldrin, and aldrin. Anecdotal evidence suggests that sheep dipping practises did occur as part of historical farming operations. But this activity occurred outside of the site, in an area that was developed for residential housing between 1995 – 2004. There are a total of three stockyards at the site, hereafter referred to as Stockyard 1, Stockyard 2, and Stockyard 3. To evaluate soil contamination risk, the stockyards were assessed from historical timeline information and compared to the historical use of sheep treatment chemicals. As a result, Stockyard

[1] The 95% upper confidence limit (UCL) is a statistical measure of the mean concentration at the site that is unlikely to be exceeded at a 5% confidence level. The 95% UCL does not represent the 'worst-case scenario' for a site. When comparing results to a soil guideline value (SGV), the result is acceptable if the 95% UCL is at or below the guideline, provided no result is more than twice the guideline value.

1 was found to be unlikely to present a risk from historical use of sheep dipping chemicals. In comparison, Stockyard 2 and Stockyard 3 were highlighted as higher risk locations of soil contamination. To quantify risk, a stratified sampling design was developed around stockyards 2 and 3, and additional soil samples were collected downstream and in the wider area. Additionally, limited judgemental sampling was completed at Stockyard 1.

The site visits did not identify any features of remnant sheep dipping structures (e.g., pot dips), but a disused spray unit was found at Stockyard 2, and a possible remnant spray enclosure observed at Stockyard 3. The concentrations of organochlorines for all samples, at all stockyards, was below analytical detection limits. **Therefore, organochlorines are concluded as highly unlikely to present a risk to human health at the stockyard locations.** The maximum arsenic concentration at Stockyard 1, Stockyard 2, and Stockyard 3 was 42 mg/kg, 91 mg/kg, and 300 mg/kg respectively. Therefore, arsenic concentrations at all three stockyards exceeded the residential 10% and 25% produce SCS of 17 mg/kg and 20 mg/kg respectively. And at stockyards 2 and 3 the high-density residential, commercial worker, and recreational SCS of 45 mg/kg, 70 mg/kg, and 80 mg/kg are exceeded. The calculated 95% UCL at Stockyard 2 was higher than the high-density residential and below the commercial SCS. At Stockyard 3 the 95% UCL (with removal of 300 mg/kg outlier) was lower than the high-density residential. Overall, the arsenic concentrations at the stockyard sites appears to be well defined laterally and vertically and is therefore expected to be relatively localised.

A sub-set of samples collected at the stockyard sites was analysed for additional heavy metals, namely chromium. The concentration of arsenic was significantly correlated with chromium, highlighting the potential for the measured arsenic concentrations to be derived from copper-chromium-arsenic (CCA) treated wood. Based on the timeline of arsenic use in sheep treatments, it is likely that arsenic in the soils at Stockyard 1 is derived from CCA treated wood. In comparison, the timeline of stockyards 2 and 3 correlates to historical arsenic-based insecticide use. Additionally, elevated concentrations of arsenic were measured at locations distance to wood CCA sources. Based on these observations and results, the author concludes that soil arsenic concentrations are likely derived from both CCA treated wood and the use of arsenic-based insecticides. **Therefore, the stockyard sites are highlighted as a piece of land requiring further delineation depending on the proposed land-use. Additionally, a Remedial Action Plan (RAP) and Site Management Plan (SMP) should be developed and site validation sampling and reporting completed at conclusion of works.**

Asbestos containing materials (ACM) in a deteriorated condition or uncontrolled demolition of ACM is a potential source of soil contamination and subsequent human health risk. An implement shed at Stockyard 3 was confirmed to have ACM building material that was observed to be in poor condition and therefore presents a vector for asbestos to contaminate the surrounding soil. Subsequent soil asbestos sampling was completed to quantify and delineate soil asbestos concentrations. A total of 19 samples were collected for analysis, of which 12 samples were tagged “hold cold” for further delineation if required. Of the seven samples analysed, asbestos was detected in one sample and was below the appropriate SGV. **Therefore, works in vicinity of the shed at Stockyard 3 is classed as unlicensed asbestos work and the risk of soil contaminated with asbestos to effect human health is highly unlikely.**

Soil asbestos and lead sampling was undertaken in the location of an unknown structure that was removed from the site between 1953 – 1971. Visual surface assessment test pits were completed in the area of the structure footprint. No evidence of building material or building platform was observed. The analytical results did not detect asbestos in the soil and lead concentrations were well below the most conservative SGVs and SCS. **Therefore, the risk to human health from asbestos and lead soil contamination at the location of the unknown structure is determined to be highly unlikely.**

The building materials and surrounding soils at the two residential buildings was not quantified for potential lead and asbestos contamination. There was no immediately evident ACM at both residential buildings. **Therefore, the residential buildings at the site present an unlikely risk to asbestos soil contamination. However, it is recommended, if these buildings are to be demolished, that an asbestos demolition survey and soil asbestos sampling (dependent on demolition survey information) is completed prior to demolition. Furthermore, the use of lead-based paints at the residential properties could present a source of soil contamination and requires further evaluation. It is recommended that paint lead presence and quantification analysis is completed concurrently with the additional arsenic delineation work.**

The disposal of dead animals is a standard practise associated with agricultural land-use and can present a source of soil and water contamination. Anecdotal information suggests that two offal pits are located on the site, one adjacent to Stockyard 1 and the other adjacent to Stockyard 3. Both offal pits are not in use and have not been used for at least 20 years. Site visits were unable to locate the offal pits. Additionally, septic tank systems are used at the residential properties at the site to treat domestic wastewater. The primary contamination concern from offal pits and septic tanks is nitrogen and pathogenic microorganisms. The nitrogen risks to receiving aquatic environments and ecological receptors was not quantified and will be limited following removal of these systems during development. **Based on survival times of pathogens in soil derived from these activities the risk to future site residents is deemed highly unlikely. However, these activities do present a possible health risk to site workers, and it is therefore recommended to be addressed in the SMP. The SMP is particularly important for outlining accidental discovery as the offal pits could potentially have been used as a dumping ground for additional farm wastes.**

Overall, the majority of the site, by area, is highly unlikely to present a risk to human health should the proposed site be developed for residential purposes. Additionally, analysis of sediment in the receiving surface water body at the site, and comparison to ecological toxicity guidelines, suggests that the risk to ecological receptors from heavy metals and organochlorines is highly unlikely. Depending in what way the development intersects with the identified pieces of land, there is potential for human health risks at the site. It is recommended that the risks are minimised and / or eliminated in the RAP and SMP management strategies that are developed alongside the site development concept plan.

CONTENTS

TABLES

FIGURES

1 INTRODUCTION

BTW Company Limited (BTW) was engaged by Brymer Farms Limited (the client) to complete a Detailed Site Investigation (DSI) for a proposed 765,044 m^2 (76.5044 ha) residential development (the site). The site is located between Brymer Road, Rotokauri and Whatawhata Road, State Highway 23, Hamilton.

This DSI is an investigation of statistically derived and analysed data to complete a robust risk assessment on a proposed subdivision and change of land-use from pastoral agriculture to residential. This is achieved by identifying if any activities on the Ministry for the Environment (MfE) Hazardous Activities and Industries List (HAIL) is being, or has been, or is more likely than not being or has been, undertaken on the site. The DSI then uses desktop and field collected data to complete an assessment that identifies the location and significance of potential HAIL (and other potential contaminant sources) activities and assesses the likelihood of contaminant pathways to affect human and environmental health.

This report was undertaken in general accordance with the requirements of the current edition of Contaminated Land Management Guidelines No. 5–Site Investigation and Analysis of Soils, Wellington, Ministry for the Environment (MfE 2021); and is reported on in accordance with the current edition of Contaminated Land Management Guidelines No. 1–Reporting on Contaminated Sites in New Zealand, Wellington, Ministry for the Environment (MfE 2021).

1.1 Objectives and Scope

1.1.1 Objectives

- Establish whether it is more likely than not that an activity or industry described in the HAIL is being or has been undertaken (i.e., piece of land).
- Conduct intrusive soil sampling to characterise and quantify soil contamination.
- Assess the human health risk from soil contamination and the suitability for the site for potential future residential development.
- Assess the activity status under the NESCS (Resource Management [National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health] Regulations 2011).

1.1.2 Scope

The scope of work undertaken by this DSI is limited to:

- Lot 1 DPS 87291; Lot 22 DPS 79526; Part Lot 2 DP 18355 / Allot 365 Pukete PSH
- Review of Waikato District Council (WDC) records.
- Review of the Hamilton City Council (HCC) records.
- Review of Waikato Regional Council (WRC) records.
- Review of aerial imagery from Retrolens, and Google Earth Pro.
- Complete a site visit and soil sampling.
- Review of information supplied by current landowner.
- Develop conceptual site model (CSM) and complete risk assessment.
- Provide a conclusion regarding the likely risk to human health from soil contamination.

2 SITE IDENTIFICATION AND ENVIRONMENT

The site is located between Brymer Road, Rotokauri and Whatawhata Road, State Highway 23, Hamilton (Figure 2.1). The site is split across three lots (Lot 1 DPS 87291; Lot 22 DPS 79526; Part Lot 2 DP 18355 / Allot 365 Pukete PSH) with a total area of 765,044 m^2 (76.5044 ha). Figure 2.1 highlights the central drainage channel (CROWN LAND SO 3037 BLK XVI NEWCASTLE SD) that splits the northern (blue) and southern (red) areas of the site. Figure 2.2 shows the location of referenced identifying features. In general, the lots are zoned rural with the exception of Lot 22 DPS 79526 zoned as residential general. See Table 2.1, Table 2.2, and Table 2.3 for further details.

The current and historic land-use across the three lots is pastoral agriculture. The surrounding land-uses are residential and pastoral agriculture, arable cropping, orchard, and sport turf (i.e., golf course). Waikato District Council Intramaps and Waikato Regional Council Map were searched and no natural environment (e.g., threatened species, indigenous fish habitat, biodiversity, ecological corridor, significant natural feature) or hazard policies (e.g., flood risk, land stability) were highlighted at the site. The site historical land-use information is presented in Section 3, and the geology, hydrology and topography of the site is outlined below.

Figure 2.1: Site location and approximate site boundaries.

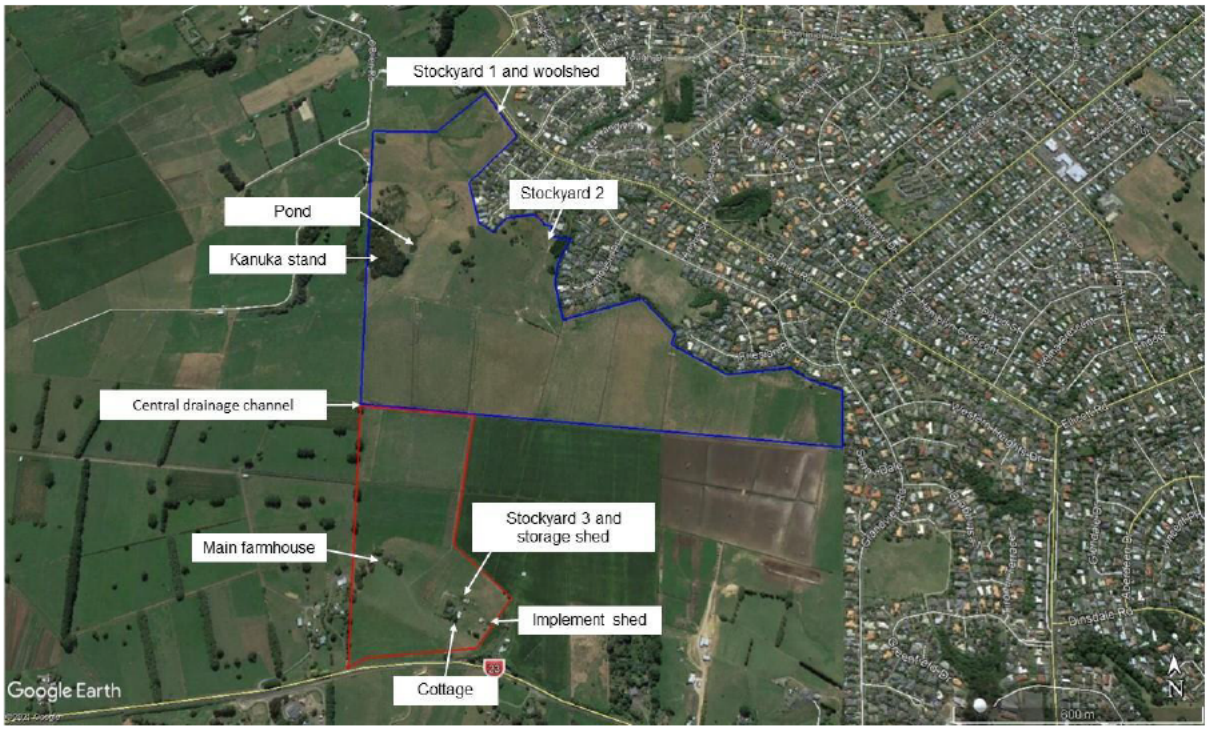

Figure 2.2: Locations of identifying features at the site.

Table 2.1: Site Identification Details for Lot 1 DPS 87291. Data sourced from Waikato District Council IntraMaps.

Item	Site Description
Location	127 Brymer Road, Rotokauri
Legal Description	LOT 1 DPS 87291
Titles	341666
Area	579,170 m^2, 57.917 ha
District Plan Zone	Rural
Territorial Authority	Waikato District Council
Regional Authority	Waikato Regional Council

Table 2.2: Site Identification Details for Lot 22 DPS 79526. Data sourced from Hamilton City Council Property Database.

Item	Site Description
Location	10 Harrogate Place, Rotokauri
Legal Description	LOT 22 DPS 79526
Titles	SA63C/424
Area	677 m^2, 0.0677 ha
District Plan Zone	Residential General
Territorial Authority	Hamilton City Council
Regional Authority	Waikato Regional Council

Table 2.3: Site Identification Details for Part Lot 2 DP 18355 and Allot 365 Pukete PSH. Data sourced from Waikato District Council IntraMaps.

Item	Site Description
Location	584 Whatawhata Road, State Highway 23, Hamilton
Legal Description	PT LOT 2 DP 18355 ALLOT 365 BLK IV ALEXANDRA SD
Titles	SA910/139 and SA6D/233
Area	185,197 m^2, 18.5197 ha
District Plan Zone	Rural
Territorial Authority	Waikato District Council
Regional Authority	Waikato Regional Council

2.1 Site Geology and Soils

The Hamilton Basin is characterised by four main landforms, low rolling hills, alluvial plains, low terraces, and gullies (Lowe 2010). The site is located in an area of low rolling hills ('Hamilton Hills') and alluvial plains. The low rolling hills are described by Lowe (2010) as ignimbrites and overlaid with tephras and alluvial clays. The plains are alluvium deposits from ancestral Waipa and Waikato Rivers derived from the volcanic catchments of central North Island, known as the Hinuera Formation (a geological formation ranging from gravel, through sand, to silt, clay, and peat) and Hinuera Surface (Lowe 2010). The depositional phase occurred between c. 22,000 and 17,000 cal. years ago (Manville and Wilson, 2004). As sediment was deposited, lakes formed in areas where drainage valleys were dammed and subsequently filled from hill drainage (Lowe 2010). From c. 17,000 cal. years ago a number of tephra layers have blanketed the Hinuera Surface and the Hamilton Basin. From c. 13,000 cal. years ago the low-lying areas developed into ombrogenous[2] peat bogs as precipitation increased (Green and Lowe, 1985). The development of peat bogs provided a peat influence (i.e., dystrophic[3]) to adjacent lakes (Lowe and Green, 1987).

The peat soils of the Hamilton Basin are the Rukuhia, Kaipaki, and Motumaoho or Te Rapa soils (Lowe 2010). The three soil types at the site are the Hamilton Clay Loam, Kaipaki, and Rukuhia soils (pers. obs.; WaikatoMaps, 2021). These soils generally matched the site topography (pers. obs). Specifically, the Hamilton Clay Loam occurred on the rolling hill areas at the northern extent of the site, with Kaipaki soils on the margins of the low-lying flat areas composed of Rukuhia soils.

2.2 Site Hydrology

There are five surface water bodies within 6 km of the site[4] (Figure 2.3):

- Horseshoe Lake / Lake Waiwhakareke (1.8 km, 18 degrees).
- Lake Rotokauri (3.24 km, 324 degrees).
- Ohote Stream (5.8 km, 300 degrees).
- Waikato River (4.55 km, 66 degrees).
- Waipa River (5.5 km, 270 degrees).

[2] Peat dependent on rain for its formation.
[3] High levels of organic material colouring water yellow-brown and generally low pH (acidic) water.
[4] Bearings and distances are approximate taken from approximate center of the site.

Horseshoe Lake / Lake Waiwhakareke and Lake Rotokauri are shallow peat lakes (i.e., <5 m) with a surface area of 3.4 hectares and 77 hectares respectively (Waikato Regional Council, 2021; Hartland Environmental, 2017). Horseshoe Lake / Lake Waiwhakareke is classed as eutrophic to hypertrophic (Duggan 2012), while Lake Rotokauri is classed as hypertrophic (Waikato Regional Council, 2021).

Horseshoe Lake / Lake Waiwhakareke has four small surface water inflows and one outflow through the Rotokauri Drain. The Rotokauri Drain feeds into Lake Rotokauri and drains to the Waipa River through the Ohote Stream. Figure 2.4 shows the catchment area of the Ohote Stream and Lake Rotokauri and Horseshoe Lake / Lake Waiwhakareke. The site is clearly within the Ohote Stream catchment and outside of the sub-catchment area of Lake Rotokauri and Horseshoe Lake / Lake Waiwhakareke.

At the site, typical of agriculture on poorly drained peat soils, there are a number of peat drainage channels (ephemeral and perennial) and a central drainage channel used to lower the water table. The perennial central drainage channel has a predicted median and mean flow of 0.050 m^3/s and 0.075 m^3/s respectively. The predicted lowest flow occurs in March with a FRE3[5] of 12.7 events per year (Whitehead and Booker, 2020). This central drainage channel runs from the site through downstream agricultural land and eventually into the Ohote Stream, which then feeds into the Waipa River. WaikatoMaps (2021) shows the drainage channel at the site and highlights a series of floodgates and stopbanks for flood mitigation further downstream. The low-lying plains $\leq$20 m elevation is marked as a flood plain management area. At the site, no flood risk or land stability was flagged on the Waikato District Council Intramaps.

The WaikatoMaps (2021) groundwater database records show no bores at the site and several surrounding bores. However, no reliable bore data from WRC was provided. A geotechnical assessment at an adjacent property (124 Bagust Road, Rotokauri) reported groundwater of 0.2 m and 0.4 m at two bore sites in winter following prolonged rainfall prior to investigation. Overall, the groundwater information is very limited at the site. The groundwater flow is expected to follow the site topography.

[5] The average number of events per year that exceed three times the median flow. Provides an estimate of flow flashiness.

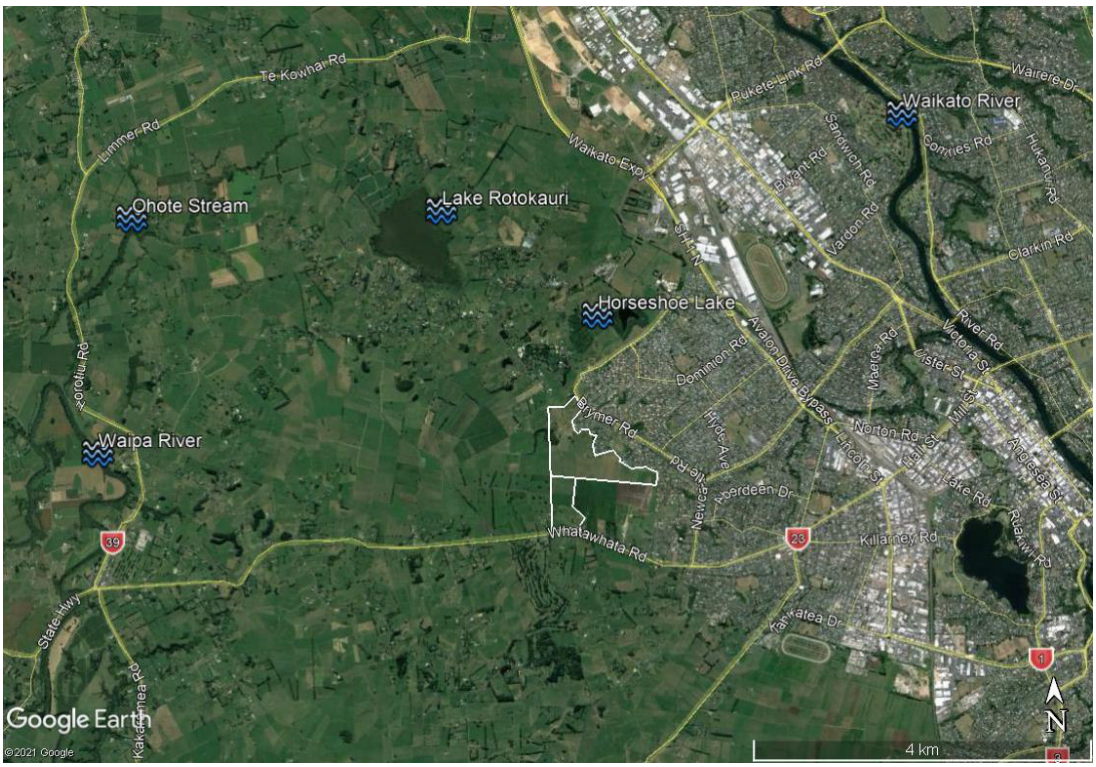

Figure 2.3: Surface water bodies within 6 km of the site (approximate boundaries outlined).

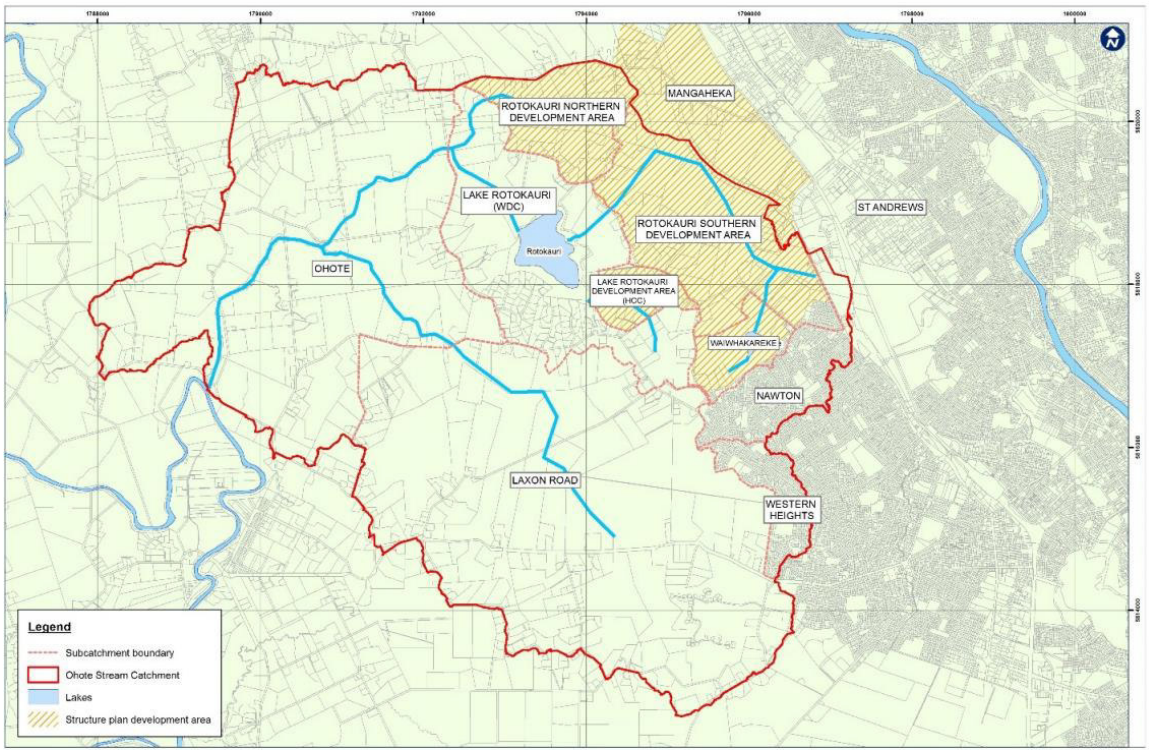

Figure 2.4: Ohote Stream catchment. Source: Hartland Environmental Ltd, 2017

2.3 Site Topography

The topography of the site is illustrated in Figure 2.5. The low-lying peat soils are generally found from the 20 – 30 m elevation above sea-level (Moturiki 1953 vertical datum). The rolling hills areas of the site are found from 30 – 55 m above sea-level.

Figure 2.5: Site topography. Source Waikato Regional Council Intramaps.

3 HISTORICAL SITE INFORMATION

3.1 Aerial Imagery Analysis

Historical aerial imagery sourced from Retrolens (1943 – 1995) and Google Earth (2004 – 2019) was reviewed (see Appendix A). A number of features and structures (e.g., unknown features, buildings, stockyards) were highlighted for further assessment as part of the site visit and formulation of the sampling plan. The year-to-year aerial imagery commentary is provided in Table 3.1. The key points, specific to the NESCS, from review of historical aerial imagery is as follows:

- Adjacent properties and land-use is residential, pastoral agriculture, arable cropping, orchard activities, sport turf (i.e., golf course).
- At the site, two historical stockyards (referred to as Stockyard 2 and Stockyard 3) are observed from 1943 imagery to present. A third stockyard is evident from 2004 imagery to present.
- An unknown structure evident from 1943 was removed between 1953 – 1971. The structure is estimated to be 16 – 25 m^2, located approximately 40 m north of the present-day main farmhouse.

Table 3.1: Historical imagery timeline.

Year	Source	Description
1943	Retrolens	Stockyard 3 is clearly evident with adjoining shed. Stockyard 2 appears to be visible, but imagery is unclear. Outside of the site, to the north a shed and stockyard is visible (on the east side of present-day Highgrove Drive). Farm cottage is clearly visible. Unknown structure of approximately 16 – 25 m^2 in Part Lot 2 DP 18355 evident. Kanuka stand visible in northwest corner. Drainage channels well established across the site.
1953	Retrolens	Stockyard 2 is clearly evident. No other changes noted.
1971	Retrolens	Orchard activities in adjacent lot evident. Implement shed appears in Part Lot 2 DP 18355. Golf course established adjacent to the site (635 Whatawhata Road). Unknown structure Part Lot 2 DP 18355 (observed in 1943 imagery) disappears and soil in the area appears disturbed.
1974	Retrolens	No other changes noted.
1979	Retrolens	Main dwelling on the property appears in 1979, close to where the unknown structure (first observed in 1943 and removed in between 1953 - 1971 imagery) was originally placed.
1991	Retrolens	There appears to have been work undertaken on the farm race in the eastern corner in Lot 1 DPS 87291. Earthworks occurring in the eastern corner of the property from the adjacent residential development activities.
1995	Retrolens	Subdivision of adjacent pasture lands. Orchard expands in size from 1979 – 1995 imagery. There appears to have been works completed on the main farm race and soil disturbance at the northern end of the main race.
2004	Google Earth	Stockyard 1 is evident in Lot 1 DPS 87291. Adjacent residential development predominately completed. The two paddocks north of the main farmhouse appear to have been tilled (along the boundary of the alluvial plains and the location of the unknown structure observed in 1943 and 1953 imagery).
2008	Google Maps	Implement shed expanded between 2004 – 2008 imagery. It is noticeable that the soil in the tractor shed paddock has been disturbed in 2008.
2009	Google Maps	No discernible changes.
2013	Google Maps	Paddock directly above the main farmhouse shows signs of tilling.
2014	Google Maps	No discernible changes.
2015	Google Maps	No discernible changes.
2016	Google Maps	No discernible changes.
2017	Google Maps	No discernible changes.
2018	Google Maps	No discernible changes.

Year	Source	Description
2019	Google Maps	No discernible changes.

3.2 Waikato Regional Council (WRC) Records

BTW requested information from WRC relating to potential contamination at the site. The site is not listed on the WRC Land-use Information Register (LUI)[6]. Two properties adjacent to the site appear on the WRC LUI, 635 Whatawhata Road (LUI03545) and 124 Bagust Road (LUI 04226).

The property at 635 Whatawhata Road is part of the Dinsdale Golf Course and is highlighted in Figure 3.1. The PSI (Preliminary Site Investigation), and addendum to the PSI, for the property was not available on WRC records. The property is classified by WRC as 'Verified HAIL – No Sampling', with the following HAIL activities:

- A.17. Storage tanks for fuel, chemicals or waste.
- A.10 Persistent pesticide bulk storage or use.

Figure 3.1: 635 Whatawhata Road (State Highway 23) property adjacent to site listed on the Waikato Regional Council (WRC) Land-use Information Register (LUI). Source WRC.

[6] WRC maintains a register of properties known to be contaminated on the basis of chemical measurements, or potentially contaminated on the basis of past land-use. This register (called the Land-use Information Register) is under development and is not considered comprehensive. The 'potentially contaminated' category is a work in progress with reference to past or present land-uses that have a greater than average chance of causing contamination. The Land-use Information Register does not include use of lead-based paint on buildings, use of asbestos in building materials, or the use of superphosphate fertiliser.

The second adjacent property listed on the WRC LUI is 124 Bagust Road, Hamilton (LUI04226). The property is classified by WRC as 'Remediated' and is listed on the WRC LUI due to land-use HAIL activity:

- A14. Pharmaceutical manufacture (associated with the storage of hazardous chemicals and equipment considered to be used in the manufacture of prohibited drugs).

No further information documentation or information was available from WRC for 124 Bagust Road.

3.3 Waikato District Council (WDC) Records

3.3.1 WDC IntraMaps

The Waikato District Council IntraMaps database was searched for supplementary information specific to the site and adjacent properties. No Hazard Policies, Significant Natural Areas or Natural Values Areas were identified at the site or adjacent properties.

3.3.2 Waikato District Council (WDC) Property File

The key documents and information from the WDC property files are summarised in Table 3.2 and illustrated in Figure 3.2 and Figure 3.3.

Table 3.2: Summary of Waikato District Council (WDC) property file information. Content in italics highlights information from adjacent properties.

Year	Lot legal description	Description of relevant information
1958	Unknown	Building permit for piggery to extend piggery constructed of concrete and corrugated iron. Unclear applicable lot for permit.
1968	*DPS 12627*	*Building permits for a golf house and implement shed for 635 Whatawhata Road property.*
1972	DP 18355	Extend existing haybarn corrugated iron walls and roofing with concrete slab.
1976	DP 18355	Building permit application for timber and concrete building (368 m^2) dwelling and veterinary surgery.
1979	DP 18355	Lockwood building plans 95.93 m^2, with note of existing house to be demolished.
1983	DP 18355	Plans to erect a dwelling 95.93 m^2 with note of existing house to be demolished.
1988	*DP 18675*	*Landfill operation and land contouring at orchard site adjacent to boundary of site.*
1997 - 1999	DPS 87291	Re-sited woolshed building consent.
2006	*DPS 12627*	*Water quality report adjacent to lot at golf course. pH range 7.3, regarded as hard, nitrate-nitrogen not found in the water, manganese found at a significant level. Escherichia coli (E. coli) and manganese above drinking water standards.*

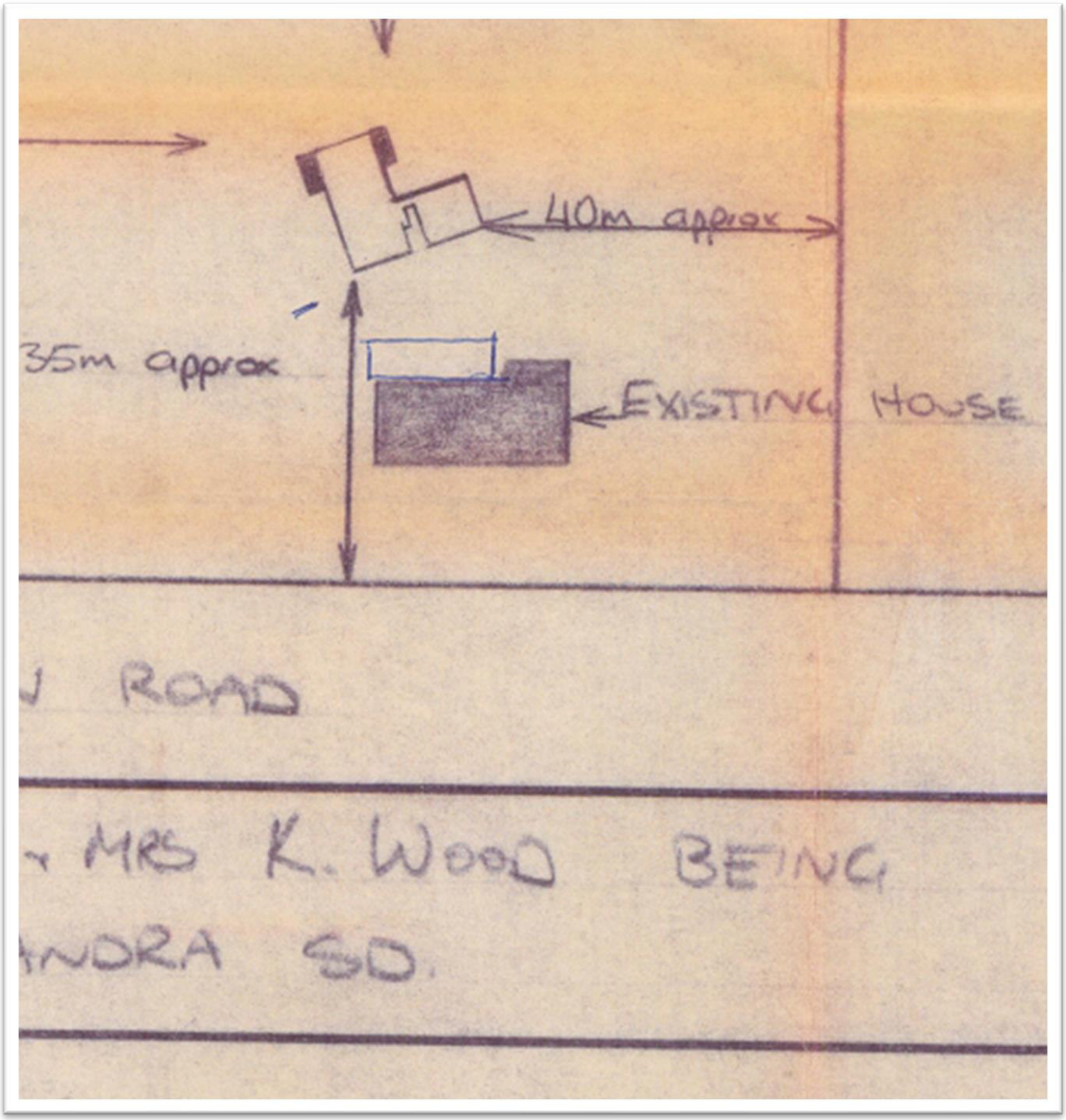

Figure 3.2: 1983 Plans for demolition of existing house and construction of new dwelling.

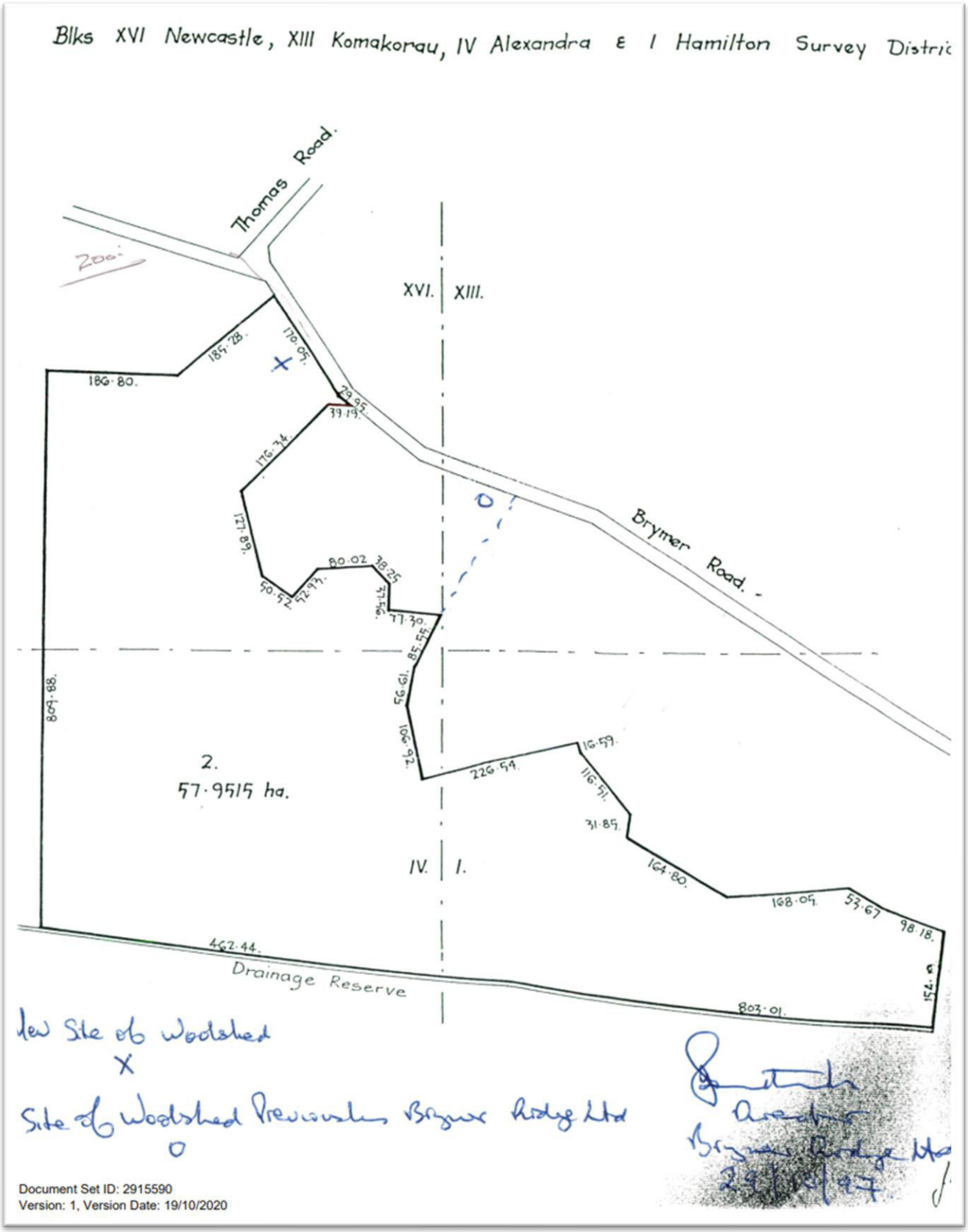

Figure 3.3: 1997 plans for relocation of woolshed.

3.3.3 HAIL report 635 Whatawhata Road, Whatawhata

The report states that the golf course was established in the late 1960s and file records identify that the site held a dangerous goods licence for a 600 litre class 3a and 1000 litre class 3c tank. The report states that HAIL activities that are or are likely to be associated with the property are:

- A.10 Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds.
- A.17. Storage tanks for fuel, chemicals or waste.

3.3.4 Geotechnical Report 124 Bagust Road, Rotokauri

No content relevant to soil contamination provided.

3.4 Hamilton City Council (HCC) Records

A request for contaminated land investigations at the site and adjacent properties was requested from HCC. In particular, information around the woolshed relocation and farming activities and surrounding residential development. No information was available.

3.5 Information from Landowner

The landowner, Gilbert Southworth, was interviewed on the phone on the 19th of May and 17th June 2021. The information provided is as follows:

- The Southworth family have owned the farm for 50 + years.
- As far as Gilbert is aware the farm has only ever been used for dry stock. Currently cows, a few horses, and sheep. Gilbert advised that for 35+ years there were "*lots of sheep on the farm*" and recently "*only have a small clearing mob of sheep*" on the farm.
- Gilbert was not aware of any sheep dipping occurring on the property. Gilbert stated that sheep dipping occurred at the location of the old woolshed. *"The woolshed was located on the city side of what is now Highgrove drive"*.
- Fertiliser and lime are applied across the site by truck.
- No fuel is, or has been, stored on the site that Gilbert is aware of. The only fuel used onsite is used for the tractor and is collected in a 20-litre container when required.
- Weed spray is applied to weeds by using a spot spray gun off the tractor.
- No knowledge of fuel or chemical spills on the site.
- There are two offal pits on the farm, "*one offal pit can be seen from the woolshed which is accessed off Brymer Road."* The second offal pit "*is located near the first big tree you drive past when accessing the farm off Whatawhata Road and head towards the stockyard."* Both offal pits are disused and have not been used for at least 20 years. The pits are "*approximately 1.2 m diameter and 5 – 6 m deep*". The pits "*were only ever used for animals, and not used for other waste material*". The approximate locations are, 37.779636° S, 175.219302° E, and 37.791704° S, 175.218287° E.
- Unsure of any buildings on the site having asbestos containing materials (ACM).
- No piggery onsite.
- Has never seen the main drainage channel dry.

- During really hot / dry summers the pond dries out completely.

3.6 Adjacent Soil Contamination Investigation Data

Soil contamination reports adjacent and in the surrounding wider area were requested from WRC, WDC, HCC, and found from online searches. The only report adjacent to the site was an addendum to a PSI completed at 635 Whatawhata Road. The wider contaminated land reports with cadmium data were used for assessing the soil cadmium variability to develop the sampling plan, this data is not presented.

3.6.1 Addendum to Preliminary Site Investigation (PSI) at 635 Whatawhata Road

The addendum to the PSI was sourced from an online search. The addendum report was dated July 2019, authored by Envirochem Evaluation Ltd. The addendum states that the PSI report recommended further sampling for arsenic based on an elevated result from PSI sampling of 26 mg/kg. Six additional samples were collected from 0 – 100 mm, the heavy metal results are presented in Table 3.3. All cadmium samples and two of six arsenic samples were above the Waikato Regional Council 95% upper background predicted concentration, hereafter referred to as $WRC_{95\%}$. In comparison to soil guidelines, all samples were below the most conservative produce scenario (NESCS residential 25% produce; NEPM[7] (2011) Residential A [10% produce]).

Table 3.3: Heavy metal screening at 635 Whatawhata Road, Whatawhata. Shading indicates result is greater than the Waikato Regional Council (WRC) upper limit (95%) background concentration ($WRC_{95\%}$).

Parameter	Lab sample number					
	2192446.1	2192446.2	2192446.3	2192446.4	2192446.5	2192446.6
Arsenic (mg/kg)	6	6	5	6	7	9
Cadmium (mg/kg)	0.23	0.3	0.48	0.36	0.23	0.24
Chromium (mg/kg)	7	7	7	8	8	7
Copper (mg/kg)	8	8	6	8	8	11
Lead (mg/kg)	13.1	16.1	15.1	19.8	17.4	13.2
Nickel (mg/kg)	3	3	2	3	3	3
Zinc (mg/kg)	38	30	27	28	32	31

[7] National Environment Protection (Assessment of Site Contamination) Measure. Australian Government.

4 SITE VISIT AND SOIL SAMPLING PLAN

4.1 BTW Site Visit

The site was visited on the 13th, 14th, 19th and 21st May 2021 and 6th July 2021. The site visit on the 13th May is referred to as the preliminary site visit, with purpose to inform sampling plan. Soil samples were collected on the 14th and 21st May and 6th July 2021. The purpose of the site visit on the 19th May was to visually evaluate the residential buildings for asbestos risk and locate the offal pits. The key observations from the site visits are as follows:

- No dipping bath or channel structures observed at the site.
- A galvanised pipe spray unit was found at Stockyard 2 (Figure 4.1).
- Shed at Stockyard 1 was constructed of wood with no suspect asbestos containing building material (ACM).
- Shed at Stockyard 3 contained suspect asbestos building material in poor condition.
- Farming sheds were not painted.
- No large tanks or storage pits observed.
- No bulk timber storage evident.
- No fuel or chemicals stored in the implement shed, no soil staining evident.
- Unable to locate the two offal pits.
- Adjacent land-uses were residential and pastoral agriculture.
- Peat soils in the lower area of the site drained. The main drainage channel flowing, higher drains limited water and flow. Water in the drainage channels clear with no odour.
- Shallow pond in the north-west of the site appears eutrophic – hypertrophic.
- Kanuka stand in the north-west corner of the site.
- Across the site there were no signs of stressed vegetation, stained soils, or odours.
- There was no evidence of the unknown structure observed in 1943 and 1953 historical imagery (removed between 1953 – 1971) from visual surface assessment and test pits completed in the area of the building footprint.
- Cottage and main farmhouse building materials appeared in good condition and did not have any immediately evident ACM. There was flaking paint at the main farmhouse on wooden building material.

Figure 4.1: Galvanised pipe spray unit located at Stockyard 2.

4.2 Hazardous Activities and Industries List (HAIL)

The preliminary site visit and desktop analysis highlighted several potential HAIL activities, either at the site, or adjacent. Namely, stockyards with potential for livestock dip or spray race operations (A.8), pesticide use (A.10), orchard and sport turf (i.e., golf course) activities at adjacent lots (A.10), buildings potentially containing asbestos products in a poor condition (E.1), the use of lead-based (I), waste (offal pits and septic tank system) disposal to land (G.5), and accumulation of cadmium in soil from fertiliser application (I).

There was no evidence of bulk fuel storage tanks or chemical storage (A.17) or bulk fertiliser storage pits (A.6) at the site. Therefore, based on the desktop information, preliminary site visit, and general pastoral agriculture land-use, the contaminants of concern at the site are organochlorines, arsenic, lead, copper, cadmium, zinc, and asbestos.

The adjacent lots with identified HAIL activities from fuel tank and chemical storage and pharmaceutical manufacture (A.10, A.14, A.17) were not examined further as information suggested that the source was not significant and had been remediated as per available desktop information.

The preliminary site visit and desktop analysis information was used to construct a preliminary conceptual site model (CSM) and sampling plan. The CSM is presented (in a revised format following analysis of quantitative soil data) in Section 6.2.

4.3 Sampling Plan

The sampling plan was developed following a preliminary site visit on the 13th of May 2021 and review of historical imagery, council property files, and general farming related activities that could cause soil contamination. In general, farming operations could have a number of potential sources of soil contamination. For example, fuel and chemical storage could result in hydrocarbon, pesticide, and heavy metal contamination. The storage and application of superphosphates or pesticides could result in the accumulation of cadmium and organochlorines in the soil. Historical building materials could result in lead (from lead-based paints) and asbestos soil contamination. Sheep dipping activities can result in contamination from environmentally persistent and toxic organochlorines and arsenic. While offal pits and wastewater disposal can increase microbial populations and accumulation of heavy metals and nitrogen.

In addition to the sampling plans presented below, one sediment sample (HO_drain_1) was collected in the main central drainage channel to provide a snapshot of the combined upstream inputs.

4.3.1 Cadmium and pH

Cadmium is a potential site wide contaminant of concern based on the application of superphosphate fertiliser. Cadmium generally accumulates in the topsoil (Gray et. al. 2003), therefore sampling depth is important to consider with comparisons to soil contaminant standards (SCSs) / soil guideline values (SGVs). The 0 – 150 mm depth covers the significant root zone and therefore best represents the home produce exposure pathway, the key determinant in cadmium exposure to future site residents.

Cadmium data from surrounding contaminated land reports was amalgamated to determine the standard deviation of cadmium concentrations from similar land-uses in the area. The statistical package ProUCL Version 5.1 (ProUCL 5.1) was then used to determine a minimum sample size of 13 (Single-Sample t-Test [$\alpha = 0.05$, $\beta = 0.05$, sd = 0.504, $\Delta = 0.5$]). A systematic sample plan was developed with a total of 16 samples for cadmium collected across the site, from one depth of 0 –

150 mm below ground level (bgl). The soil pH influences cadmium bioavailability and was therefore measured at all cadmium sampling locations. However, as pH of soils can be modified by farming activities, such as fertiliser application and liming, a total of six additional pH samples were collected to derive a 'natural' pH for the site. The purpose of the 'natural' pH samples is to provide data to apply an appropriate pH adjusted soil guideline value (SGV) if required.

4.3.2 Stockyard organochlorines and heavy metals

Three stockyards (referred to as Stockyard 1, Stockyard 2, and Stockyard 3) were evident from aerial imagery and preliminary site visit. The timeline of these stockyards was examined from a review of available historical imagery. Stockyard 2 and Stockyard 3 were observed in imagery that correlates with the use of arsenic and organochlorines in livestock dipping activities. While Stockyard 1 was present from 2004 imagery onwards (relocated between 1994 – 2004), which is outside the timeline for arsenic and organochlorine based chemicals used in livestock dipping.

Based on this information Stockyard 2 and Stockyard 3 were sampled for arsenic and organochlorines. A systematic sample plan[8] was developed across the area of the stockyard where dipping and spraying could have occurred. At both sites a total of 12 – 13 samples from 0 – 100 mm bgl (surface) and four – six samples from 250 – 300 mm bgl (sub-surface) were collected for arsenic and organochlorines[9]. The number of surface samples were determined using equations from MfE (2011b) to detect a 6 m diameter hotspot with 95 % confidence. At one of the sampling locations with both a surface and sub-surface sample, heavy metal screening analysis was completed. Furthermore, judgemental samples were collected down gradient from the stockyards in the 0 – 100 mm bgl sediment to provide 'worst-case' scenario if chemicals were discharged or migrating downstream (from stockyard sites and location of historical sheep dip location). Additionally, samples outside of the stockyards were collected to provide a site-specific background concentration (n=6). There were a few instances where farming operations, animals, or subsurface concrete prevented sampling at pre-planned locations and at depth, which required adjustments to sampling locations while in the field.

At Stockyard 1, limited judgemental sampling was completed. Two locations at two depths within the stockyard and one surface sample collected down gradient at the location of anticipated runoff from the stockyard was completed.

4.3.3 Adjacent orchard and arable cropping activities

The historical imagery highlighted that orchard and arable cropping activities have occurred adjacent to the property. These activities present a potential contaminant source for the site from spray drift and / or downstream migration. Therefore, soil heavy metals (e.g., lead, arsenic, copper) and organochlorines requires quantification. Soil samples for these potential contaminants were collected at the location of the systematically distributed cadmium samples located adjacent to the boundary of the site. In total, five samples were collected along the boundary for heavy metal and organochlorine analysis.

4.3.4 Asbestos building materials and lead-based paints

The buildings on the site were visually inspected during site visits and one shed at Stockyard 3 was identified as suspect of asbestos containing material (ACM) in a poor condition. One sample was

[8] MfE (2006) describes the outcomes of a study that compared four different sampling strategies (judgemental, systematic grid, sniffer dog and portable XRF sampling) in order to assess the most appropriate sampling regime for historical sheep-dip sites. It was found that the systematic sampling approach provides current best practice for assessing contamination at old sheep-dip sites.

[9] Organophosphates were not tested as they are less persistent in the environment compared to organochlorines (Jayaraj, et. al. 2016) and are not a priority contaminant under the NESCS.

collected from this shed for asbestos analysis on the 14th of May 2021. The sample confirmed that this implement shed (at Stockyard 3) was composed of asbestos containing building material. A sample plan was then developed to analyse and delineate, if present, asbestos in the soil surrounding the shed. Seven samples were taken at a depth of 0 – 150 mm bgl within approximately 0.4 m from the shed.

Additional delineation samples were collected at a depth of 250 – 300 mm (n=5) within 0.4 m of the shed, and at a distance of approximately 1 – 1.5 m from the shed (n=7). The delineation samples were all “hold cold” at the lab.

The historical imagery highlighted an unknown (presumably shed) structure in 1943, which was removed between 1953 – 1971. Visual surface assessment test pits completed in the area of the building footprint provided no evidence of soil disturbance, building materials, or building foundations. Soil samples for analysis of lead (n=4) and asbestos in soil (n=4) were collected from 0 – 150 mm bgl in judgementally selected locations.

5 SOIL SAMPLING RESULTS

The locations of the stockyards, cadmium specific and heavy metal (including cadmium) and organochlorine screening sampling locations is presented in Figure 5.1. The soil sampling data and statistical analysis is presented in the following sections. Statistical outputs were calculated using the statistical package ProUCL 5.1. A 95% Upper Confidence Limit (95% UCL)[10] is calculated for sample sizes $\geq$ 10. Data distribution (i.e., normal, gamma, log-normal) is examined using Goodness-of-Fit (GOF) tests (i.e., Quantile-Quantile plots and output from Shapiro Wilk and Kolmogorov-Smirnov Gamma GOF tests). The laboratory analytical data is presented in Appendix B and supplementary statistical plots presented in Appendix C.

Figure 5.1: Aerial image of site with location of stockyards, cadmium specific, 'natural' pH, drain, and heavy metal and organochlorine screening sampling locations.

The results in the following sections are compared to the WRC and the Landcare Research (LCR) 95% upper background predicted concentration, hereafter referred to as $WRC_{95\%}$ and $LCR_{95\%}$. The $WRC_{95\%}$ represents an upper limit for concentrations of natural soils away from human (i.e., anthropogenic) influence for Waikato soils (n=38). In comparison, $LCR_{95\%}$ represents a predicted concentration modelled from local geology (Cavanagh, et al. 2015). LCR lists two geological units at the site, Mudstone Pakihi and Ignimbrite, and therefore presents predicted background concentrations for these two geological units. The $WRC_{95\%}$ and $LCR_{95\%}$ upper limit predicted background concentrations are presented in Table 5.1.

[10] The 95% upper confidence limit (UCL) is a statistical measure of the mean concentration at the site that is unlikely to be exceeded at a 5% confidence level. The 95% UCL does not represent the 'worst-case scenario' for a site. When comparing results to a soil guideline value (SGV), the result is acceptable if the 95% UCL is at or below the guideline, provided no result is more than twice the guideline value.

Table 5.1: Upper limit (95%) background concentrations for selected heavy metals (total recoverable) in Waikato soils and site-specific geology. Sourced from Waikato Regional Council (WRC) and Landcare Research (LCR).

Parameter	$WRC_{95\%}$	$LCR_{95\%}$ (alluvial plains)	$LCR_{95\%}$ (low rolling hills)
Arsenic (mg/kg)	6.8 (n=38)	9.97 (n=87)	16.38 (n=91)
Cadmium (mg/kg)	0.22 (n=38)	0.33 (n=11)	0.49 (n=31)
Chromium (mg/kg)	30 (n=38)	56.88 (n=106)	67.35 (n=100)
Copper (mg/kg)	25 (n=38)	48.14 (n=37)	42.16 (n=51)
Lead (mg/kg)	20 (n=38)	25.83 (n=106)	24.79 (n=99)
Nickel (mg/kg)	7.6 (n=38)	35.15 (n=100)	33.75 (n=100)
Zinc (mg/kg)	53 (n=38)	97.97 (n=11)	129.7 (n=32)

5.1 Cadmium and pH

A total of 16 samples were analysed for cadmium (composed of 10 samples collected specifically for cadmium and six samples collected for heavy metals and organochlorine screening). The concentration of cadmium ranged from 0.2 – 0.71 mg/kg, with a mean of 0.36 mg/kg (n=16) (Table 5.2). Soil pH at cadmium sampling locations ranged from 5.3 – 6.3 with a mean of 5.61 (n=10) (Table 5.3). The 'natural' soil pH samples ranged from 4.1 – 6.5, with a mean of 5.3 (n=6) (Table 5.4).

In comparison to $WRC_{95\%}$ and $LCR_{95\%}$ background cadmium concentrations cadmium appears elevated at the site. The SGVs (at default pH of 5) for cadmium at the high-density residential, residential 10%, and residential 25%, exposure scenarios are 230 mg/kg, 3 mg/kg and 0.8 mg/kg respectively. No samples exceeded any of the aforementioned residential guideline values. The calculated 95% UCL for cadmium across the site is 0.42 mg/kg (Table 5.2), 48% lower than the most stringent NESCS criteria (25% produce exposure).

Sample naming logic is Cd#$_1$_depth, where #$_1$ indicates sample number, and depth is the sample depth (mm).

Table 5.2: Soil cadmium sampling and statistical data summary.

Statistical Parameter	Value
Number of samples (n)	16
Sample depth	0 – 150 mm
Mean	0.355 mg/kg
Median	0.305 mg/kg
Minimum	0.20 mg/kg
Maximum	0.71 mg/kg
Standard deviation	0.139 mg/kg
Coefficient of variation	0.391
Data distribution	Normal
95% Student's-t UCL	0.416 mg/kg
One Sample t-Test	Conclude mean <0.8 (α = 0.05, p = 0.0000)

Table 5.3: Soil pH for collected cadmium samples and statistical data summary.

Statistical Parameter	Value
Number of samples (n)	10
Sample depth	0 – 150 mm
Mean	5.61
Median	5.45
Minimum	5.3
Maximum	6.3
Standard deviation	0.36
Coefficient of variation	0.0642

Table 5.4: Natural soil pH samples and statistical data summary.

Statistical Parameter	Value
Number of samples (n)	5
Sample depth	0 – 150 mm
Mean	5.3
Median	5.4
Minimum	4.1
Maximum	6.5
Standard deviation	0.99
Coefficient of variation	0.186

5.2 Organochlorines and heavy metals

5.2.1 Stockyard sites

The concentration of arsenic collected across the three stockyard sites ranged from 3 – 300 mg/kg. Figure 5.3 highlights the range of concentrations at the three sites and between surface (0 – 100 mm) and sub-surface (250 – 300 mm) samples (all data). While, Figure 5.3 presents the concentrations of arsenic for paired surface and sub-surface samples only. Therefore, concentration of arsenic appears to be higher in surface soils at all sites sampled (no statistical comparison completed). A number of arsenic samples were higher than the $WRC_{95\%}$, $LCR_{95\%}$, and NESCS SGVs. Soil arsenic concentrations are presented for each stockyard in Section 5.2.2, Section 5.2.3, Section 5.2.4. The organochlorine screening analysis results at all stockyard sites reported concentrations below analytical detection limits (Appendix B) and are therefore not presented further.

Heavy metal screening at the three stockyards found samples of cadmium, copper, lead, and zinc higher than the $WRC_{95\%}$ and $LCR_{95\%}$ (Table 5.5). All heavy metal concentrations were below the most conservative (stringent) NESCS residential 25% produce and NEPM (2011) Residential A (10% produce) standards.

Sample naming logic is S#$_1$_#$_2$_depth, where #$_1$ indicates stockyard number, #$_2$ indicates sample number, and depth is the sample depth (mm).

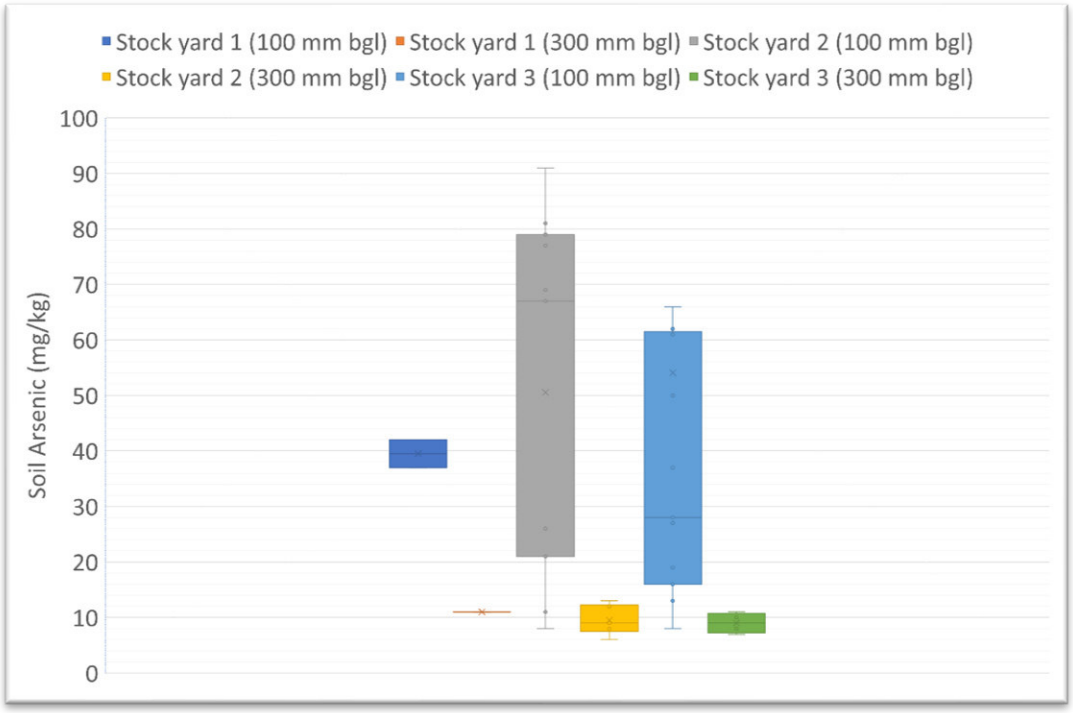

Figure 5.2: Box plots of all soil arsenic concentrations (mg/kg) at the three stockyard sites in soil surface (0 – 100mm) and sub-surface (250 – 300 mm) samples. At stockyard three an outlier of 300 mg/kg has been removed for graphical clarity.

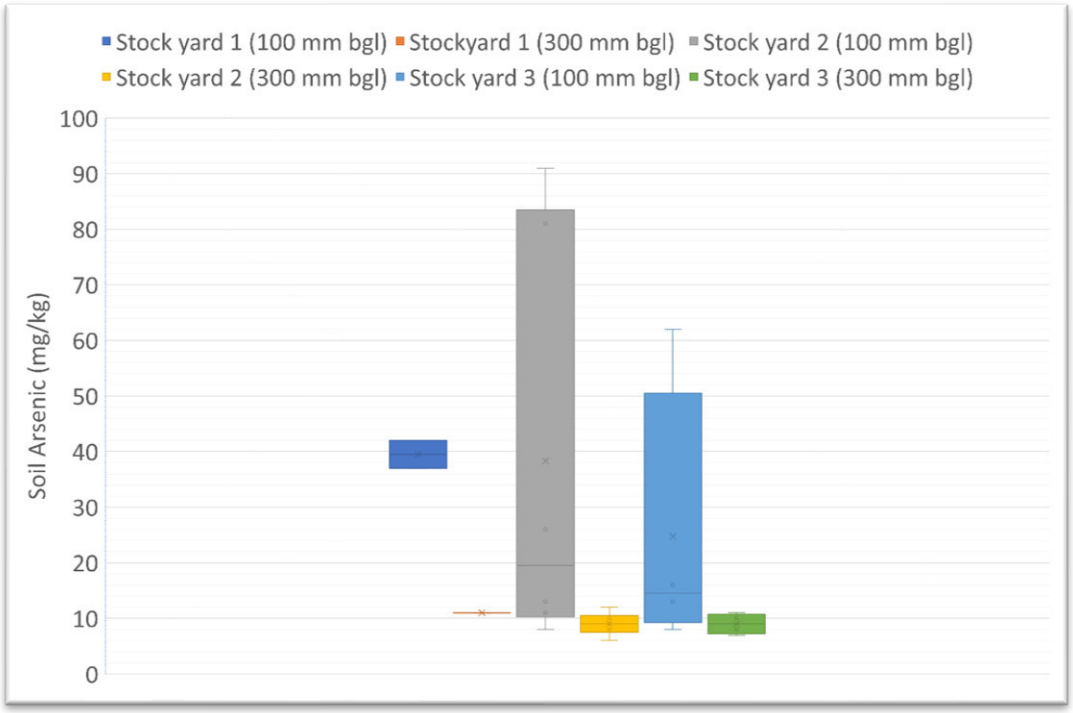

Figure 5.3: Box plots of paired surface and sub-surface soil arsenic concentrations (mg/kg) at the three stockyard sites. At stockyard three an outlier of 300 mg/kg has been removed for graphical clarity.

Table 5.5: Heavy metal soil samples at surface (0 – 150 mm) and sub-surface (250 – 300 mm) at the three stockyards and downstream locations. Shading indicates result is greater than the Waikato Regional Council (WRC) upper limit (95%) background concentration ($WRC_{95\%}$). Italicised values indicate result is greater than the highest Landcare Research predicted 95% concentration ($LCR_{95\%}$) for the site.

Sample Name:	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)
S2-1-100	0.49	26	*54*	*28*	5	*193*
S2-1-300	0.19	11	20	18.3	4	90
S2-13-100[11]	0.24	7	13	*27*	3	93
S2-14-100[11]	0.14	7	10	*23*	2	51
S2-15-100[11]	0.28	7	14	*39*	4	86
S2-16-100[11]	0.21	6	10	*29*	2	43
S1-1-100	0.24	22	35	*60*	5	*200*
S1-1-300	0.11	14	16	*30*	5	44
S1-2-100	0.12	22	28	*53*	4	84
S1-2-300	< 0.10	12	13	*26*	5	43
S1-3-100[11]	< 0.10	4	5	15.7	< 2	25
S3-B-100	0.21	15	*27*	*26*	6	*133*
S3-B-300	< 0.10	13	14	22	6	57

5.2.2 Soil Arsenic at Stockyard 1

A total of four samples were collected at Stockyard 1 (two sites, at two depths), and one sample downstream, see Figure 5.4 and Figure 5.8 (note depth samples are offset in figures for graphical clarity). All samples at the stockyard were higher than $WRC_{95\%}$ and only the surface samples were higher than the $LCR_{95\%}$ (Table 5.6). The downstream sample was lower than $WRC_{95\%}$. The surface samples at the stockyard exceed the residential 25% produce SCS, and were below the high density residential SCS. The sub-surface samples and downstream sample were all below the residential 25% produce SCS.

[11] Downstream sampling locations.

Figure 5.4: Soil sampling locations at Stockyard 1 and downstream. Surface and sub-surface samples are offset for visual display clarity.

Table 5.6: Soil arsenic concentrations at surface (0 – 150 mm) and sub-surface (250 – 300 mm) at Stockyard 1 and downstream sampling locations. Shading indicates result is greater than the Waikato Regional Council (WRC) upper limit (95%) background concentration ($WRC_{95\%}$). Italicised values indicate result is greater than the highest Landcare Research predicted 95% concentration ($LCR_{95\%}$) for the site.

Sample Name:	Arsenic (mg/kg)
S1-1-100	*37*
S1-1-300	11
S1-2-100	*42*
S1-2-300	11
S1-3-100	3

Figure 5.5: Soil arsenic concentration at Stockyard 1 and downstream site. Data for both surface and sub-surface samples are presented and offset for visual display clarity. Numerical values adjacent to sampling locations represents arsenic concentration in mg/kg.

5.2.3 Soil Arsenic at Stockyard 2

At Stockyard 2, the concentration of arsenic in surface (0 – 100 mm) soil samples ranged from 8 – 91 mg/kg with a mean of 47.9 mg/kg (n=12). The 95% UCL for surface soils was calculated at 64.4 mg/kg (Table 5.7), which exceeds the high-density residential but is lower than the commercial worker SCS. At 250 – 300 mm bgl arsenic concentration ranged from of 6 – 13 mg/kg, with a mean of 9.5 mg/kg (n=6) (Table 5.8). All sub-surface (250 – 300 mm) samples were below the $LCR_{95\%}$ and the SCS for residential 25% produce land-use.

Downstream and background (i.e., away from stockyard) locations and arsenic concentrations are presented in Figure 5.7. The background concentrations ranged from 5 – 7 mg/kg (n=6) and the downstream samples ranged from 5 – 14 mg/kg (n=4), all below the most conservative (i.e., 25% produce) residential SCS.

Table 5.7: Soil arsenic surface (0 – 100 mm) sampling and statistical data summary from Stockyard 2.

Statistical Parameter	Value
Number of samples (n)	12
Sample depth	0 – 150 mm
Mean	47.92 mg/kg
Median	46.5 mg/kg
Minimum	8 mg/kg
Maximum	91 mg/kg
Standard deviation	31.69 mg/kg

Statistical Parameter	Value
Coefficient of variation	0.661
Data distribution	Nonparametric[12]
95% BCA Bootstrap UCL	62.75 mg/kg
95% Student's-t UCL	64.35 mg/kg
95% Modified-t UCL	64.36 mg/kg

Table 5.8: Soil arsenic sub-surface (250 – 300 mm) sampling and statistical data summary from Stockyard 2.

Statistical Parameter	Value
Number of samples (n)	6
Sample depth	250 – 300 mm
Mean	9.5 mg/kg
Median	9 mg/kg
Minimum	6 mg/kg
Maximum	13 mg/kg
Standard deviation	2.588 mg/kg
Coefficient of variation	0.272

[12] For mildly skewed nonparametric data sets of n <30 most of the parametric and nonparametric methods such as bootstrap BCA, Student's t-statistic or modified-t- statistic (excluding Chebyshev inequality which is meant for skewed data sets) yield comparable 95% UCL values.

Figure 5.6: Soil arsenic concentration at Stockyard 2. Data for both surface and sub-surface samples are presented and offset for visual display clarity. Numerical values adjacent to sampling locations represents arsenic concentration in mg/kg.

Figure 5.7: Background and downstream surface (0 – 100 mm) soil arsenic concentrations at Stockyard 2 site. Numerical values adjacent to sampling locations represents arsenic concentration in mg/kg.

5.2.4 Soil Arsenic at Stockyard 3

At Stockyard 3, the concentration of arsenic in surface (0 – 100 mm) soil samples ranged from 8 – 300 mg/kg with a mean of 54 mg/kg (n=13) (Table 5.9). At 250 – 300 mm bgl arsenic concentration ranged from of 7 – 11 mg/kg, with a mean of 9 mg/kg (n=4) (Table 5.10). All samples (both surface and sub-surface) were higher than $WRC_{95\%}$, and 53% were greater than the highest $LCR_{95\%}$ for the site.

The 95% UCL for surface soils was calculated at 101 mg/kg (Table 5.9), which exceeds the all residential SCS in addition to commercial worker SCS. However, as one sample is identified as an outlier at 300 mg/kg and is more than twice applicable guideline values (e.g., high-density and commercial worker) the 95% UCL from the full dataset is not a valid application for a 95% UCL. A further delineation sample, see Figure 5.8, suggests that the 300 mg/kg hotspot is isolated to the area between adjacent sampling points. Therefore, the outlier (hotspot) was removed and statistical summary and 95%UCL recalculated (Table 5.11). The soil arsenic dataset with outlier removed ranged from 8 – 66 mg/kg with a mean and 95% UCL of 34 mg/kg and 45 mg/kg respectively (n=12). The 95% UCL (with outlier removed) exceeds SCS for a 10% and 25% produce residential scenario and is at the high-density residential SCS.

The background (i.e., away from stockyard) locations and arsenic concentrations are presented in Figure 5.8 and Figure 5.9. The background concentrations ranged from 4 – 12 mg/kg, with a mean of 6.2 mg/kg (n=6), all below the most conservative (i.e., 25% produce) residential SCS.

Figure 5.8: Soil arsenic concentrations at Stockyard 3 and downstream / background concentrations. Data for both surface and depth samples are presented and offset for visual display clarity. Numerical values adjacent to sampling locations represents arsenic concentration in mg/kg.

Figure 5.9: Soil arsenic concentration at Stockyard 3. Data for both surface and sub-surface samples are presented and offset for visual display clarity. Numerical values adjacent to sampling locations represents arsenic concentration in mg/kg.

Table 5.9: Soil arsenic surface (0 – 100 mm) sampling and statistical data summary from Stockyard 3.

Statistical Parameter	Value
Number of samples (n)	13
Sample depth	0 – 150 mm
Mean	54.08 mg/kg
Median	28 mg/kg
Minimum	8 mg/kg
Maximum	300 mg/kg
Standard deviation	76.59 mg/kg
Coefficient of variation	1.416
Data distribution	Gamma
95% Adjusted Gamma UCL	101.4 mg/kg

Table 5.10: Soil arsenic sub-surface (250 – 300 mm) sampling and statistical data summary from Stockyard 3.

Statistical Parameter	Value
Number of samples (n)	4
Sample depth	250 – 300 mm
Mean	9 mg/kg

Statistical Parameter	Value
Median	9 mg/kg
Minimum	7 mg/kg
Maximum	11 mg/kg
Standard deviation	1.826 mg/kg
Coefficient of variation	0.203

Table 5.11: Soil arsenic surface (0 – 100 mm) sampling and statistical data summary from Stockyard 3, with outlier removed.

Statistical Parameter	Value
Number of samples (n)	12
Sample depth	0 – 150 mm
Mean	33.58 mg/kg
Median	27.5 mg/kg
Minimum	8 mg/kg
Maximum	66 mg/kg
Standard deviation	21.05 mg/kg
Coefficient of variation	0.627
Data distribution	Normal
95% Student's-t UCL	44.5 mg/kg

5.2.5 Stockyard arsenic correlations with copper and chromium

Samples screened for heavy metals from the three stockyards were amalgamated to examine the relationship of arsenic with copper and chromium. Simple linear regression was completed in ProUCL 5.1. Test assumptions were validated by visual examination of plots of residuals versus fitted and quantile-quantile plot of residuals.

Arsenic was found to significantly correlate with concentration of chromium (n=13, $\alpha = 0.05$, $R^2 = 0.807$, p=0.0000) and copper (n=13, $\alpha = 0.05$, $R^2 = 0.899$, p=0.0000). Therefore, 80.7% and 89.9% of the observed variability in arsenic concentrations is explained by chromium and copper concentrations respectively. Statistical plots are presented in Appendix C.

5.2.6 Drain and adjacent to property boundary sampling locations

Heavy metal and organochlorine pesticide screening was completed along the property boundary based on the adjacent arable farming and orchard land-use (Figure 5.10). The organochlorine screening concentrations were below analytical detection limits and are not presented further. The heavy metal data is presented in Table 5.12.

Several samples reported concentrations higher than upper predicted background concentrations. All samples, excluding HO_6_150, were below the most conservative produce scenarios (NESCS residential 25% produce; NEPM [2011] Residential A [10% produce] standards). Sample HO_6_150 (sediment sample collected within a small ephemeral drainage channel) reported arsenic exceeding residential 25% and 10% SCS and was below the high-density residential SCS.

Sample naming logic is HO_#$_1$_depth, where #$_1$ indicates sample number, and depth is the sample depth (mm).

Table 5.12: Heavy metal screening surface (0 – 150 mm) sample concentrations. Shading indicates result is greater than the Waikato Regional Council (WRC) upper limit (95%) background concentration ($WRC_{95\%}$). Italicised values indicate result greater than highest Landcare Research predicted 95% concentration ($LCR_{95\%}$) for the site.

Sample Name:	Arsenic (mg/kg)	Cadmium (mg/kg) [13]	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)
HO_1_150	6	0.2	7	20	22	< 4	57
HO_2_150	< 4	0.4	5	24	9.3	< 4	10
HO_3_150	< 2	0.3	4	34	5.7	2	25
HO_4_150	< 5	0.3	< 5	17	6.4	< 5	14
HO_5_150	7	0.35	6	26	11.6	3	55
HO_6_150	22	*0.71*	8	25	20	5	*182*
HO_DRAIN_1	6	0.16	5	9	11.5	2	77

Figure 5.10: Locations of heavy metal and organochlorine sampling.

5.3 Asbestos building materials and lead-based paints

One sample (S3_1_A) was collected from suspected asbestos containing building material (i.e., fibre cement) in poor condition from the implement shed at Stockyard 3 (Figure 5.11). The sample was confirmed to contain chrysotile (white asbestos).

[13] Note: cadmium data presented in Table 5.12 were included in the site wide cadmium data presented in Section 5.1.

Figure 5.11: Shed with fibre cement cladding.

On the 6th of July 19 soil samples were collected surrounding the shed located at Stockyard 3. Seven of these samples were taken at a depth of 0 – 150 mm and were within approximately 0.4 m of the shed. Of the seven samples, one sample (SH1_AS_5_150) detected chrysotile (white asbestos) as asbestos fines. The SGV for fibrous asbestos (FA) and / or asbestos fines (AF) is 0.001 % w/w. The asbestos concentration from the one detect was below the 0.001 % w/w guideline. Asbestos was not detected in any of the remaining samples (see Appendix B for full analytical results). A total of 12 additional samples delivered to the laboratory were "hold cold" for depth and lateral delineation analysis if required. The depth delineation samples were not analysed as the source of asbestos was from the above ground fibre cement cladding, there was no visual evidence of soil vertical mixing (so more likely than not to be only in the surface soils), and there was only one sample detect which was well below the guideline value. Similarly, the lateral delineation samples were not analysed based on the one detect and concentration from the seven samples within 0.4 m from the shed.

5.4 Field and Laboratory Quality Assurance and Quality Control

Soil samples were collected in clean laboratory supplied (Hill Laboratories; IANZ accredited laboratory) containers. Soil sampling equipment was decontaminated prior to work and between each sample. Samples were individually labelled and stored and transported in a chilled polystyrene bin. Samples collected on the 14th May were unable to be immediately transported to the laboratory and were stored in BTW cool storage prior to delivery to Hill Laboratories for analysis on the 17th of May. Samples collected on the 21st of May and 6th of July were transported directly to Hill Laboratories. Chain of Custody forms are available in Appendix D.

One duplicate sample[14], HO_8_150, was collected at the location of HO_2_150. The relative percentage differences (RPD)[15] between the primary and duplicate sample for the suite of heavy metals is outlined in Table 5.13.

Table 5.13: Heavy metal duplicate sample data.

Parameter	Sample	Duplicate	RPD %
Arsenic (mg/kg)	4	2	66.67
Cadmium (mg/kg)	0.4	0.45	11.76
Chromium (mg/kg)	5	6	18.18
Copper (mg/kg)	24	28	15.38
Lead (mg/kg)	9.3	18.1	64.23
Nickel (mg/kg)	4	4	0.00
Zinc (mg/kg)	10	15	40.00

[14] Duplicate samples (also known as blind replicate) collection of two separate samples from a single sample location. The blind replicate provides information on the overall variability (or precision) of both the sampling technique and the analytical laboratory. As a minimum, one blind replicate should be collected up to the first 10 samples, and an additional replicate taken for every 10 samples thereafter, although this will be dependent on the specific Data Quality Objectives (DQOs).

[15] RPD provides a quantitative measure of the overall variability or precision of the soil results. It is typically considered acceptable if an RPD range of less than 50% is achieved for soil samples.

6 SITE CHARACTERISATION AND EVALUATION

To evaluate the magnitude of the risk pursuant to the NESCS (i.e., determine that it is highly unlikely that there will be a risk to human health if the activity is done to the piece of land) the investigation must complete a site risk assessment. Central to the requirements of the risk assessment is the development of a conceptual site model (CSM, as referred to in Section 4.2). A CSM is an evaluation of the probability of contaminate sources in an environmental system and identification and characterisation of the pathways (e.g., biological, physical, chemical vectors) to human health and environmental receptors (see Figure 6.1 and MfE 2012 for further details). Ultimately the goal is to evaluate the source-pathway-receptor linkage. Instances where the linkage is complete presents a risk to human health that requires robust assessment and / or management.

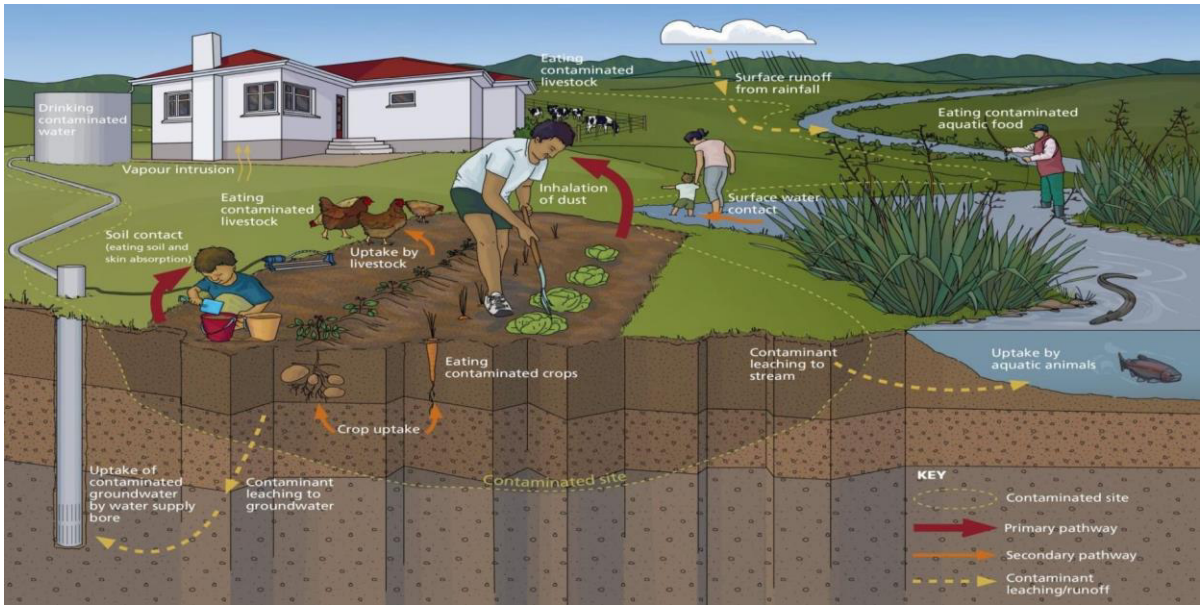

Figure 6.1: Conceptual model of contaminate sources and pathway vectors for human health risk. Source: MfE (2012).

6.1 Land-use and Exposure Scenarios for Proposed Development

To evaluate the risk of soil contaminants to human health the MfE has developed SCSs and SGVs for a number of exposure scenarios for land-use ranging from rural residential to commercial worker (MfE 2011; MfE 2012). The SCSs and SGVs provide guidance around the concentration of a contaminant above which further health investigation and evaluation will be required.

For residential properties, the proportion of home-grown produce is an important determinate in the development of the exposure scenario and risk evaluation. However, it is important to acknowledge that the data in New Zealand is limited on the proportions of residents that grow their own produce and the quantities (i.e., percentages) of home-grown produce achieved. Moreover, there is no clear lot size or geographic data to delineate the appropriate land-use scenario. MfE (2011) states, *'In the absence of more definitive data, it is considered appropriate to continue to use a fraction of 10 per cent produce for home-grown produce for the urban residential scenario but reduce the home-grown produce percentage for rural residential from 50 to 25 per cent.'* However, the MfE guidelines lack definitions around the lot sizes of urban, standard and rural residential properties.

The site does not have a developed plan for lot sizes. Therefore, the site evaluation considers the range of exposure scenarios outlined by MfE (2011, 2012) to inform future site development plan.

6.2 Conceptual Site Model (CSM)

Table 6.1: Conceptual site model (CSM) of key potential contaminant sources at the site.

Potential Sources	Contaminants of Concern	Potential Exposure Pathways	Receptors	Complete Linkage Commentary
Fertiliser bulk storage and site wide application.	Cadmium.	Produce consumption, groundwater and surface water runoff.	Future site residents, aquatic biota.	Across the site concentrations below human health SGVs. Potential for bulk storage at Stockyard 3. Unlikely risk to aquatic biota as cadmium in central drain sediment below DGV[16] and Eco-SGVs[17].
Livestock dip or spray race operations (and treated timber).	Arsenic and organochlorines.	Ingestion, inhalation, groundwater and surface water runoff.	Future site residents, construction and maintenance workers, groundwater and surface water, aquatic biota.	Complete linkage as arsenic exceeded human health SGVs. Unlikely risk to aquatic biota as arsenic in central drain sediment is below DGV and Eco-SGVs.
Zinc for facial eczema treatment.	Zinc.	Ingestion, groundwater and surface water runoff.	Future site residents, aquatic biota.	Not present at levels above human health SGVs so unlikely risk to human health. Unlikely risk to aquatic biota as zinc in central drain sediment is below DGV and Eco-SGVs.
Orchard adjacent to property.	Organochlorine pesticides and heavy metals.	Windblown sprays migrating to site. Dermal, ingestion, inhalation, produce consumption, migration to groundwater and surface waters.	Future site residents, construction and maintenance workers, groundwater and surface water.	No complete linkage as concentrations below human health SGVs. Unlikely risk to aquatic biota as heavy metals in central drain sediment below DGV, Eco-SGVs.
Asbestos from ACM building materials from demolition or in deteriorated condition.	Asbestos Fibres.	Fibre inhalation.	Future site residents, construction and maintenance workers.	Suspect ACM building material confirmed at implement shed. Soil sampling identified asbestos soil contamination, but at concentration below appropriate guideline value. No evidence of building footprint or material at the location of the unknown structure removed between 1953 – 1971. Additionally, supplementary sampling found no evidence of asbestos in soil. Linkage is incomplete.

[16] Toxicant default guideline values for sediment quality sourced from: https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/sediment-quality-toxicants

[17] Soil guideline values for the protection of ecological receptors sourced from: Cavanagh, J., Munir, K. 2016. Development of soil guideline values for the protection of ecological receptors (Eco-SGVs): Technical document. Landcare Research Contract Report: LC2605.

Potential Sources	Contaminants of Concern	Potential Exposure Pathways	Receptors	Complete Linkage Commentary
Lead-based paints.	Lead.	Ingestion.	Future site residents, construction and maintenance workers, groundwater and surface water, aquatic biota.	Soil lead not quantified at residential building sites. Potential complete linkage. No evidence of soil lead contamination at unknown structure removed between 1953 – 1971. Linkage is incomplete. Unlikely risk to aquatic biota as heavy metals in central drain sediment below DGV, Eco-SGVs. Linkage is incomplete.
Offal pits and septic tanks and dispersion fields.	Pathogenic microorganism populations, nitrogen, heavy metals.	Ingestion, groundwater and surface water runoff.	Future site residents, construction and maintenance workers, groundwater and surface water, aquatic biota.	Offal and septic systems presents a nitrogen risk to aquatic systems andpathogenic risk to site workers. Unlikely risk to future site residents based on survival of pathogens in soils. Removal of systems during development removes source risk to aquatic biota.

7 DISCUSSION

7.1 Fertiliser bulk storage and application

The bulk storage and application of fertiliser can result in the accumulation of several contaminants in soil, namely, calcium phosphate, calcium sulphate, copper chloride, sulphur, sulphuric and phosphoric acid, molybdenum, selenium, iron, cadmium, nitrates, and ammonia (MfE 2012). The primary contaminant of concern is cadmium (MfE 2012). Cadmium is a natural, non-essential heavy metal, and is toxic to humans, animals and plants. Increased levels of cadmium in New Zealand agricultural soils due to fertiliser application is well documented (Kim, N. 2005). When superphosphate fertiliser comes into contact with moisture cadmium is released and is rapidly sequestered by soil particles. The adsorption of cadmium to soil varies due to differences in soil particle size, pH, organic matter content, and abundance of metal cations (Gray et al., 1999).

No bulk storage of fertiliser was observed at the site. Anecdotal information indicated that bulk storage has not occurred historically, but land-based vehicular application of fertiliser (and lime) occurs (presently and historically) at the site. Soil samples were collected across the site to quantify potential cadmium soil contamination. The concentration of cadmium ranged from 0.2 – 0.71 mg/kg, with a 95% UCL of 0.42 mg/kg. These concentrations are elevated in comparison to predicted upper background concentrations but lower than the most stringent residential SGV (25% produce) for cadmium (at default pH of 5 of 0.8 mg/kg) Therefore, across the site (excluding Stockyard 3), the soil cadmium source-pathway-receptor linkage is incomplete, and the risk to human health is highly unlikely. However, the cadmium outlier of 0.71 mg/kg collected from sediment in a drain suggests that fertiliser bulk storage could have occurred upgradient, specifically at Stockyard 3. Therefore, cadmium soil contamination could present a risk to human health at Stockyard 3.

The attenuation of cadmium increases strongly from source, therefore minimising the potential for cadmium to contribute to groundwater and surface water bodies. Kim (2005) concluded that cadmium in groundwater is unlikely except for sandy soils, or soils with substantial losses of organic matter. Based on the likely affinity of cadmium to soils, the main vector to surface water bodies is via particulate bound transport (Kim, N. 2005). To provide a site-wide cadmium indicator to downstream receiving water bodies, a sediment sample in the central drainage channel was collected and did not show elevated levels of cadmium. Therefore, assuming that sediment sample within the drain reflects the main vector of particulate transport, the risk to receiving water bodies is deemed highly unlikely.

7.2 Livestock dip or spray race operations

It is estimated that there are 50,000 historic sheep dip sites across New Zealand, with over 10,000 in the Waikato Region. A wide range of chemicals has been used in sheep dipping. Arsenic and the organochlorines (aldrin, dieldrin, DDT, and lindane) are the chemicals of greatest concern due to toxicity and persistence in the environment (MfE 2012). The desktop assessment and preliminary site visit highlighted the potential of sheep dipping or spray race operations at the site.

Anecdotal information suggests that sheep dipping did occurred as part of historical farming operations, but outside the boundaries of the current site. Specifically, sheep dipping occurred in the vicinity of a historic woolshed (see Figure 3.3). The location of the woolshed was developed into residential housing between 1995 – 2004. There are no records of dipping activity or soil testing at this location on the HCC records. Downstream sampling at the site was completed to assess the potential migration of contaminants from this historical sheep dipping. Concentrations of organochlorines were below analytical detection and arsenic concentrations were below the most

stringent SCS. Therefore, the risk of contaminant migration from the historical sheep dip activities into the site is highly unlikely to present a risk to human health.

A total of three stockyards were evident at the site. The timeline of presence in historical imagery and property file information was compared to the period of usage for arsenic and organochlorine chemicals (i.e., arsenic from 1840s – 1980 and organochlorines from 1945 – 1961). Property file information indicated that the woolshed at Stockyard 1 was relocated from the location of the aforementioned off-site sheep dip to the current location between 1997 – 1999. The woolshed and Stockyard 1 was observed in aerial imagery from 2004 (no imagery available from 1997 – 2004). Based on the timeline of presence, Stockyard 1 is highly unlikely to present a risk to human health from the use of sheep dipping chemicals. In comparison, Stockyard 2 and Stockyard 3 are observed in historical imagery from 1943 to present, and therefore required further evaluation.

The site visits did not identify any structures typical of sheep dipping such as pot dips. However, at Stockyard 2 a galvanised spray unit (unknown to the landowner) was observed, and at Stockyard 3, a concrete structure displayed characteristics of a possible above ground spray shower enclosure (Figure 7.1). Based on these observations soil sampling was completed at the three stockyards for arsenic and organochlorines. The concentration of organochlorines was below analytical detection at all three stockyard sites. Arsenic was found at concentrations exceeding SCS for 10% and 25% produce scenarios at the three stockyards. At Stockyard 1 arsenic was below the high-density residential SCS. At Stockyard 2 and Stockyard 3, arsenic concentrations were found exceeding the high-density residential, commercial worker, and recreational SCS. Therefore, the risk of organochlorine soil contaminant is highly unlikely to present a risk to human health at the stockyard sites, while arsenic presents a risk (dependent on developed land-use) that requires further characterisation and evaluation.

The concentration of arsenic was correlated with soil copper and chromium concentrations. Copper and chromium models predicted 89.9% and 80.7% of the variability in soil arsenic concentrations. This data suggests that a component of soil arsenic is derived from H4 CCA treated (i.e., copper-chromium-arsenic treated wood) used at the stockyards. However, as soil copper concentrations could also be derived from the use of copper-based treatments, chromium concentration provides the best indicator of CCA contamination. A high density of wood posts was observed at the stockyard sites and is presumed to be H4 CCA treated wood. CCA concentrations from treated wood decreases rapidly with increasing distance from the post (Zagury et al., 2003), however the literature is inconsistent with lateral and vertical distances reported. Zagury et al., (2003) found arsenic concentrations laterally to a distance of 0.5 m and a depth of 1 m from the post. It must be acknowledged that there is potential that soil sampling occurred in the location, or in close proximity, to a historical post that has since been removed.

At Stockyard 1, soil arsenic is therefore likely derived solely from CCA leaching from wooden posts creating 'micro-hotspots'. The arsenic depth profile and surrounding arsenic concentrations are conducive to using soil mixing[18] as a remediation option (depending on proposed end land-use) that would be required if subdivision, soil disturbance, and / or change of land-use is to occur at this location. At stockyards 2 and 3, arsenic concentrations exceeding 60 mg/kg were found at distance, or in absence of, wooden posts, see Figure 7.1. Subsequently, the hypothesis is that the source of soil arsenic at stockyards 2 and 3 is derived from both CCA treated wood and historical use of arsenic-based insecticide for treating sheep.

[18] Soil mixing can reduce contaminant concentrations to below guideline concentrations by vertical (and lateral) mixing of contaminated soil with underlying (and adjacent) uncontaminated soil. This method is not suitable for hot spots and is appropriate when contaminant concentrations are less than two to three times the applicable guideline level.

Figure 7.1: Soil sampling sites at Stockyard 2 (left) and Stockyard 3 (right) where soil arsenic exceeded 60 mg/kg. At Stockyard 2 the soil sampled was approximately 1.4 m from the wooden fence. At Stockyard 3 no nearby wooden posts or fences was observed.

Arsenic generally binds strongly to soil, and therefore leaching into the groundwater from contaminated sites is expected to be minimal. Based on the likely affinity of arsenic to soils, the main vector to surface water bodies is via particulate bound transport. However, the behaviour of arsenic in soil is highly site-specific. For example, arsenic can be mobilised from the soil by addition of phosphate. The stockyards are located in close proximity to surface waters and drainage channels and therefore any water contamination could present a human and environmental health risk. Downstream and the central drainage channel sediment sampling showed that arsenic concentrations were generally below the most stringent SCS. However, sampling of sediment from the drainage channel (HO_6_150) immediately below Stockyard 3 found elevated arsenic concentration of 22 mg/kg, exceeding residential 10% and 25% produce SCS. Additionally, cadmium and zinc concentrations were elevated at this sampling location (but below the most stringent SCS). This finding suggests that use of fertilisers and animal treatment products have been used in the vicinity of Stockyard 3.

The controlling pathway for arsenic to human health risk is via soil ingestion, followed by produce consumption. Dermal pathway is insignificant for arsenic. Arsenic was found at concentrations presenting a risk to human health, albeit dependent on the development activity and end land-use. Therefore, as the source-pathway-receptor linkage is complete, the stockyard sites are flagged as a piece of land (see Appendix E). It is recommended that arsenic is further quantified and delineated, and a management plan is developed alongside the site development plan as part of a Remedial Action Plan (RAP). Additionally, a Site Management Plan (SMP) should be developed for commercial workers. The 95% UCL at stockyards 2 and 3 were below commercial worker exposure SCS (with outlier sample removed from Stockyard 3 data). At Stockyard 3, a hot spot of arsenic of 300 mg/kg

exceeds commercial worker SCS, this area requires delineation and specific management plan developed (e.g., capped, or remediated).

7.3 Persistent pesticide bulk storage or use

The storage and use of persistent pesticides can result in accumulation in soils and present subsequent human health risks. The MfE (2012) lists the hazardous substances associated with pesticide use as: arsenic, lead, copper, mercury, organochlorines and organophosphates. Of which, arsenic and organochlorines are listed as priority due to toxicity and persistence in the environment (MfE 2012). A golf course, arable cropping, and orchard activities are adjacent to the site and therefore present a risk of pesticide contamination at the site.

The golf course was located downgradient and soil heavy metal sampling data from an addendum to a Preliminary Site Investigation (PSI) completed at the site was below residential 25% produce SCS. Therefore, the source risk is low, and the pathway unlikely. Subsequently the adjacent golf course is highly unlikely to present a risk to human health.

The adjacent orchard activities and arable cropping were located upgradient to the site and therefore could present a risk of soil contamination from spray migration. Soil sampling was completed adjacent to the boundary between the site and upgradient arable cropping and orchard activities. The organochlorine screening concentrations were below analytical detection. A number of samples reported elevated heavy metals compared to predicted background concentrations. More critically, in comparison to SCSs, all samples were below the most stringent SCS produce scenario, excluding one sample HO_6_150. This sample was collected within a small drainage channel and is expected to reflect activities at Stockyard 3 and not adjacent land-uses. Additionally, a sediment sample collected in the central drainage channel is expected to reflect side wide and upstream inputs did not show elevated levels of heavy metals or organochlorines. Therefore, the adjacent arable cropping and orchard land-uses present a highly unlikely risk to human and health at the site and downstream aquatic receptors.

7.4 Storage tanks or drums for fuel, chemicals or liquid waste

The site visit and desktop assessment provided no indication that fuel tanks or substantial quantities of chemicals are stored at the site (apart from possibly at Stockyard 3). During the site visit no odours, soil staining, or discoloured vegetation was observed. Therefore, the risk of soil contamination from storage tanks is highly unlikely to present a risk to human and health at the site.

7.5 Asbestos and lead use in buildings

Asbestos importation and manufacture in New Zealand started from around 1939 (Graham, B. 2014) and peaked around 1975. From the 1940's – 1960's asbestos cladding and roofing was prevalent in buildings. Asbestos products were manufactured in New Zealand until 1987 and banned in New Zealand in 2000. Therefore, buildings that were constructed between the 1940's – 1980's correlates to the peak timing of asbestos use and therefore could potentially be comprised of asbestos containing materials (ACM).

The residential houses and farming sheds / structures were examined for suspect ACM and condition as the historical timeline correlates with use of asbestos products. Of the buildings onsite, one structure, a storage shed at Stockyard 3, was observed in poor condition with suspect ACM. The storage shed at Stockyard 3 was confirmed to contain ACM building material. As the ACM was

observed to be in poor condition it is more likely than not to result in soil asbestos contamination of the surrounding soils. Subsequently, soil asbestos sampling was completed to determine presence, quantify concentration, and delineate any soil contamination. Asbestos fines were found in the one of seven samples analysed at a concentration well below guideline value. Therefore, the asbestos soil contamination at the Stockyard 3 shed is highly unlikely to pose a risk to human health. The historical timeline of the two residential buildings at the site correspond with asbestos use in building materials. The residential buildings were visually inspected, and cladding material was in good condition and suspect potential ACM was not immediately evident. The property files contain building plans from 1979 to demolish and erect a new dwelling in the area of the residential property identified as the cottage (i.e., highlighting potential for uncontrolled demolition). However, the historical imagery review provides no evidence to support that this activity occurred. Therefore, residential buildings at the site present an unlikely risk to human health from asbestos soil contamination.

The historical imagery highlights a structure present on the site in 1943 and removed between 1953 – 1971. This structure was located close to the residential building referred to as the farmhouse. During a site visit, visual surface assessment test pits were completed in the area of the structure footprint and found no evidence of building material or building platform. In addition, limited intrusive sampling was completed to provide supplementary data for asbestos and lead risk assessment. No asbestos was detected and lead was well below the most conservative guideline value. Therefore, the unknown structure is highly unlikely to pose a risk to human health.

It is recommended that an asbestos demolition survey is undertaken prior to the demolition of the two residential buildings at the site. The results of the demolition survey should inform any additional soil asbestos sampling requirements. Furthermore, the use of lead-based paints, while not specifically included in the MfE HAIL register, is considered a potential source of soil contamination (i.e., HAIL I) as the use of lead-based paints in New Zealand was common until the 1980s. The residential properties at the site coincide with the timeline of lead-based paint use in New Zealand. As lead is environmentally persistent and is a significant human health hazard further evaluation of lead containing paint and potential for soil contamination is recommended at the two residential buildings if subdivision, soil disturbance, and / or change of land-use is to occur at these locations. This evaluation is recommended to occur concurrently with additional arsenic delineation works.

7.6 Offal pits and septic tanks

The desktop assessment provides evidence that disposal of farm animals in offal pits has occurred at the site, and residential wastewater disposal has, and is, occurring using septic tanks. These activities can increase pathogenic[19] microorganism populations (i.e., bacteria, viruses, helminths, protozoa), nitrogen[20], and result in the accumulation of heavy metals. The primary contaminants of concern associated with these activities are pathogenic microorganisms in soil and water, and nitrogen inputs to receiving water bodies.

Anecdotal information suggests that there are two offal pits on the site, one adjacent to Stockyard 1 and the other adjacent to Stockyard 3. Both offal pits are not in use and have not been used for at

[19] Pathogen is a bacteria, virus or other microorganism that can cause disease.

[20] In soils ammoniacal nitrogen (ammonia [NH_3] and ammonium [NH_4^+]), exhibits low toxicity (ammonium sorbs to the cation exchanges complexes of soils and sediments and anions in solution reducing bioavailability and toxicity) and transforms into less toxic forms (nitrate [NO_3^-]). In comparison, in aquatic environments ammoniacal nitrogen can be toxic to aquatic organisms. High concentrations of nitrogen can cause methaemoglobinaemia or “blue baby” syndrome, gastric cancer, hypertension, leukaemia and non-Hodgkins lymphoma.

least 20 years. Site visits were unable to locate the offal pits, approximate location information has been provided by the landowner.

In general, there is very little information available regarding the environmental impacts of livestock burial. NABCC (2004) reviewed carcass disposal processes and environmental impacts. In brief, the review highlights that the pollutant load is likely to be released during the early stages of decomposition with nitrogen impacts to groundwater being more problematic than microbial contamination. For example, it was reported that 50% of total volume from a carcass occurs in the first two months. However, the rate of decomposition is dependent on depth, soil type, species and size, and hydrology. Regardless, based on anecdotal information that the offal pits are no longer in use, and have not been in use for at least 20 years, the nitrogen impacts to downstream water bodies is likely to be limited. Additionally, as the duration of survival times for pathogenic microorganisms are generally <100 days (Feachem et al. 1983) it is expected that the pathogenic risk will be unlikely for future site residents.

Septic tanks are designed to reduce nutrients and pathogenic microorganisms by collection and settling of sludge and digestion. Consequently, the levels of pathogens reaching soil (e.g., from septic tank disposal field [drain-field]) from a septic tank are reduced. Therefore, based on the survival times for pathogenic microorganisms it is expected that the pathogenic risk will be unlikely for future site residents. The age of the septic tanks and the expected high groundwater table at the site increases the risk of septic tank nitrogen inputs to downstream waterbodies. No faecal source tracking tests were completed to assess. However, the removal of these systems for site development will remove the nitrogen source risk to downstream aquatic environments.

The offal pits and septic tanks present a risk to site workers. Therefore, it is recommended that offal pits and septic tanks are addressed in the Site Management Plan (SMP) for commercial workers to ensure safe procedures are in place to minimise pathogenic health effects. Moreover, there is potential that the offal pits could have been used to discard other farm waste materials although anecdotal evidence suggests that this did not occur.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

- Cadmium accumulation in soils at the site was evaluated (above upper predicted background concentrations) but found below the most stringent soil contaminant standard (SCS) and is therefore highly unlikely to present a risk to human health. However, an elevated sample of cadmium from sediment within a drain below Stockyard 3 suggests that fertiliser bulk storage could have occurred at Stockyard 3.
- Adjacent orchard, arable cropping, and sport turf (i.e., golf course) contaminant sources were evaluated and concluded highly unlikely to present a risk to human health at the site.
- Building material containing asbestos in a poor condition was identified at the Stockyard 3 shed. Asbestos was detected in one of seven soil samples analysed. 12 additional delineation (depth and lateral) samples were collected but not analysed. The concentration of asbestos was well below guideline concentration and therefore is highly unlikely to pose a risk to human health and is classified as unlicensed asbestos works.
- Anecdotal information suggests that sheep dipping did not occur on the site but did occur north of Stockyard 2 in the area developed into residential housing between 1995 – 2004.
- No remnant sheep dipping structures were observed at the site or at the three stockyards. A galvanised spray unit was found at Stockyard 2, and a possible spray enclosure at Stockyard 3 noted.
- The historical timeline of the three stockyards was evaluated against the timeline of arsenic and organochlorine chemical use. It was determined that Stockyard 1 was unlikely to have soil contamination derived from sheep dipping and spray operations.
- Organochlorine concentrations were below analytical detection at the three stockyards and therefore the risk of organochlorine contamination is deemed highly unlikely.
- At all three stockyards, arsenic concentrations were elevated in comparison to upper predicted background concentrations and exceeded the residential SCS for 10% and 25% produce scenarios. The concentrations at Stockyard 1 were below the high-density residential SCS, while Stockyard 2 and Stockyard 3 concentrations exceeded high-density residential, commercial worker, and recreational SCS.
- Evaluation of arsenic data suggests that concentrations are derived from both CCA treated (i.e., copper-chromium-arsenic treated wood) and use of arsenic-based chemicals. This conclusion was determined by the evaluation of soil arsenic concentrations against soil chromium, and arsenic concentration at distance to wooden posts. Chromium concentrations explained 80% of the variability in soil arsenic (from samples analysed for both arsenic and chromium) therefore suggesting that treated wood is a source of arsenic.
- At Stockyard 1 soil arsenic is likely derived from CCA leaching from wooden posts creating ‘micro-hotspots’.
- At stockyards 2 and 3, arsenic concentrations exceeding 60 mg/kg were found at distance, or in absence of, wooden posts. Therefore, the source of contamination is likely historical use of arsenic-based insecticide for treating sheep. The hypothesis is that both CCA wood and arsenic-based insecticide are likely contamination sources are at stockyards 2 and 3.
- The risk to downstream ecological receptors is determined to be unlikely as sediment collected from the central drainage channel is below ecological toxicity guideline values.

- The activity status under the NESCS (Resource Management [National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health] Regulations 2011) for the site is restricted discretionary if subdivision, soil disturbance, and / or change of land-use is to occur.

8.2 Recommendations

- The findings of this DSI are considered in the development of the subdivision plans.
- Data gaps limiting risk assessment are addressed and supplied as an addendum to the DSI:
  - Further lateral and vertical delineation of arsenic concentration in the soil at the three stockyard sites.
  - Additional soil cadmium sampling at Stockyard 3.
  - Asbestos demolition survey is undertaken prior to the demolition of the two residential buildings at the site. In addition, soil asbestos sampling completed at the residential buildings dependent on asbestos demolition survey results.
  - Lead-based paint and potential soil contamination is evaluated at the two residential buildings.
- This DSI is provided to the Hamilton City Council (HCC), the Waikato District Council (WDC) and Waikato Regional Council (WRC) as part of any subdivision application.
- A Remedial Action Plan (RAP) is developed based on the findings of the DSI, supplementary investigations, proposed subdivision plans, and planned construction works.
- A simple, concise Site Management Plan (SMP), presented on one A3 sheet that can be displayed on a site noticeboard is developed based on the findings of the DSI and information developed in the RAP.

9 REPORT LIMITATIONS

This report has used information provided by third parties which has been taken to be accurate and correct. BTW Company is not responsible for any inaccuracies in this information.

This report has been prepared by BTW Company to satisfy the requirements of the NESCS regulations and to deliver the objectives outlined within the report. BTW Company accepts no liability if the report is used for any other purpose or is relied on by any person(s) other than the client. Any such use or reliance will be solely at their own risk.

No soil investigation or desktop investigation can guarantee the absence of contaminated soil as soil conditions by nature are not uniform. This report is representative of all the information available to the author, and the conclusions and recommendations made in this report are derived from that information which was available at the time the report was written.

The services of this project are in accordance with current best practise and known professional standards for environmental site assessments at the time of investigation. Should additional information become available at a later date, BTW Company reserves the right to update this report.

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APPENDIX A HISTORICAL AERIAL IMAGERY

Figure A 1: 1943 aerial imagery of the site. Source: Retrolens.

Figure A 2: 1943 aerial imagery. Yellow boxes highlighting Stockyard 2, Stockyard 3, unknown structure (north-west of Stockyard 3), and woolshed and stockyard outside of site boundary. Source: Retrolens.

Figure A 3: 1953 aerial imagery of the site. Source: Retrolens.

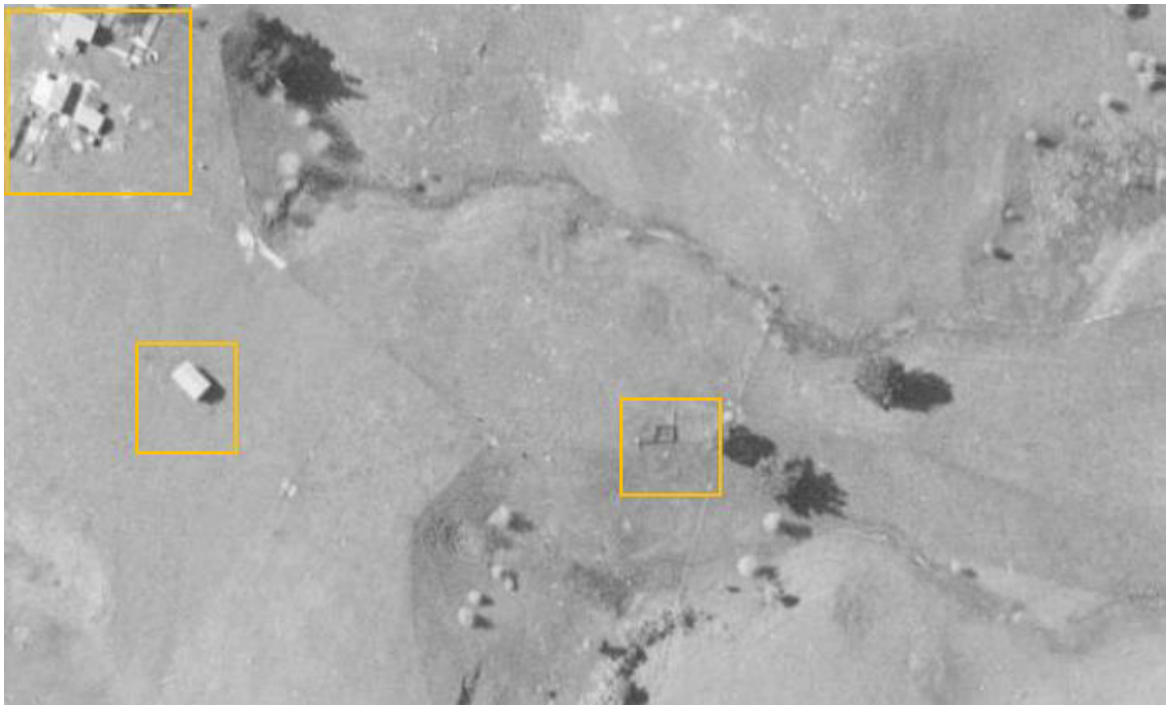

Figure A 4: 1953 aerial imagery. Yellow boxes highlighting Stockyard 2, and features to the north outside the site boundary. Source: Retrolens.

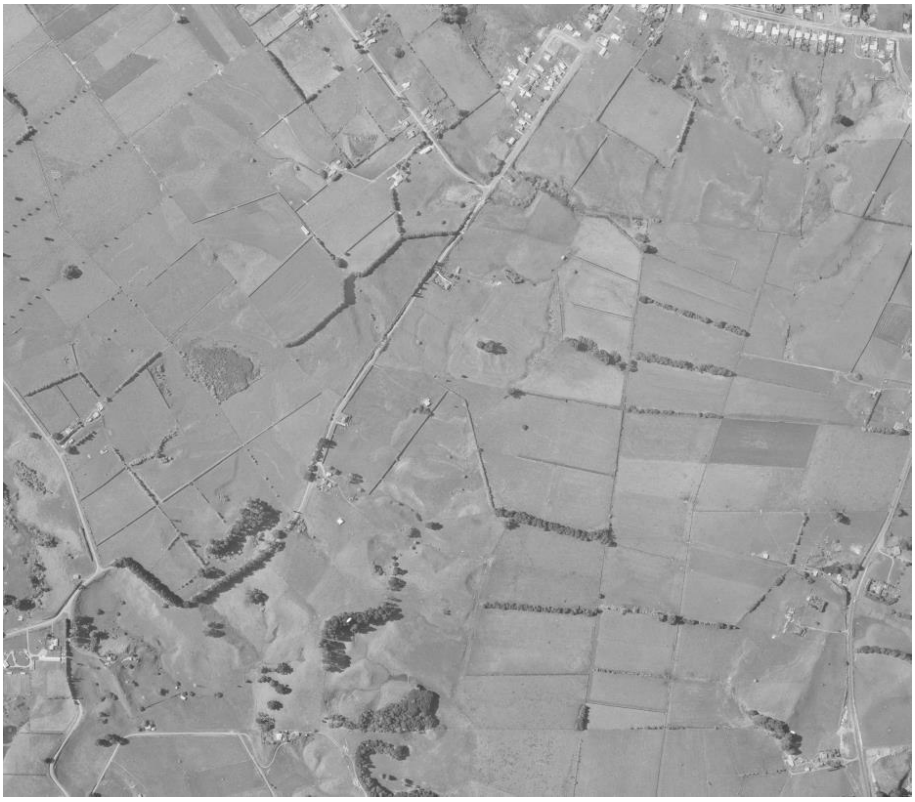

Figure A 5: 1971 aerial imagery of the site. Source: Retrolens.

Figure A 6: 1974 aerial imagery. Source: Retrolens.

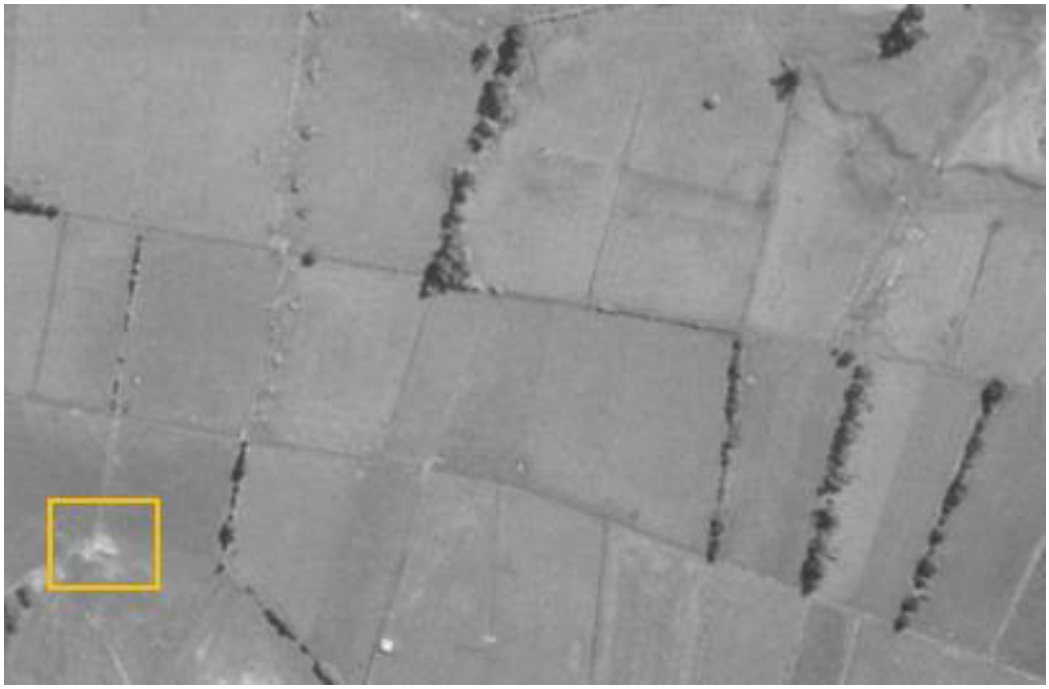

Figure A 7: 1974 aerial imagery. Yellow box highlighting removal of unknown structure. Source: Retrolens.

Figure A 8: 1979 aerial imagery. Source: Retrolens.

Figure A 9: 1979: Yellow box highlighting the main farmhouse on the property. Source: Retrolens.

Figure A 10: 1991 aerial imagery. Source: Retrolens.

Figure A 11: 1995 aerial imagery. Source: Retrolens.

Figure A 12: 2004 aerial imagery. Source: Google Earth.

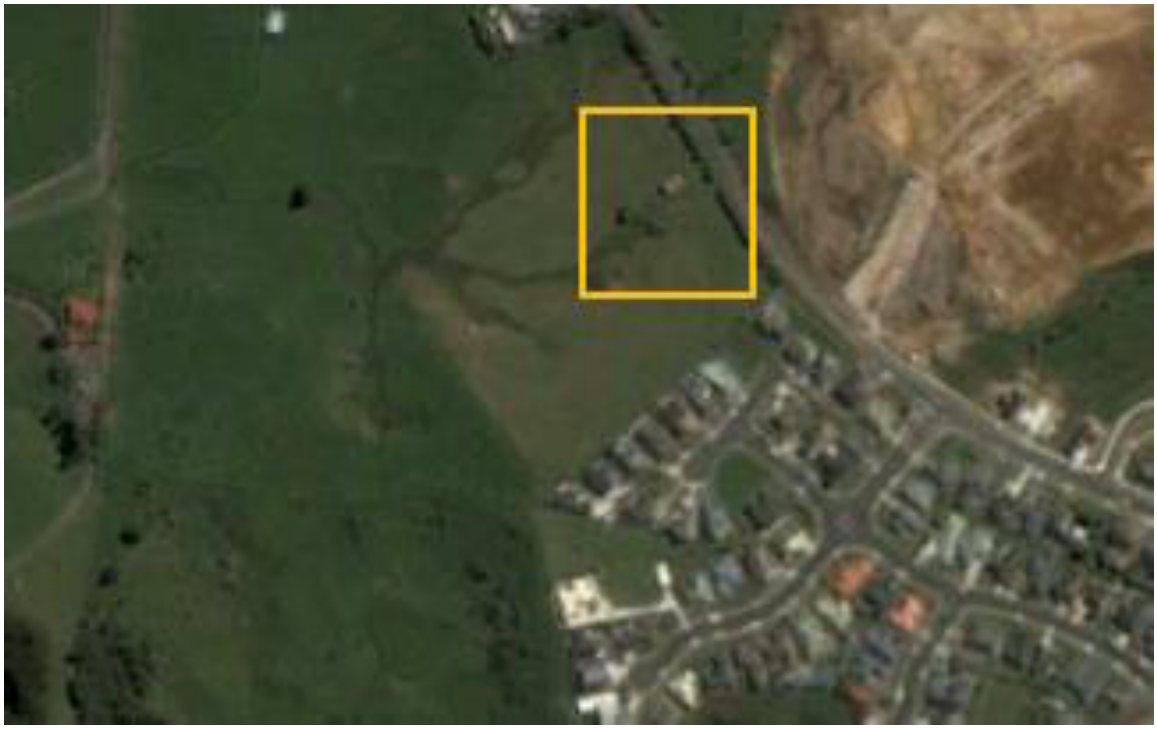

Figure A 13: 2004 aerial imagery. Yellow box highlighting Stockyard 1.

Figure A 14: 2008 aerial imagery. Source: Retrolens.

Figure A 15: 2008 aerial imagery. Yellow box highlighting implement shed extension. Source: Google Earth.

Figure A 16: 2013 aerial imagery. Source: Google Earth.

Figure A 17: 2017 aerial imagery. Source: Retrolens.

Figure A 18: 2019 aerial imagery. Source: Google Earth.

APPENDIX B SOIL SAMPLING ANALYTICAL RESULTS

Hill Laboratories
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Certificate of Analysis

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2613287 SPv1
Contact:	Dean Sandwell C/- BTW Company Ltd - Hamilton Branch PO Box 551 New Plymouth 4340	**Date Received:**	17-May-2021
		Date Reported:	20-May-2021
		Quote No:	111463
		Order No:	
		Client Reference:	210406
		Submitted By:	Nakeysha Lammers

Sample Type: Soil

Sample Name:		S2_1_100 14-May-2021 7:52 am	S2_1_300 14-May-2021 8:03 am	S2_2_100 14-May-2021 10:04 am	S2_3_100 14-May-2021 10:12 am	S2_3_300 14-May-2021 10:16 am
Lab Number:		2613287.1	2613287.2	2613287.3	2613287.4	2613287.5
Individual Tests						
Dry Matter	g/100g as rcvd	66	60	65	68	57
Total Recoverable Arsenic	mg/kg dry wt	-	-	79	11	6
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	67	13	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.49	0.19	-	-	-
Total Recoverable Chromium	mg/kg dry wt	26	11	-	-	-
Total Recoverable Copper	mg/kg dry wt	54	20	-	-	-
Total Recoverable Lead	mg/kg dry wt	28	18.3	-	-	-
Total Recoverable Nickel	mg/kg dry wt	5	4	-	-	-
Total Recoverable Zinc	mg/kg dry wt	193	90	-	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
alpha-BHC	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
beta-BHC	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
delta-BHC	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
gamma-BHC (Lindane)	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
cis-Chlordane	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
trans-Chlordane	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
2,4'-DDD	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
4,4'-DDD	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
2,4'-DDE	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
4,4'-DDE	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
2,4'-DDT	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
4,4'-DDT	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
Total DDT Isomers	mg/kg dry wt	< 0.09	< 0.10	< 0.10	< 0.09	< 0.11
Dieldrin	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
Endosulfan I	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
Endosulfan II	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
Endosulfan sulphate	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
Endrin	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
Endrin aldehyde	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
Endrin ketone	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
Heptachlor	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
Heptachlor epoxide	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
Hexachlorobenzene	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018
Methoxychlor	mg/kg dry wt	< 0.015	< 0.017	< 0.016	< 0.015	< 0.018

Sample Type: Soil						
Sample Name:		S2_4_100 14-May-2021 8:16 am	S2_5_100 14-May-2021 10:26 am	S2_5_300 14-May-2021 10:30 am	S2_6_100 14-May-2021 10:44 am	S2_7_100 14-May-2021 8:23 am
Lab Number:		2613287.6	2613287.7	2613287.8	2613287.9	2613287.10
Individual Tests						
Dry Matter	g/100g as rcvd	69	72	63	71	72
Total Recoverable Arsenic	mg/kg dry wt	77	91	8	21	81
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
alpha-BHC	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
beta-BHC	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
delta-BHC	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
gamma-BHC (Lindane)	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
cis-Chlordane	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
trans-Chlordane	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
2,4'-DDD	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
4,4'-DDD	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
2,4'-DDE	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
4,4'-DDE	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
2,4'-DDT	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
4,4'-DDT	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
Total DDT Isomers	mg/kg dry wt	< 0.09	< 0.09	< 0.10	< 0.09	< 0.09
Dieldrin	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
Endosulfan I	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
Endosulfan II	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
Endosulfan sulphate	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
Endrin	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
Endrin aldehyde	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
Endrin ketone	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
Heptachlor	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
Heptachlor epoxide	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
Hexachlorobenzene	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014
Methoxychlor	mg/kg dry wt	< 0.015	< 0.014	< 0.016	< 0.014	< 0.014

Sample Name:		S2_7_300 14-May-2021 10:51 am	S2_8_100 14-May-2021 10:56 am	S2_9_100 14-May-2021 11:01 am	S2_9_300 14-May-2021 11:21 am	S2_10_100 14-May-2021 8:29 am
Lab Number:		2613287.11	2613287.12	2613287.13	2613287.14	2613287.15
Individual Tests						
Dry Matter	g/100g as rcvd	60	60	60	58	81
Total Recoverable Arsenic	mg/kg dry wt	12	69	8	9	26
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
alpha-BHC	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
beta-BHC	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
delta-BHC	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
gamma-BHC (Lindane)	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
cis-Chlordane	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
trans-Chlordane	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
2,4'-DDD	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
4,4'-DDD	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
2,4'-DDE	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
4,4'-DDE	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
2,4'-DDT	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
4,4'-DDT	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
Total DDT Isomers	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.11	< 0.08
Dieldrin	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
Endosulfan I	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
Endosulfan II	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
Endosulfan sulphate	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013

Sample Type: Soil						
Sample Name:		S2_7_300 14-May-2021 10:51 am	S2_8_100 14-May-2021 10:56 am	S2_9_100 14-May-2021 11:01 am	S2_9_300 14-May-2021 11:21 am	S2_10_100 14-May-2021 8:29 am
Lab Number:		2613287.11	2613287.12	2613287.13	2613287.14	2613287.15
Organochlorine Pesticides Screening in Soil						
Endrin	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
Endrin aldehyde	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
Endrin ketone	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
Heptachlor	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
Heptachlor epoxide	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
Hexachlorobenzene	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013
Methoxychlor	mg/kg dry wt	< 0.017	< 0.017	< 0.017	< 0.018	< 0.013

Sample Name:		S2_11_100 14-May-2021 8:45 am	S2_11_300 14-May-2021 11:13 am	S2_12_100 14-May-2021 8:52 am	S2_13_100 14-May-2021 9:06 am	S2_14_100 14-May-2021 9:12 am
Lab Number:		2613287.16	2613287.17	2613287.18	2613287.19	2613287.20
Individual Tests						
Dry Matter	g/100g as rcvd	65	55	60	31	42
Total Recoverable Arsenic	mg/kg dry wt	26	9	19	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	-	-	-	14	9
Total Recoverable Cadmium	mg/kg dry wt	-	-	-	0.24	0.14
Total Recoverable Chromium	mg/kg dry wt	-	-	-	7	7
Total Recoverable Copper	mg/kg dry wt	-	-	-	13	10
Total Recoverable Lead	mg/kg dry wt	-	-	-	27	23
Total Recoverable Nickel	mg/kg dry wt	-	-	-	3	2
Total Recoverable Zinc	mg/kg dry wt	-	-	-	93	51
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
alpha-BHC	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
beta-BHC	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
delta-BHC	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
gamma-BHC (Lindane)	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
cis-Chlordane	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
trans-Chlordane	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
2,4'-DDD	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
4,4'-DDD	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
2,4'-DDE	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
4,4'-DDE	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
2,4'-DDT	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
4,4'-DDT	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
Total DDT Isomers	mg/kg dry wt	< 0.10	< 0.11	< 0.10	< 0.19	< 0.14
Dieldrin	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
Endosulfan I	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
Endosulfan II	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
Endosulfan sulphate	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
Endrin	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
Endrin aldehyde	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
Endrin ketone	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
Heptachlor	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
Heptachlor epoxide	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
Hexachlorobenzene	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03
Methoxychlor	mg/kg dry wt	< 0.016	< 0.019	< 0.017	< 0.04	< 0.03

Sample Name:		S2_15_100 14-May-2021 9:48 am	S2_16_100 14-May-2021 9:43 am	S1_1_100 14-May-2021 1:34 pm	S1_1_300 14-May-2021 1:38 pm	S1_2_100 14-May-2021 1:42 pm
Lab Number:		2613287.21	2613287.22	2613287.23	2613287.24	2613287.25
Individual Tests						
Dry Matter	g/100g as rcvd	32	31	64	68	71

Sample Type: Soil						
Sample Name:		S2_15_100 14-May-2021 9:48 am	S2_16_100 14-May-2021 9:43 am	S1_1_100 14-May-2021 1:34 pm	S1_1_300 14-May-2021 1:38 pm	S1_2_100 14-May-2021 1:42 pm
Lab Number:		2613287.21	2613287.22	2613287.23	2613287.24	2613287.25
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	10	5	37	11	42
Total Recoverable Cadmium	mg/kg dry wt	0.28	0.21	0.24	0.11	0.12
Total Recoverable Chromium	mg/kg dry wt	7	6	22	14	22
Total Recoverable Copper	mg/kg dry wt	14	10	35	16	28
Total Recoverable Lead	mg/kg dry wt	39	29	60	30	53
Total Recoverable Nickel	mg/kg dry wt	4	2	5	5	4
Total Recoverable Zinc	mg/kg dry wt	86	43	200	44	84
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
alpha-BHC	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
beta-BHC	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
delta-BHC	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
gamma-BHC (Lindane)	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
cis-Chlordane	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
trans-Chlordane	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
2,4'-DDD	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
4,4'-DDD	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
2,4'-DDE	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
4,4'-DDE	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
2,4'-DDT	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
4,4'-DDT	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
Total DDT Isomers	mg/kg dry wt	< 0.18	< 0.19	< 0.10	< 0.09	< 0.09
Dieldrin	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
Endosulfan I	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
Endosulfan II	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
Endosulfan sulphate	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
Endrin	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
Endrin aldehyde	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
Endrin ketone	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
Heptachlor	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
Heptachlor epoxide	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
Hexachlorobenzene	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014
Methoxychlor	mg/kg dry wt	< 0.03	< 0.04	< 0.016	< 0.015	< 0.014

Sample Name:		S1_2_300 14-May-2021 1:49 pm	S1_3_100 14-May-2021 1:54 pm	S3_1_100 14-May-2021 3:51 pm	S3_3_100 14-May-2021 3:44 pm	S3_2_100 14-May-2021 3:51 pm
Lab Number:		2613287.26	2613287.27	2613287.28	2613287.29	2613287.30
Individual Tests						
Dry Matter	g/100g as rcvd	68	52	70	70	68
Total Recoverable Arsenic	mg/kg dry wt	-	-	66	16	13
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	11	3	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt	12	4	-	-	-
Total Recoverable Copper	mg/kg dry wt	13	5	-	-	-
Total Recoverable Lead	mg/kg dry wt	26	15.7	-	-	-
Total Recoverable Nickel	mg/kg dry wt	5	< 2	-	-	-
Total Recoverable Zinc	mg/kg dry wt	43	25	-	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
alpha-BHC	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
beta-BHC	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
delta-BHC	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
gamma-BHC (Lindane)	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015

Sample Type: Soil						
Sample Name:		S1_2_300 14-May-2021 1:49 pm	S1_3_100 14-May-2021 1:54 pm	S3_1_100 14-May-2021 3:51 pm	S3_3_100 14-May-2021 3:44 pm	S3_2_100 14-May-2021 3:51 pm
Lab Number:		2613287.26	2613287.27	2613287.28	2613287.29	2613287.30
Organochlorine Pesticides Screening in Soil						
cis-Chlordane	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
trans-Chlordane	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
2,4'-DDD	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
4,4'-DDD	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
2,4'-DDE	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
4,4'-DDE	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
2,4'-DDT	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
4,4'-DDT	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
Total DDT Isomers	mg/kg dry wt	< 0.09	< 0.12	< 0.09	< 0.09	< 0.09
Dieldrin	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
Endosulfan I	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
Endosulfan II	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
Endosulfan sulphate	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
Endrin	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
Endrin aldehyde	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
Endrin ketone	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
Heptachlor	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
Heptachlor epoxide	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
Hexachlorobenzene	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015
Methoxychlor	mg/kg dry wt	< 0.015	< 0.02	< 0.015	< 0.014	< 0.015

Sample Name:		S3_2_300 14-May-2021 3:59 pm	S3_6_100 14-May-2021 3:40 pm	S3_7_100 14-May-2021 3:34 pm	S3_8_100 14-May-2021 3:37 pm	S3_8_300 14-May-2021 3:41 pm
Lab Number:		2613287.31	2613287.32	2613287.33	2613287.34	2613287.35
Individual Tests						
Dry Matter	g/100g as rcvd	67	65	67	69	71
Total Recoverable Arsenic	mg/kg dry wt	10	19	28	62	11
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
alpha-BHC	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
beta-BHC	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
delta-BHC	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
gamma-BHC (Lindane)	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
cis-Chlordane	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
trans-Chlordane	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
2,4'-DDD	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
4,4'-DDD	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
2,4'-DDE	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
4,4'-DDE	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
2,4'-DDT	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
4,4'-DDT	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
Total DDT Isomers	mg/kg dry wt	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Dieldrin	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
Endosulfan I	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
Endosulfan II	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
Endosulfan sulphate	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
Endrin	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
Endrin aldehyde	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
Endrin ketone	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
Heptachlor	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
Heptachlor epoxide	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
Hexachlorobenzene	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014
Methoxychlor	mg/kg dry wt	< 0.015	< 0.015	< 0.015	< 0.015	< 0.014

Sample Type: Soil						
Sample Name:		S3_9_100 14-May-2021 3:26 pm	S3_11_100 14-May-2021 3:28 pm	S3_12_100 14-May-2021 3:24 pm	S3_15_100 14-May-2021 3:59 pm	S3_16_100 14-May-2021 4:10 pm
Lab Number:		2613287.36	2613287.37	2613287.38	2613287.39	2613287.40
Individual Tests						
Dry Matter	g/100g as rcvd	66	49	78	66	67
Total Recoverable Arsenic	mg/kg dry wt	50	300	27	61	37
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
alpha-BHC	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
beta-BHC	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
delta-BHC	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
gamma-BHC (Lindane)	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
cis-Chlordane	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
trans-Chlordane	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
2,4'-DDD	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
4,4'-DDD	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
2,4'-DDE	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
4,4'-DDE	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
2,4'-DDT	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
4,4'-DDT	mg/kg dry wt	< 0.016	< 0.02	< 0.013	< 0.015	< 0.015
Total DDT Isomers	mg/kg dry wt	< 0.09	< 0.12	< 0.08	< 0.09	< 0.09
Dieldrin	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
Endosulfan I	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
Endosulfan II	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
Endosulfan sulphate	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
Endrin	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
Endrin aldehyde	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
Endrin ketone	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
Heptachlor	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
Heptachlor epoxide	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
Hexachlorobenzene	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015
Methoxychlor	mg/kg dry wt	< 0.015	< 0.02	< 0.013	< 0.015	< 0.015

Sample Name:		S3A_100 14-May-2021 4:13 pm	S3A_300 14-May-2021 4:20 pm	S3B_100 14-May-2021 4:35 pm	S3B_300 14-May-2021 4:36 pm	
Lab Number:		2613287.41	2613287.42	2613287.43	2613287.44	
Individual Tests						
Dry Matter	g/100g as rcvd	65	68	71	71	-
Total Recoverable Arsenic	mg/kg dry wt	8	7	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	-	-	16	8	-
Total Recoverable Cadmium	mg/kg dry wt	-	-	0.21	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt	-	-	15	13	-
Total Recoverable Copper	mg/kg dry wt	-	-	27	14	-
Total Recoverable Lead	mg/kg dry wt	-	-	26	22	-
Total Recoverable Nickel	mg/kg dry wt	-	-	6	6	-
Total Recoverable Zinc	mg/kg dry wt	-	-	133	57	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
alpha-BHC	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
beta-BHC	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
delta-BHC	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
cis-Chlordane	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
trans-Chlordane	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
2,4'-DDD	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
4,4'-DDD	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
2,4'-DDE	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-

Sample Type: Soil						
Sample Name:		S3A_100 14-May-2021 4:13 pm	S3A_300 14-May-2021 4:20 pm	S3B_100 14-May-2021 4:35 pm	S3B_300 14-May-2021 4:36 pm	
Lab Number:		2613287.41	2613287.42	2613287.43	2613287.44	
Organochlorine Pesticides Screening in Soil						
4,4'-DDE	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
2,4'-DDT	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
4,4'-DDT	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
Total DDT Isomers	mg/kg dry wt	< 0.09	< 0.09	< 0.09	< 0.09	-
Dieldrin	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
Endosulfan I	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
Endosulfan II	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
Endosulfan sulphate	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
Endrin	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
Endrin aldehyde	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
Endrin ketone	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
Heptachlor	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
Heptachlor epoxide	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
Hexachlorobenzene	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-
Methoxychlor	mg/kg dry wt	< 0.015	< 0.015	< 0.014	< 0.014	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-44
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	3-18, 28-42
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	1-2, 19-27, 43-44
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	1-44
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-44
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	3-18, 28-42
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	3-18, 28-42

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

Testing was completed between 18-May-2021 and 20-May-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Martin Cowell - BSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2613529	SPv1
Contact:	Dean Sandwell C/- BTW Company Ltd - Hamilton Branch PO Box 551 New Plymouth 4340	**Date Received:**	17-May-2021	
		Date Reported:	19-May-2021	
		Quote No:	111463	
		Order No:		
		Client Reference:	210406	
		Submitted By:	Nakeysha Lammers	

Sample Type: Soil

Sample Name:		HO_1_150 14-May-2021 9:25 am	HO_2_150 14-May-2021 9:57 am	HO_3_150 14-May-2021 10:24 am	HO_4_150 14-May-2021 10:52 am	HO_5_150 14-May-2021 2:21 pm
Lab Number:		2613529.1	2613529.2	2613529.3	2613529.4	2613529.5
Individual Tests						
Dry Matter	g/100g as rcvd	59	46	39	54	54
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	< 4	< 2	< 5	7
Total Recoverable Cadmium	mg/kg dry wt	0.2	0.40	0.30	0.3	0.35
Total Recoverable Chromium	mg/kg dry wt	7	5	4	< 5	6
Total Recoverable Copper	mg/kg dry wt	20	24	34	17	26
Total Recoverable Lead	mg/kg dry wt	22	9.3	5.7	6.4	11.6
Total Recoverable Nickel	mg/kg dry wt	< 4	< 4	2	< 5	3
Total Recoverable Zinc	mg/kg dry wt	57	10	25	14	55
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
alpha-BHC	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
beta-BHC	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
delta-BHC	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
gamma-BHC (Lindane)	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
cis-Chlordane	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
trans-Chlordane	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
2,4'-DDD	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
4,4'-DDD	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
2,4'-DDE	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
4,4'-DDE	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
2,4'-DDT	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
4,4'-DDT	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
Total DDT Isomers	mg/kg dry wt	< 0.3	< 0.13	< 0.16	< 0.3	< 0.11
Dieldrin	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
Endosulfan I	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
Endosulfan II	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
Endosulfan sulphate	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
Endrin	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
Endrin aldehyde	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
Endrin ketone	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
Heptachlor	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
Heptachlor epoxide	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
Hexachlorobenzene	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019
Methoxychlor	mg/kg dry wt	< 0.04	< 0.03	< 0.03	< 0.04	< 0.019

Sample Type: Soil							
Sample Name:		HO_6_150 14-May-2021 5:00 pm	HO_8_150 14-May-2021 10:01 am	HO_DRAIN_1 14-May-2021 2:52 pm		
Lab Number:		2613529.6	2613529.7	2613529.8		
Individual Tests						
Dry Matter	g/100g as rcvd	52	-	47	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	22	2	6	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.71	0.45	0.16	-	-
Total Recoverable Chromium	mg/kg dry wt	8	6	5	-	-
Total Recoverable Copper	mg/kg dry wt	25	28	9	-	-
Total Recoverable Lead	mg/kg dry wt	20	18.1	11.5	-	-
Total Recoverable Nickel	mg/kg dry wt	5	4	2	-	-
Total Recoverable Zinc	mg/kg dry wt	182	15	77	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.019	-	< 0.03	-	-
alpha-BHC	mg/kg dry wt	< 0.019	-	< 0.03	-	-
beta-BHC	mg/kg dry wt	< 0.019	-	< 0.03	-	-
delta-BHC	mg/kg dry wt	< 0.019	-	< 0.03	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.019	-	< 0.03	-	-
cis-Chlordane	mg/kg dry wt	< 0.019	-	< 0.03	-	-
trans-Chlordane	mg/kg dry wt	< 0.019	-	< 0.03	-	-
2,4'-DDD	mg/kg dry wt	< 0.019	-	< 0.03	-	-
4,4'-DDD	mg/kg dry wt	< 0.019	-	< 0.03	-	-
2,4'-DDE	mg/kg dry wt	< 0.019	-	< 0.03	-	-
4,4'-DDE	mg/kg dry wt	< 0.019	-	< 0.03	-	-
2,4'-DDT	mg/kg dry wt	< 0.019	-	< 0.03	-	-
4,4'-DDT	mg/kg dry wt	< 0.019	-	< 0.03	-	-
Total DDT Isomers	mg/kg dry wt	< 0.12	-	< 0.13	-	-
Dieldrin	mg/kg dry wt	< 0.019	-	< 0.03	-	-
Endosulfan I	mg/kg dry wt	< 0.019	-	< 0.03	-	-
Endosulfan II	mg/kg dry wt	< 0.019	-	< 0.03	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.019	-	< 0.03	-	-
Endrin	mg/kg dry wt	< 0.019	-	< 0.03	-	-
Endrin aldehyde	mg/kg dry wt	< 0.019	-	< 0.03	-	-
Endrin ketone	mg/kg dry wt	< 0.019	-	< 0.03	-	-
Heptachlor	mg/kg dry wt	< 0.019	-	< 0.03	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.019	-	< 0.03	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.019	-	< 0.03	-	-
Methoxychlor	mg/kg dry wt	< 0.019	-	< 0.03	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-8
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	1-8
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	1-6, 8
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-6, 8

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

Testing was completed between 18-May-2021 and 19-May-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Martin Cowell - BSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2613284	SPv1
Contact:	Dean Sandwell C/- BTW Company Ltd - Hamilton Branch PO Box 551 New Plymouth 4340	**Date Received:**	17-May-2021	
		Date Reported:	20-May-2021	
		Quote No:	111463	
		Order No:		
		Client Reference:	210406	
		Submitted By:	Nakeysha Lammers	

Sample Type: Soil

Sample Name:		Cd-1-150 14-May-2021 5:00 pm	Cd-2-150 14-May-2021 4:41 pm	Cd-3-150 14-May-2021 1:28 pm	Cd-4-150 14-May-2021 11:47 am	Cd-5-150 14-May-2021 1:26 pm
Lab Number:		2613284.1	2613284.2	2613284.3	2613284.4	2613284.5
Total Recoverable Cadmium	mg/kg dry wt	0.58	0.25	< 0.5	0.37	0.23
pH*	pH Units	6.3	5.7	5.4	6.2	5.5

Sample Name:		Cd-6-150 14-May-2021 12:46 pm	Cd-7-150 14-May-2021 1:26 pm	Cd-8-150 14-May-2021 11:19 am	Cd-9-150 14-May-2021 8:36 am	Cd-10-150 14-May-2021 9:05 am
Lab Number:		2613284.6	2613284.7	2613284.8	2613284.9	2613284.10
Total Recoverable Cadmium	mg/kg dry wt	0.31	0.38	< 0.2	0.3	0.3
pH*	pH Units	5.3	5.4	5.4	5.3	5.6

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-10
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	1-10
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-10
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-10
Total Recoverable Cadmium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.10 mg/kg dry wt	1-10
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-10

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

Testing was completed between 18-May-2021 and 20-May-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Martin Cowell - BSc
Client Services Manager - Environmental

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

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Certificate of Analysis

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2613286	SPv1
Contact:	Dean Sandwell C/- BTW Company Ltd - Hamilton Branch PO Box 551 New Plymouth 4340	**Date Received:**	17-May-2021	
		Date Reported:	20-May-2021	
		Quote No:	111463	
		Order No:		
		Client Reference:	210406	
		Submitted By:	Nakeysha Lammers	

Sample Type: Soil

	Sample Name:	pH-1-150 14-May-2021 12:23 pm	pH-2-150 14-May-2021 12:34 pm	pH-3-150 14-May-2021 12:41 pm	pH-4-150 14-May-2021 5:14 pm	pH-5-150 14-May-2021 5:12 pm
	Lab Number:	2613286.1	2613286.2	2613286.3	2613286.4	2613286.5
pH	pH Units	5.5	4.1	4.3	5.3	6.5

	Sample Name:	pH-6-150 14-May-2021 5:20 pm				
	Lab Number:	2613286.6				
pH	pH Units	6.3	-	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-6
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-6
pH	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-6

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

Testing was completed between 18-May-2021 and 20-May-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Martin Cowell - BSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2618236 SPv1
Contact:	Dean Sandwell C/- BTW Company Ltd - Hamilton Branch PO Box 551 New Plymouth 4340	**Date Received:**	21-May-2021
		Date Reported:	26-May-2021
		Quote No:	111463
		Order No:	
		Client Reference:	210406
		Submitted By:	Nakeysha Lammers

Sample Type: Soil

	Sample Name:	S2_N_1_100 21-May-2021 3:54 pm	S2_N_2_100 21-May-2021 4:14 pm	S2_N_3_100 21-May-2021 4:00 pm	S2_N_4_100 21-May-2021 4:37 pm	S2_N_5_100 21-May-2021 4:05 pm
	Lab Number:	2618236.1	2618236.2	2618236.3	2618236.4	2618236.5
Total Recoverable Arsenic	mg/kg dry wt	7	7	5	7	5

	Sample Name:	S2_N_6_100 21-May-2021 4:27 pm
	Lab Number:	2618236.6
Total Recoverable Arsenic	mg/kg dry wt	6

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-6
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	1-6
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-6
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-6

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

Testing was completed on 26-May-2021. 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.

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Client Services Manager - Environmental

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Certificate of Analysis

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2618238 SPv1
Contact:	Dean Sandwell C/- BTW Company Ltd - Hamilton Branch PO Box 551 New Plymouth 4340	**Date Received:**	21-May-2021
		Date Reported:	26-May-2021
		Quote No:	111463
		Order No:	
		Client Reference:	210406
		Submitted By:	Nakeysha Lammers

Sample Type: Soil

	Sample Name:	S3_N_1_100 21-May-2021 3:18 pm	S3_N_2_100 21-May-2021 3:14 pm	S3_N_3_100 21-May-2021 3:22 pm	S3_N_4_100 21-May-2021 2:49 pm	S3_N_5_100 21-May-2021 2:43 pm
	Lab Number:	2618238.1	2618238.2	2618238.3	2618238.4	2618238.5
Total Recoverable Arsenic	mg/kg dry wt	6	6	4	4	5

	Sample Name:	S3_N_6_100 21-May-2021 2:36 pm	S3_11B_100 21-May-2021 2:27 pm			
	Lab Number:	2618238.6	2618238.7			
Total Recoverable Arsenic	mg/kg dry wt	12	30	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-7
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	1-7
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-7
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-7

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

Testing was completed on 26-May-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2613285	A2Pv1
Contact:	Dean Sandwell	**Date Received:**	17-May-2021	
	C/- BTW Company Ltd - Hamilton Branch	**Date Reported:**	19-May-2021	
	PO Box 551	**Quote No:**	111463	
	New Plymouth 4340	**Order No:**		
		Client Reference:	210406	
		Add. Client Ref:	Sampled: 14/05/21	
		Submitted By:	Nakeysha Lammers	

Sample Type: Building Material

Sample Name	Lab Number	Sample Category	Sample Weight on receipt (g)	Asbestos Presence / Absence	Description of Asbestos in Non Homogeneous Samples
S3_1_A	2613285.1	Fibre Cement	13.04	Chrysotile (White Asbestos) detected. Organic fibres detected.	-

Glossary of Terms

- Loose fibres (Minor) - One or two fibres/fibre bundles identified during analysis by stereo microscope/PLM.
- Loose fibres (Major) - Three or more fibres/fibre bundles identified during analysis by stereo microscope/PLM.
- ACM Debris (Minor) - One or two small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
- ACM Debris (Major) - Large (>2mm) piece, or more than three small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
- Unknown Mineral Fibres - Mineral fibres of unknown type detected by polarised light microscopy including dispersion staining. The fibres detected may or may not be asbestos fibres. To confirm the identities, another independent analytical technique may be required.
- Trace - Trace levels of asbestos, as defined by AS4964-2004.

For further details, please contact the Asbestos Team.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Building Material

Test	Method Description	Default Detection Limit	Sample No
Asbestos in Bulk Material			
Sample Category	Assessment of sample type. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	-	1
Sample Weight on receipt	Sample weight. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	0.01 g	1
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1
Description of Asbestos in Non Homogenous Samples	Form, dimensions and/or weight of asbestos fibres present. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1

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

Dates of testing are available on request. 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.

Mahaleel (May) Alfante BSc, PGDipSci
Laboratory Technician - Asbestos

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Certificate of Analysis

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2651414	A2Pv1
Contact:	Dean Sandwell	**Date Received:**	06-Jul-2021	
	C/- BTW Company Ltd - Hamilton Branch	**Date Reported:**	12-Jul-2021	
	PO Box 551	**Quote No:**	112324	
	New Plymouth 4340	**Order No:**		
		Client Reference:	210406	
		Submitted By:	Dean Sandwell	

Sample Type: Soil

Sample Name:		SH1_AS_1_150 06-Jul-2021 2:01 pm	SH1_AS_2_150 06-Jul-2021 1:37 pm	SH1_AS_3_150 06-Jul-2021 1:25 pm	SH1_AS_4_150 06-Jul-2021 1:11 pm	SH1_AS_5_150 06-Jul-2021 12:48 pm
Lab Number:		2651414.1	2651414.2	2651414.3	2651414.4	2651414.5
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Chrysotile (White Asbestos) detected.
Description of Asbestos Form		-	-	-	-	Loose fibres
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
As Received Weight	g	563.0	514.9	620.6	574.4	726.2
Dry Weight	g	386.5	303.6	419.8	419.8	626.4
Moisture	%	31	41	32	27	14
Sample Fraction >10mm	g dry wt	65.0	4.1	38.0	5.7	36.6
Sample Fraction <10mm to >2mm	g dry wt	94.1	34.8	67.5	68.2	339.2
Sample Fraction <2mm	g dry wt	226.9	264.0	313.7	345.8	250.3
<2mm Subsample Weight	g dry wt	52.7	50.6	52.9	57.2	58.2
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	0.00026

Sample Name:		SH1_AS_6_150 06-Jul-2021 2:52 pm	SH1_AS_7_150 06-Jul-2021 2:42 pm			
Lab Number:		2651414.6	2651414.7			
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	-	-	-
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
As Received Weight	g	561.5	592.1	-	-	-
Dry Weight	g	312.4	440.0	-	-	-

Sample Type: Soil						
Sample Name:		SH1_AS_6_150 06-Jul-2021 2:52 pm	SH1_AS_7_150 06-Jul-2021 2:42 pm			
Lab Number:		2651414.6	2651414.7			
Moisture	%	44	26	-	-	-
Sample Fraction >10mm	g dry wt	11.5	8.6	-	-	-
Sample Fraction <10mm to >2mm	g dry wt	34.4	45.1	-	-	-
Sample Fraction <2mm	g dry wt	266.2	386.0	-	-	-
<2mm Subsample Weight	g dry wt	56.9	58.6	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	-	-	-

Glossary of Terms

• Loose fibres (Minor) - One or two fibres/fibre bundles identified during analysis by stereo microscope/PLM.
• Loose fibres (Major) - Three or more fibres/fibre bundles identified during analysis by stereo microscope/PLM.
• ACM Debris (Minor) - One or two small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
• ACM Debris (Major) - Large (>2mm) piece, or more than three small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
• Unknown Mineral Fibres - Mineral fibres of unknown type detected by polarised light microscopy including dispersion staining. The fibres detected may or may not be asbestos fibres. To confirm the identities, another independent analytical technique may be required.
• Trace - Trace levels of asbestos, as defined by AS4964-2004.
For further details, please contact the Asbestos Team.

Please refer to the BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil.
https://www.branz.co.nz/asbestos

The following assumptions have been made:

1. Asbestos Fines in the <2mm fraction, after homogenisation, is evenly distributed throughout the fraction
2. The weight of asbestos in the sample is unaffected by the ashing process.

Results are representative of the sample provided to Hill Laboratories only.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Wgt of Asbestos as Asbestos Fines in <10mm >2mm Fraction*	Measurement on analytical balance, from the <10mm >2mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g dry wt	1-7
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-7
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-7
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1-7
Sample Fraction >10mm	Sample dried at 100 to 105°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-7
Sample Fraction <10mm to >2mm	Sample dried at 100 to 105°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-7
Sample Fraction <2mm	Sample dried at 100 to 105°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-7
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1-7

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1-7
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-7
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-7
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-7
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-7
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-7
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-7
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-7

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

Testing was completed on 12-Jul-2021. 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.

John Keneth Paglingayen BApSc
Laboratory Technician - Asbestos

Hill Laboratories
TRIED, TESTED AND TRUSTED

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Hornby
Christchurch 8042 New Zealand

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T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2652570	A2Pv1
Contact:	Dean Sandwell	**Date Received:**	08-Jul-2021	
	C/- BTW Company Ltd - Hamilton Branch	**Date Reported:**	12-Jul-2021	
	PO Box 551	**Quote No:**	112324	
	New Plymouth 4340	**Order No:**		
		Client Reference:	210406	
		Submitted By:	Dean Sandwell	

Sample Type: Soil

Sample Name:		SH2-AS-1-150 06-Jul-2021 11:41 am	SH2-AS-2-150 06-Jul-2021 12:07 pm	SH2-AS-3-150 06-Jul-2021 11:53 am	SH2-AS-4-150 06-Jul-2021 11:28 am	
Lab Number:		2652570.1	2652570.2	2652570.3	2652570.4	
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	-
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
As Received Weight	g	575.8	525.2	505.4	524.4	-
Dry Weight	g	371.0	314.6	295.7	303.0	-
Moisture	%	36	40	41	42	-
Sample Fraction >10mm	g dry wt	7.0	< 0.1	< 0.1	< 0.1	-
Sample Fraction <10mm to >2mm	g dry wt	76.8	78.5	61.3	72.8	-
Sample Fraction <2mm	g dry wt	286.1	234.9	233.3	229.1	-
<2mm Subsample Weight	g dry wt	53.7	52.0	55.6	52.2	-
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-

Glossary of Terms
• Loose fibres (Minor) - One or two fibres/fibre bundles identified during analysis by stereo microscope/PLM.
• Loose fibres (Major) - Three or more fibres/fibre bundles identified during analysis by stereo microscope/PLM.
• ACM Debris (Minor) - One or two small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
• ACM Debris (Major) - Large (>2mm) piece, or more than three small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
• Unknown Mineral Fibres - Mineral fibres of unknown type detected by polarised light microscopy including dispersion staining. The fibres detected may or may not be asbestos fibres. To confirm the identities, another independent analytical technique may be required.
• Trace - Trace levels of asbestos, as defined by AS4964-2004.
For further details, please contact the Asbestos Team.

Please refer to the BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil.
https://www.branz.co.nz/asbestos

The following assumptions have been made:

1. Asbestos Fines in the <2mm fraction, after homogenisation, is evenly distributed throughout the fraction
2. The weight of asbestos in the sample is unaffected by the ashing process.

Results are representative of the sample provided to Hill Laboratories only.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Wgt of Asbestos as Asbestos Fines in <10mm >2mm Fraction*	Measurement on analytical balance, from the <10mm >2mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g dry wt	1-4
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-4
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-4
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1-4
Sample Fraction >10mm	Sample dried at 100 to 105°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-4
Sample Fraction <10mm to >2mm	Sample dried at 100 to 105°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-4
Sample Fraction <2mm	Sample dried at 100 to 105°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-4
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1-4
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1-4
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-4
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-4
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-4
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-4
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-4

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-4
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-4

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

Testing was completed on 12-Jul-2021. 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.

Rhodri Williams BSc (Hons)
Technical Manager - Asbestos

Hill Laboratories
TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2651410	SPv1
Contact:	Dean Sandwell	**Date Received:**	06-Jul-2021	
	C/- BTW Company Ltd - Hamilton Branch	**Date Reported:**	09-Jul-2021	
	PO Box 551	**Quote No:**	112324	
	New Plymouth 4340	**Order No:**		
		Client Reference:	210406	
		Submitted By:	Nakeysha Lammers	

Sample Type: Soil

	Sample Name:	Pb-1-150 06-Jul-2021 11:44 am	Pb-2-150 06-Jul-2021 12:06 pm	Pb-3-150 06-Jul-2021 11:55 am	Pb-4-150 06-Jul-2021 11:30 am	
	Lab Number:	2651410.5	2651410.6	2651410.7	2651410.8	
Total Recoverable Lead	mg/kg dry wt	28	22	22	17.8	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	5-8
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	5-8
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	5-8
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	5-8

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

Testing was completed on 09-Jul-2021. 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.

Carole Rodgers-Carroll BA, NZCS
Client Services Manager - Environmental

APPENDIX C STATISTICAL DATA ANALYSIS

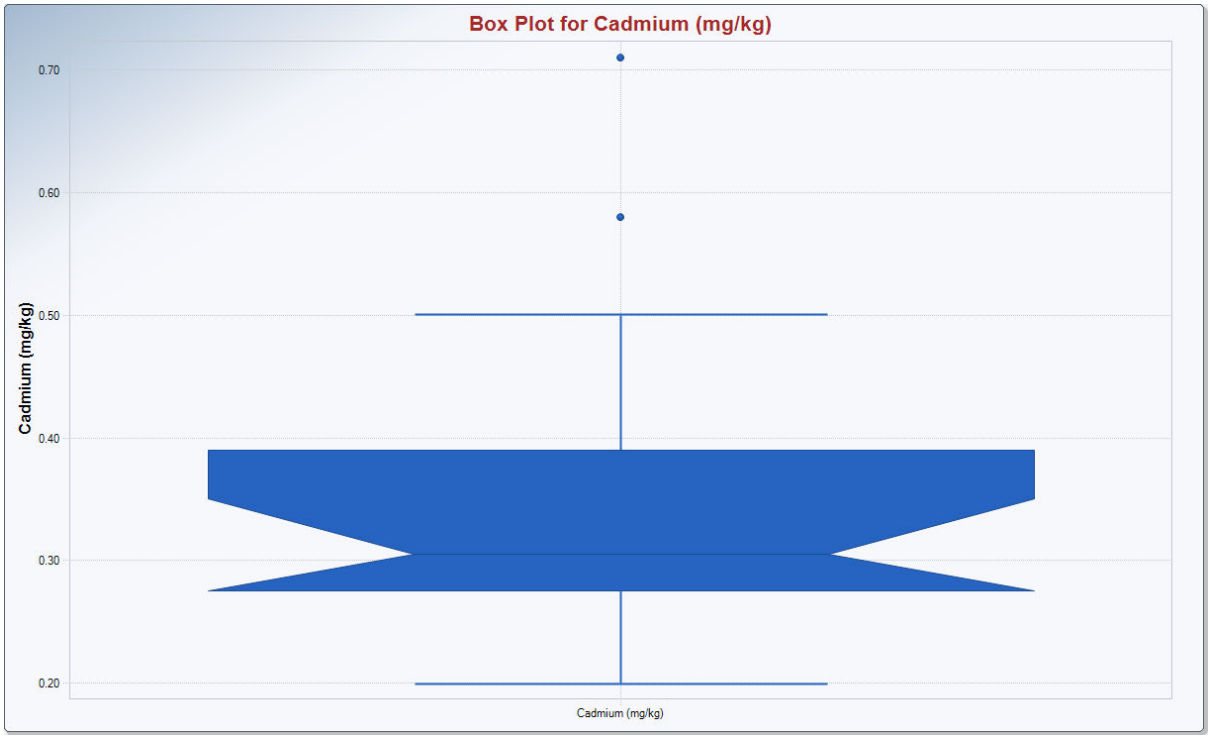

Figure C 1: Cadmium boxplot.

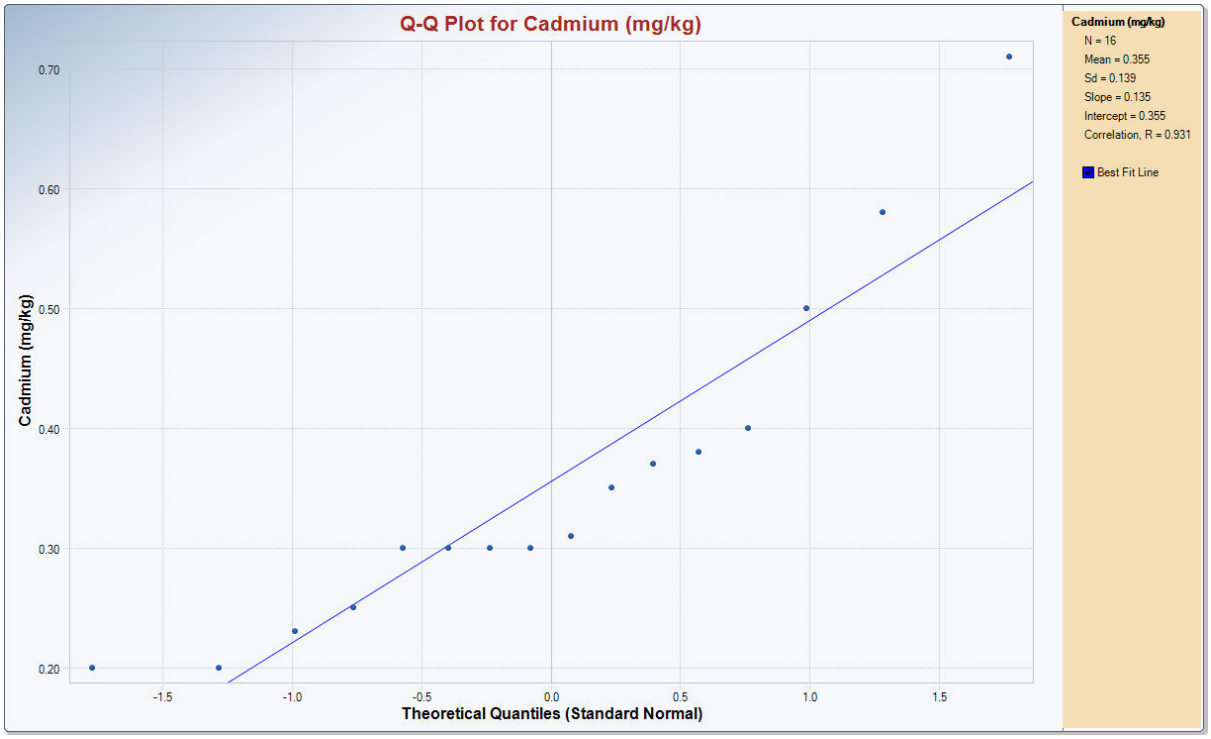

Figure C 2: Quantile-quantile plot for cadmium.

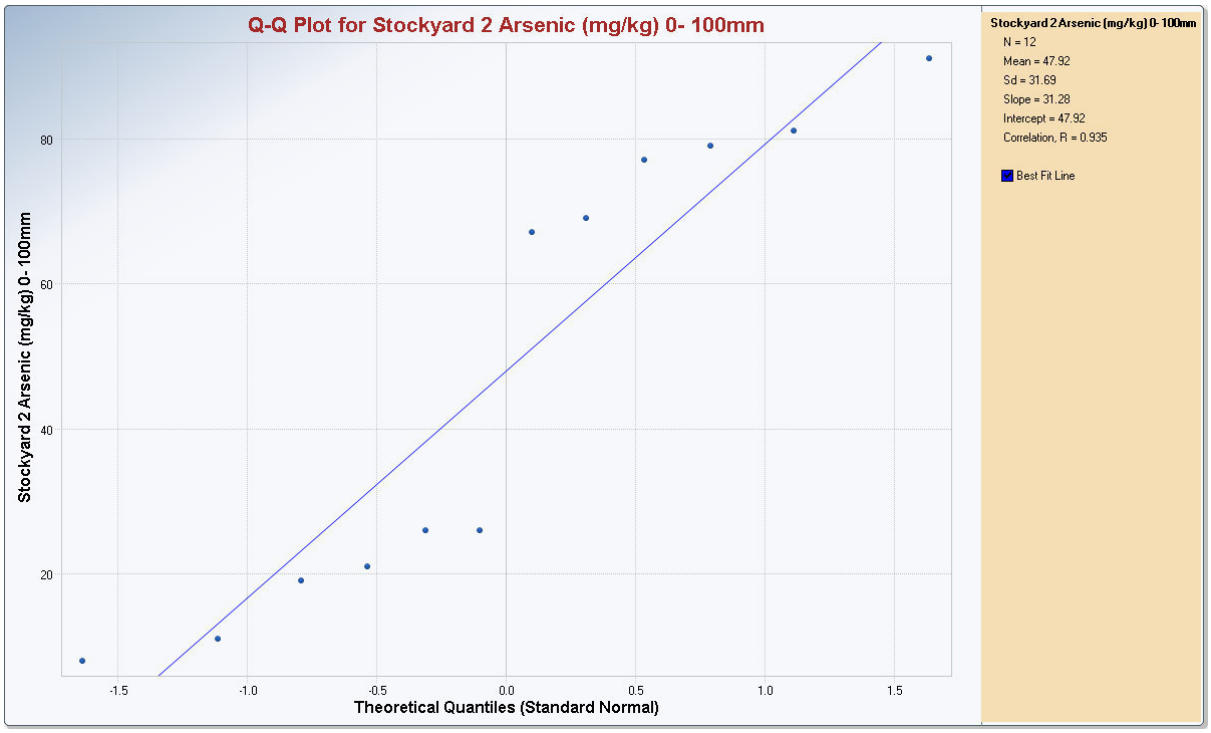

Figure C 3: Quantile-quantile plot for arsenic 0 - 100 mm at Stockyard 2.

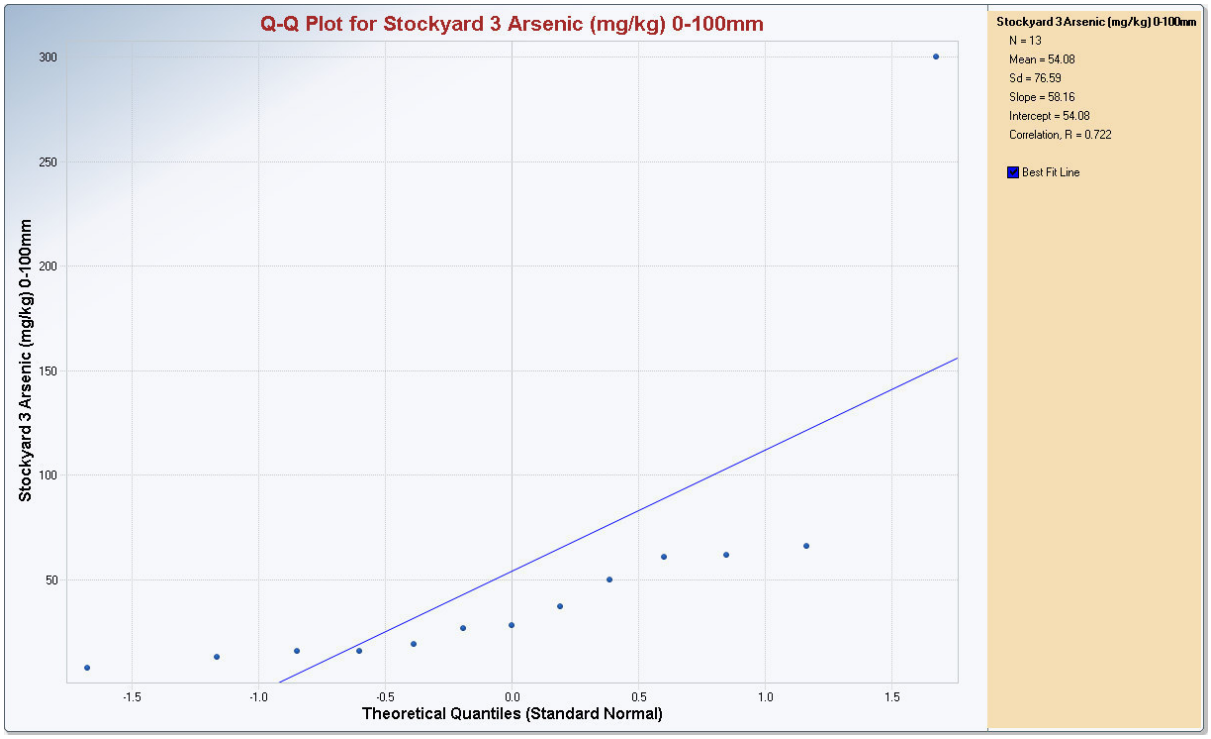

Figure C 4: Quantile-quantile plot for arsenic 0 - 100 mm at Stockyard 3.

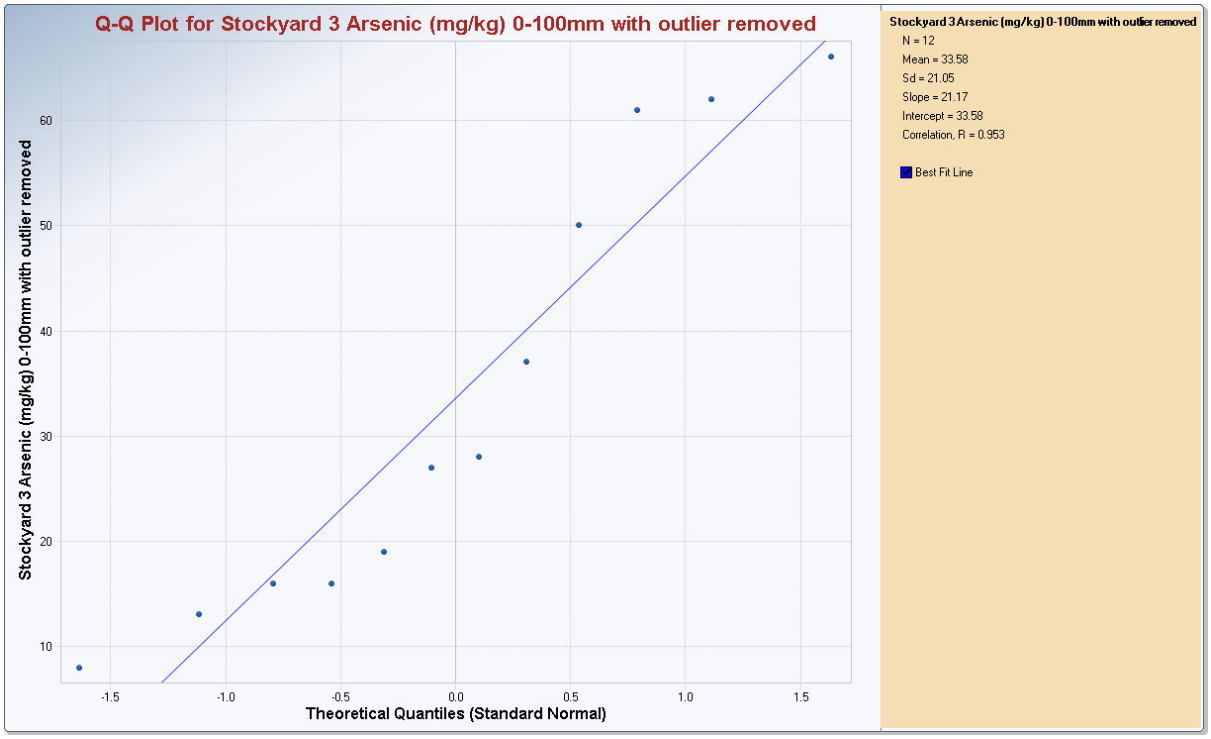

Figure C 5: Quantile-quantile plot for arsenic 0 - 100 mm at Stockyard 3 with outlier removed.

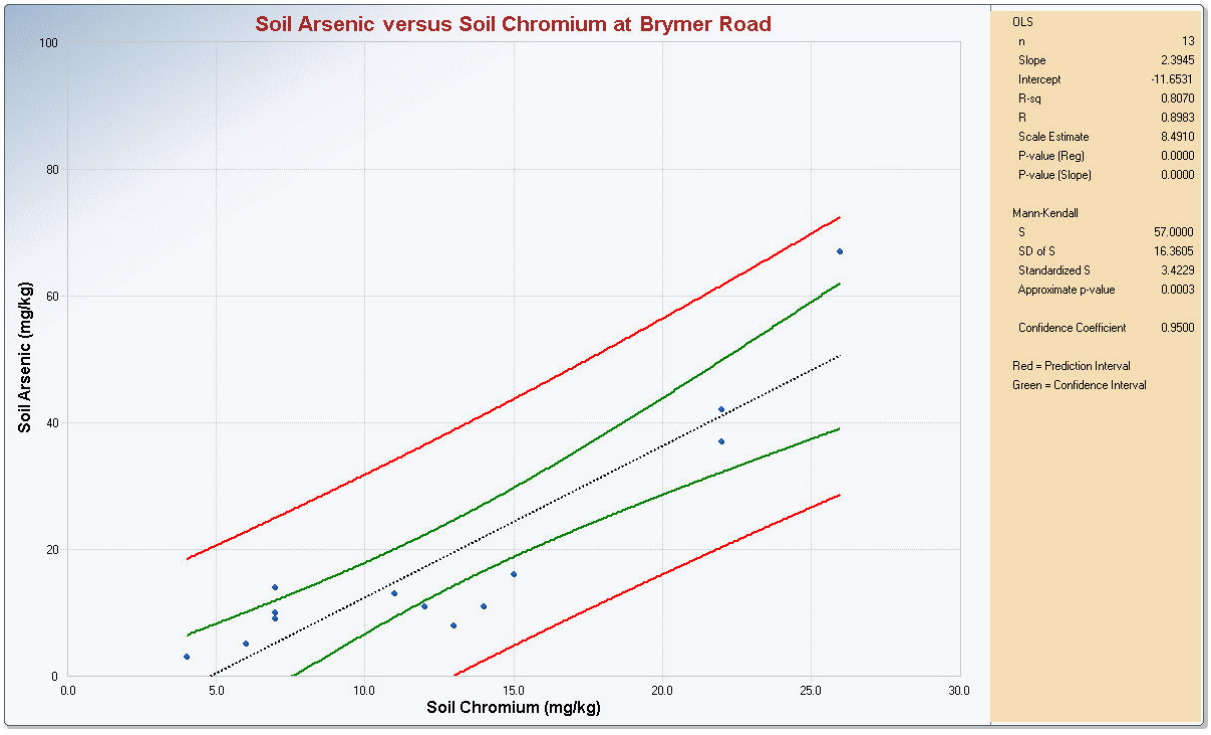

Figure C 6: Arsenic versus chromium linear regression.

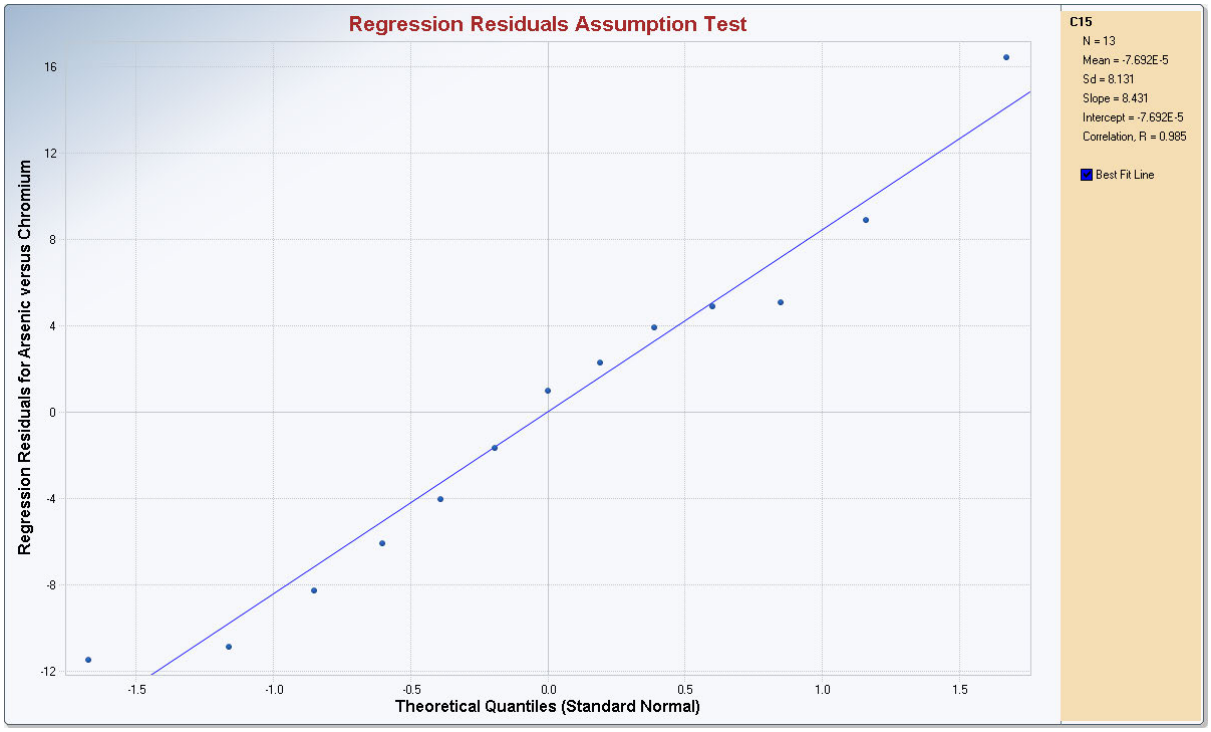

Figure C 7: Arsenic versus chromium linear regression residuals quantile-quantile plot.

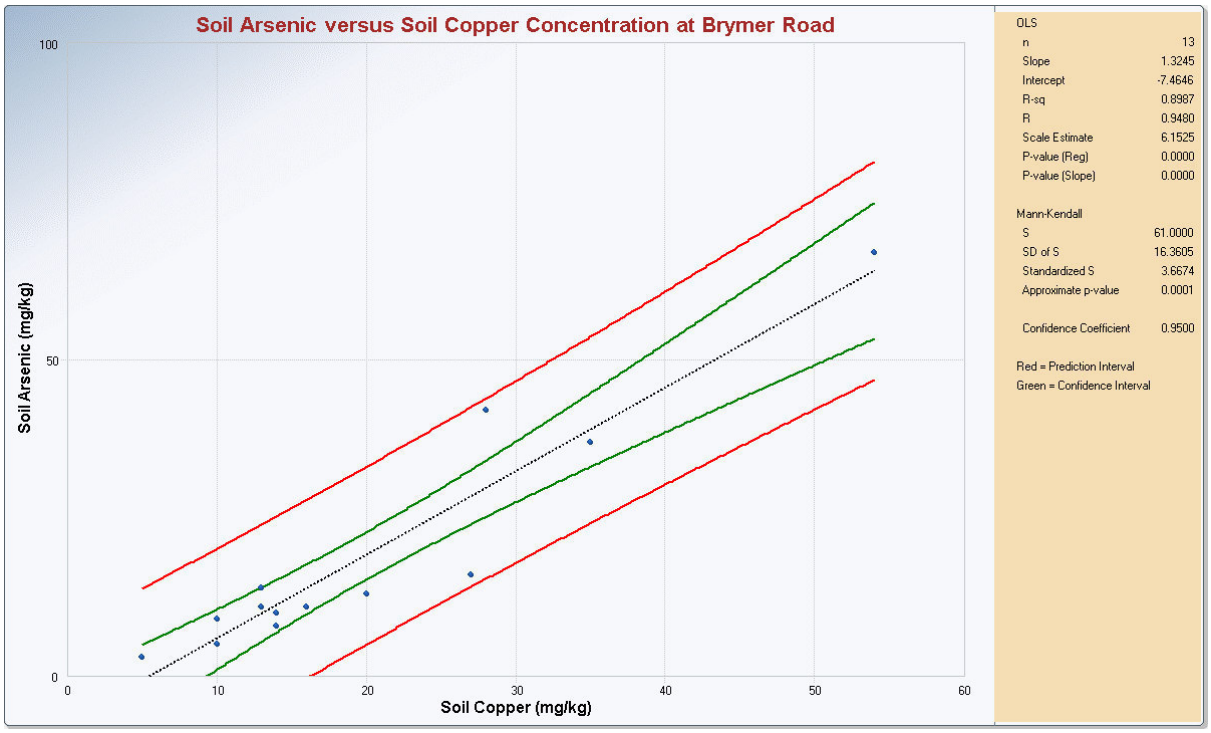

Figure C 8: Arsenic versus copper linear regression.

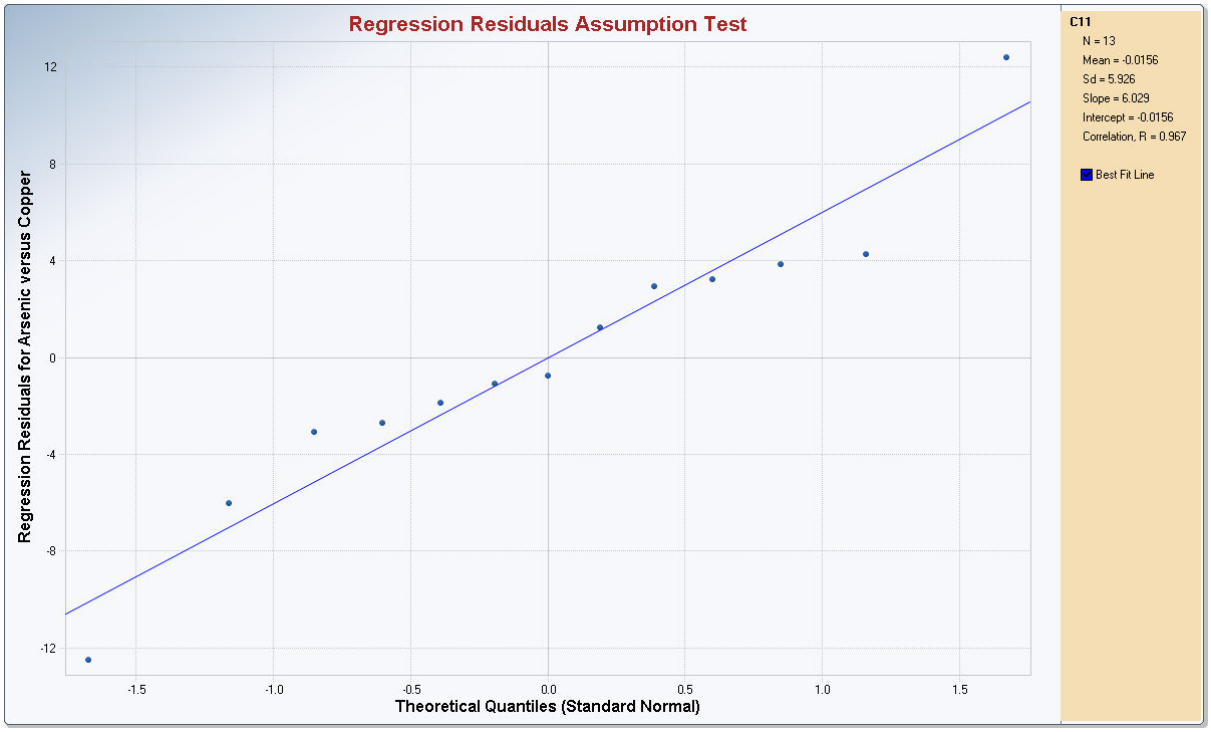

Figure C 9: Arsenic versus copper linear regression residuals quantile-quantile plot.

APPENDIX D SOIL SAMPLING CHAIN OF CUSTODY

Hill Laboratories
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

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

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

Job No: **261 3284**
Date Recv: 17-May-21 09:01
Received by: Simon Argent

3126132842

Quote No 111463

Primary Contact Dean Sandwell 268298

Submitted By Nakeysha Lammers 272946

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile*

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

- [x] Email Primary s 9(2)(a)
- [ ] 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 Laboratories
- [x] *Tick if you require COC to be emailed back*

Date & Time: 17/5/21
Name: Nakeysha Lammers
Signature: Lammers

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

Condition *Temp:* 7.4
- [ ] Room Temp
- [ ] Chilled
- [ ] Frozen

- [ ] Sample & Analysis details checked

Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

All samples collected 14/05/2021

Priority
- [ ] Low
- [ ] Normal
- [x] 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)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	Cd_1_150	1700	SOIL	CdRs, pH
2	Cd_2_150	1641		
3	Cd_3_150	1328		
4	Cd_4_150	1147		
5	Cd_5_150	1326		
6	Cd_6_150	1246		
7	Cd_7_150	1326		
8	Cd_8_150	1119		
9	Cd_9_150	0836		
10	Cd_10_150	0905	SOIL	Cd Rs, pH

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

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

Job Information Summary

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2613284
Contact:	Dean Sandwell	**Date Registered:**	17-May-2021 10:54 am
	C/- BTW Company Ltd - Hamilton Branch	**Priority:**	High
	PO Box 551	**Quote No:**	111463
	New Plymouth 4340	**Order No:**	
		Client Reference:	210406
		Add. Client Ref:	
		Submitted By:	Nakeysha Lammers
		Charge To:	BTW Company Limited
		Target Date:	24-May-2021 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	Cd-1-150 14-May-2021 5:00 pm	Soil	PSoil500	Total Recoverable Cadmium; pH
2	Cd-2-150 14-May-2021 4:41 pm	Soil	PSoil500	Total Recoverable Cadmium; pH
3	Cd-3-150 14-May-2021 1:28 pm	Soil	PSoil500	Total Recoverable Cadmium; pH
4	Cd-4-150 14-May-2021 11:47 am	Soil	PSoil500	Total Recoverable Cadmium; pH
5	Cd-5-150 14-May-2021 1:26 pm	Soil	PSoil500	Total Recoverable Cadmium; pH
6	Cd-6-150 14-May-2021 12:46 pm	Soil	PSoil500	Total Recoverable Cadmium; pH
7	Cd-7-150 14-May-2021 1:26 pm	Soil	PSoil500	Total Recoverable Cadmium; pH
8	Cd-8-150 14-May-2021 11:19 am	Soil	PSoil500	Total Recoverable Cadmium; pH
9	Cd-9-150 14-May-2021 8:36 am	Soil	PSoil500	Total Recoverable Cadmium; pH
10	Cd-10-150 14-May-2021 9:05 am	Soil	PSoil500	Total Recoverable Cadmium; pH

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-10
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	1-10
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-10
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-10
Total Recoverable Cadmium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.10 mg/kg dry wt	1-10
pH	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-10

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ANALYSIS REQUEST

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

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job No: **261 3286**
Date Recv: 17-May-21 09:01
Received by: Simon Argent

Quote No 111463

Primary Contact Dean Sandwell 268298

Submitted By Nakeysha Lammers 272946

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile*

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

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 s 9(2)(a)
☐ 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 Laboratories
☑ *Tick if you require COC to be emailed back*
Date & Time: 17/5/21
Name: Nakeysha Lammers
Signature: Lams

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

Condition ☐ Room Temp ☐ Chilled ☐ Frozen *Temp:* 7.4

☐ Sample & Analysis details checked
Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

All samples collected 14/5/21

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)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	PH_1_150	12:23	SOIL	pH
2	PH_2_150	12:34	〃	〃
3	PH_3_150	1241	〃	〃
4	PH_4_150	1714	〃	〃
5	PH_5_150	1712	〃	〃
6	PH_6_150	1720	SOIL	pH
7				
8				
9				
10				

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Private Bag 3205
Hamilton 3240 New Zealand

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job Information Summary

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2613286
Contact:	Dean Sandwell	**Date Registered:**	17-May-2021 10:49 am
	C/- BTW Company Ltd - Hamilton Branch	**Priority:**	High
	PO Box 551	**Quote No:**	111463
	New Plymouth 4340	**Order No:**	
		Client Reference:	210406
		Add. Client Ref:	
		Submitted By:	Nakeysha Lammers
		Charge To:	BTW Company Limited
		Target Date:	24-May-2021 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	pH-1-150 14-May-2021 12:23 pm	Soil	PSoil500	pH
2	pH-2-150 14-May-2021 12:34 pm	Soil	PSoil500	pH
3	pH-3-150 14-May-2021 12:41 pm	Soil	PSoil500	pH
4	pH-4-150 14-May-2021 5:14 pm	Soil	PSoil500	pH
5	pH-5-150 14-May-2021 5:12 pm	Soil	PSoil500	pH
6	pH-6-150 14-May-2021 5:20 pm	Soil	PSoil500	pH

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-6
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-6
pH	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-6

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ANALYSIS REQUEST

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Hamilton 3240 New Zealand

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job No: **261 3287**
Date Recv: 17-May-21 09:01
Received by: Simon Argent
3126132879

Quote No 111463

Primary Contact Dean Sandwell 268298

Submitted By Nakeysha Lammers 272946

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

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 s 9(2)(a)
☐ 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 Laboratories
☑ *Tick if you require COC to be emailed back*
Date & Time: 17/05/21
Name: Dean Sandwell
Signature:

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

Condition ☐ Room Temp ☐ Chilled ☐ Frozen *Temp:* 8.1

☐ Sample & Analysis details checked
Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

Soil

All samples collected 14/5/21

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)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	S2_1_100	14/5/21	0752	HM_s SOIL, OCP_sc
2	S2_1_300		0803	HM_s SOIL, OCP_sc
3	S2_2_100		1004	As Rs, OCP_sc
4	S2_3_100		1012	
5	S2_3_300		1016	
6	S2_4_100	14/5/21	0816	
7	~~S2_4_100~~			
8	S2_5_100	14/5/21	1026	
9	S2_5_300	14/5/21	1030	
10	S2_6_100	14/5/21	1044	As Rs, OCP_sc

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ANALYSIS REQUEST

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Office use only (Job No)

Quote No 111463

Primary Contact Dean Sandwell 268298

Submitted By Nakeysha Lammers 272946

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

Order No

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- [x] Email Primary Contact
- [x] Email Submitter
- [ ] Email Client
- [ ] Email Other s 9(2)(a)
- [ ] Other

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CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories
- [x] *Tick if you require COC to be emailed back*

Date & Time: 17/05/21
Name: Nakeysha Lammers
Signature: Nlammers

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

Condition *Temp:*
- [ ] Room Temp
- [ ] Chilled
- [ ] Frozen

- [ ] Sample & Analysis details checked

Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

Soil

All samples collected 14/5/21

Priority
- [ ] Low
- [ ] Normal
- [x] 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)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	S2_7_100	14/5/21	0823	As_R, OCP_{SC}
2	S2_7_300		1051	
3	S2_8_100		1056	
4	S2_9_100		1101	
5	S2_9_300		1121	
6	S2_10_100		0829	
7	S2_11_100		0845	
8	S2_11_300		1113	
9	S2_12_100		0852	As_R, OCP_{SC}
10	S2_13_100	14/5/21	0906	HM_S SOIL, OCP_{SC}

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Office use only (Job No)

Quote No 111463

Primary Contact Dean Sandwell 268298

Submitted By Nakeysha Lammers 272946

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

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☐ Email Other s 9(2)(a)
☐ Other

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CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories ☑ *Tick if you require COC to be emailed back*
Date & Time: 17/05/21
Name: Nakeysha Lammers
Signature: [signature]

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

Condition ☐ Room Temp ☐ Chilled ☐ Frozen *Temp:*

☐ Sample & Analysis details checked
Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

Soil

All samples collected 14/5/21

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)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	S2_14_100	14/5/21	0912	HM$_s$ SOIL OCP$_{sc}$
2	S2_15_100		0948	HM$_s$ SOIL OCP$_{sc}$
3	S2_16_100		0943	HM$_s$ SOIL OCP$_{sc}$
4	~~S2_UN~~		~~0~~	~~HM$_s$ SOIL, OCP$_{sc}$~~
5	S1_1_100		1334	HM$_s$ SOIL OCP$_{sc}$
6	S1_1_300		1338	
7	S1_2_100		1342	
8	S1_2_300		1349	
9	S1_3_100		1354	HM$_s$ SOIL OCP$_{sc}$
10	S3_1_100	14/5/21	1551	As$_s$ Rs, OCP$_{sc}$

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Office use only (Job No)

Quote No 111463

Primary Contact Dean Sandwell 268298

Submitted By Nakeysha Lammers 272946

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

Order No

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☑ Email Primary Contact ☐ Email Submitter ☐ Email Client
☐ Email Other s 9(2)(a)
☐ Other

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CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories
☑ *Tick if you require COC to be emailed back*
Date & Time: 17/5/21
Name: Nakeysha Lammers
Signature: Lammas

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

Condition ☐ Room Temp ☐ Chilled ☐ Frozen *Temp:*

☐ Sample & Analysis details checked
Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

All samples collected on 14/5/21

Soil

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)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	S3_3_100	1544	SOIL	As_S, Rs_S, OCP_{SC}
2	S3_2_100	1551	SOIL	B
3	S3_2_300	1559		
4	S3_6_100	1540		
5	S3_7_100	1534		
6	S3_8_100	1537		
7	S3_8_300	1541		
8	S3_9_100	1526		
9	S3_11_100	1528		
10	S3_12_100	1524	SOIL	As_S, Rs_S, OCP_{SC}

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ANALYSIS REQUEST

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W www.hill-laboratories.com

Office use only (Job No)

Quote No 111463

Primary Contact Dean Sandwell 268298

Submitted By Nakeysha Lammers 272946

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

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 s 9(2)(a)
☐ 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

All samples collected 14/05/21

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories
☑ *Tick if you require COC to be emailed back*
Date & Time: 17/5/21
Name: Nakeysha Lammers
Signature:

Received at Hill Laboratories
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)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	S3_15_100	1559	SOIL	As Fs, OCPsc
2	S3_16_100	1610		As Fs, OCPsc
3	S3A_100	1613		As Fs, OCPsc
4	S3A_300	1620		As Fs, OCPsc
5	S3B_100	1635		HMs SOIL, OCPsc
6	S3B_300	1636	SOIL	HMs SOIL, OCPsc
7				
8				
9				
10				

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Hamilton 3240 New Zealand

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job Information Summary

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2613287
Contact:	Dean Sandwell	**Date Registered:**	17-May-2021 12:25 pm
	C/- BTW Company Ltd - Hamilton Branch	**Priority:**	High
	PO Box 551	**Quote No:**	111463
	New Plymouth 4340	**Order No:**	
		Client Reference:	210406
		Add. Client Ref:	
		Submitted By:	Nakeysha Lammers
		Charge To:	BTW Company Limited
		Target Date:	19-May-2021 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	S2_1_100 14-May-2021 7:52 am	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
2	S2_1_300 14-May-2021 8:03 am	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
3	S2_2_100 14-May-2021 10:04 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
4	S2_3_100 14-May-2021 10:12 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
5	S2_3_300 14-May-2021 10:16 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
6	S2_4_100 14-May-2021 8:16 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
7	S2_5_100 14-May-2021 10:26 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
8	S2_5_300 14-May-2021 10:30 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
9	S2_6_100 14-May-2021 10:44 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
10	S2_7_100 14-May-2021 8:23 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
11	S2_7_300 14-May-2021 10:51 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
12	S2_8_100 14-May-2021 10:56 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
13	S2_9_100 14-May-2021 11:01 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
14	S2_9_300 14-May-2021 11:21 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
15	S2_10_100 14-May-2021 8:29 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
16	S2_11_100 14-May-2021 8:45 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
17	S2_11_300 14-May-2021 11:13 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
18	S2_12_100 14-May-2021 8:52 am	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
19	S2_13_100 14-May-2021 9:06 am	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
20	S2_14_100 14-May-2021 9:12 am	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
21	S2_15_100 14-May-2021 9:48 am	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
22	S2_16_100 14-May-2021 9:43 am	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
23	S1_1_100 14-May-2021 1:34 pm	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
24	S1_1_300 14-May-2021 1:38 pm	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
25	S1_2_100 14-May-2021 1:42 pm	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
26	S1_2_300 14-May-2021 1:49 pm	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
27	S1_3_100 14-May-2021 1:54 pm	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
28	S3_1_100 14-May-2021 3:51 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
29	S3_3_100 14-May-2021 3:44 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
30	S3_2_100 14-May-2021 3:51 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
31	S3_2_300 14-May-2021 3:59 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
32	S3_6_100 14-May-2021 3:40 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
33	S3_7_100 14-May-2021 3:34 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
34	S3_8_100 14-May-2021 3:37 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
35	S3_8_300 14-May-2021 3:41 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
36	S3_9_100 14-May-2021 3:26 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
37	S3_11_100 14-May-2021 3:28 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
38	S3_12_100 14-May-2021 3:24 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
39	S3_15_100 14-May-2021 3:59 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
40	S3_16_100 14-May-2021 4:10 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
41	S3A_100 14-May-2021 4:13 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
42	S3A_300 14-May-2021 4:20 pm	Soil	GSoil300	Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
43	S3B_100 14-May-2021 4:35 pm	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
44	S3B_300 14-May-2021 4:36 pm	Soil	GSoil300	Heavy Metals, Screen Level; 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 Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-44
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	3-18, 28-42
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	1-2, 19-27, 43-44
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	1-44

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-44
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	3-18, 28-42
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	3-18, 28-42

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ANALYSIS REQUEST

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

T 0508 HILL LAB (44 555 2
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job No: **261 3529**

Date Recv: 17-May-21 12:10

Received by: Sarah Marsh

3126135294

Quote No 111463

Primary Contact Dean Sandwell 268298

Submitted By Nakeysha Lammers 272946

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

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 s 9(2)(a)
☐ 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 Laboratories
☑ *Tick if you require COC to be emailed back*
Date & Time: 17/5/21
Name: Nakeysha Lammers
Signature: Lammers

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

Condition ☐ Room Temp ☐ Chilled ☐ Frozen *Temp:* 8.1

☐ Sample & Analysis details checked
Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

All samples collected
14/5/21

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)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	HO_1_150	0925	SOIL	HMs SOIL, OCPsc
2	HO_2_150	0957		
3	HO_3_150	1024		
4	HO_4_150	1052		
5	HO_5_150	1421		
6	HO_6_150	1700		HMs SOIL, OCPsc
7	~~HO_7_150~~	~~=~~	~~SOIL~~	~~HMs SOIL~~
8	HO_8_150	1001	SOIL	HMs SOIL
9	HO_DRAIN_1	1452	SOIL	HMs SOIL, OCPsc
10				

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

T 0508 HILL LAB (44 555 22)
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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job Information Summary

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2613529
Contact:	Dean Sandwell	**Date Registered:**	17-May-2021 12:35 pm
	C/- BTW Company Ltd - Hamilton Branch	**Priority:**	High
	PO Box 551	**Quote No:**	111463
	New Plymouth 4340	**Order No:**	
		Client Reference:	210406
		Add. Client Ref:	
		Submitted By:	Nakeysha Lammers
		Charge To:	BTW Company Limited
		Target Date:	19-May-2021 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	HO_1_150 14-May-2021 9:25 am	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
2	HO_2_150 14-May-2021 9:57 am	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
3	HO_3_150 14-May-2021 10:24 am	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
4	HO_4_150 14-May-2021 10:52 am	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
5	HO_5_150 14-May-2021 2:21 pm	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
6	HO_6_150 14-May-2021 5:00 pm	Soil	GSoil300	Heavy Metals, Screen Level; Organochlorine Pesticides Screening in Soil
7	HO_8_150 14-May-2021 10:01 am	Soil	GSoil300	Heavy Metals, Screen Level
8	HO_DRAIN_1 14-May-2021 2:52 pm	Soil	GSoil300	Heavy Metals, Screen Level; 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 Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-8
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	1-8
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	1-6, 8
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-6, 8

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ANALYSIS REQUEST

Job No: 261 3285 Date Recv: 17-May-21 09:01

R J Hill Laboratories Limited
28 Duke Street Frankton 32
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Received by: Simon Argent

3126132855

Quote No 111463

Primary Contact Dean Sandwell 268298

Submitted By Nakeysha Lammers 272946

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

- [x] Email Primary Contact
- [x] Email Submitter
- [ ] Email Client
- [ ] Email Other s 9(2)(a)
- [ ] 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 Laboratories
- [x] *Tick if you require COC to be emailed back*

Date & Time: 17/5/2021
Name: Nakeysha Lammers
Signature: Lamm

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

Condition *Temp:*
- [ ] Room Temp
- [ ] Chilled
- [ ] Frozen

- [ ] Sample & Analysis details checked

Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

Sample taken 16/05/2021

Priority
- [ ] Low
- [ ] Normal
- [x] 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)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	S3_1_A	1610	BM	Asbestos Presence/Absence
2				
3				
4				
5				
6				
7				
8				
9				
10				

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

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

Job Information Summary

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2613285
Contact:	Dean Sandwell	**Date Registered:**	18-May-2021 11:23 am
	C/- BTW Company Ltd - Hamilton Branch	**Priority:**	High
	PO Box 551	**Quote No:**	111463
	New Plymouth 4340	**Order No:**	
		Client Reference:	210406
		Add. Client Ref:	Sampled: 14/05/21
		Submitted By:	Nakeysha Lammers
		Charge To:	BTW Company Limited
		Target Date:	19-May-2021 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	S3_1_A	Building Material	cpzBag2	Asbestos in Bulk Material

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Building Material

Test	Method Description	Default Detection Limit	Sample No
Asbestos in Bulk Material			
Sample Category	Assessment of sample type. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	-	1
Sample Weight on receipt	Sample weight. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	0.01 g	1
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1
Description of Asbestos in Non Homogenous Samples	Form, dimensions and/or weight of asbestos fibres present. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1

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ANALYSIS REQUEST

Job No: **261 8238** Date Recv: 21-May-21 17:07

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

T 0508 HILL LAB (44 555 22
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Received by: Reshmi Kumar

3126182381

Quote No 111463

Primary Contact Dean Sandwell 268298

Submitted By Nakeysha Lammers 272946

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

- [x] Email Primary Contact
- [x] Email Submitter
- [ ] Email Client
- [x] Email Other s 9(2)(a)
- [ ] 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 Laboratories
- [x] *Tick if you require COC to be emailed back*

Date & Time: 21/05/21 5:00PM
Name: Nakeysha Lammers
Signature: Lammers

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

Condition *Temp:* 16.9
- [ ] Room Temp
- [ ] Chilled
- [ ] Frozen
- [ ] Sample & Analysis details checked

Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

Soil arsenic all collected on 21/05/2021

Priority
- [ ] Low
- [ ] Normal
- [x] 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)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	S3_N_1_100	3:18PM	SOIL	Total Recoverable Arsenic As Rs
2	S3_N_2_100	3:14PM		
3	S3_N_3_100	3:22PM		
4	S3_N_4_100	2:49PM		
5	S3_N_5_100	2:43PM		
6	S3_N_6_100	2:36PM		
7	S3_11B_100	2:27PM	SOIL	Total Recoverable Arsenic As R
8				
9				
10				

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

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job Information Summary

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2618238
Contact:	Dean Sandwell	**Date Registered:**	22-May-2021 7:52 am
	C/- BTW Company Ltd - Hamilton Branch	**Priority:**	High
	PO Box 551	**Quote No:**	111463
	New Plymouth 4340	**Order No:**	
		Client Reference:	210406
		Add. Client Ref:	
		Submitted By:	Nakeysha Lammers
		Charge To:	BTW Company Limited
		Target Date:	26-May-2021 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	S3_N_1_100 21-May-2021 3:18 pm	Soil	GSoil300	Total Recoverable Arsenic
2	S3_N_2_100 21-May-2021 3:14 pm	Soil	GSoil300	Total Recoverable Arsenic
3	S3_N_3_100 21-May-2021 3:22 pm	Soil	GSoil300	Total Recoverable Arsenic
4	S3_N_4_100 21-May-2021 2:49 pm	Soil	GSoil300	Total Recoverable Arsenic
5	S3_N_5_100 21-May-2021 2:43 pm	Soil	GSoil300	Total Recoverable Arsenic
6	S3_N_6_100 21-May-2021 2:36 pm	Soil	GSoil300	Total Recoverable Arsenic
7	S3_11B_100 21-May-2021 2:27 pm	Soil	GSoil300	Total Recoverable Arsenic

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-7
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	1-7
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-7
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-7

Hill Laboratories
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ANALYSIS REQUEST

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

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

Job No: **261 8236**
Date Recv: 21-May-21 17:05
Received by: Reshmi Kumar

3126182367

Quote No 111463

Primary Contact Dean Sandwell 268298

Submitted By Nakeysha Lammers 272946

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

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 s 9(2)(a)
☐ 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 Laboratories
Date & Time: 21/05/21 5:00pm
Name: Nakeysha Lammers
Tick if you require COC to be emailed back
Signature: Lamms

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

Condition ☐ Room Temp ☐ Chilled ☐ Frozen *Temp:* 15.7

☐ Sample & Analysis details checked
Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

Soil arsenic all collected on 21/05/2021

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)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	S2_N_1_100	3:54pm	SOIL	Total Recoverable Arsenic AsRs
2	S2_N_2_100	4:14pm		
3	S2_N_3_100	4:00pm		
4	S2_N_4_100	4:37pm		
5	S2_N_5_100	4:05pm		
6	S2-N-6_100	4:27pm	SOIL	Total Recoverable Arsenic AsRs
7				
8				
9				
10				

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

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

Job Information Summary

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2618236
Contact:	Dean Sandwell	**Date Registered:**	22-May-2021 7:49 am
	C/- BTW Company Ltd - Hamilton Branch	**Priority:**	High
	PO Box 551	**Quote No:**	111463
	New Plymouth 4340	**Order No:**	
		Client Reference:	210406
		Add. Client Ref:	
		Submitted By:	Nakeysha Lammers
		Charge To:	BTW Company Limited
		Target Date:	26-May-2021 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	S2_N_1_100 21-May-2021 3:54 pm	Soil	GSoil300	Total Recoverable Arsenic
2	S2_N_2_100 21-May-2021 4:14 pm	Soil	GSoil300	Total Recoverable Arsenic
3	S2_N_3_100 21-May-2021 4:00 pm	Soil	GSoil300	Total Recoverable Arsenic
4	S2_N_4_100 21-May-2021 4:37 pm	Soil	GSoil300	Total Recoverable Arsenic
5	S2_N_5_100 21-May-2021 4:05 pm	Soil	GSoil300	Total Recoverable Arsenic
6	S2_N_6_100 21-May-2021 4:27 pm	Soil	GSoil300	Total Recoverable Arsenic

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-6
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	1-6
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-6
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-6

Hill Laboratories
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ANALYSIS REQUEST

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

T 0508 HILL LAB (44 555 2
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job No: **265 1414**
Date Recv: 06-Jul-21 17:05
Received by: Ben Kingston
3126514146

Quote No 112324

Primary Contact Dean Sandwell 268298

Submitted By Dean Sandwell 268298

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

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 s 9(2)(a)
☐ 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 Laboratories
☑ *Tick if you require COC to be emailed back*
Date & Time: 6/7/21
Name: Nakeysha Lammers
Signature: Lammers

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

Condition ☐ Room Temp ☐ Chilled ☐ Frozen *Temp:* 15.1

☐ Sample & Analysis details checked
Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

All samples collected 6/7/21

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, 2 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types

Soil (Soil)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	SH1_AS_1_150	14:01	soil	NZ guidelines semi quantitive asbestos in soil.
2	SH1_AS_2_150	13:37		
3	SH1_AS_3_150	13:25		
4	SH1_AS_4_150	13:11		
5	SH1_AS_5_150	12:48		
6	SH1_AS_6_150	14:52		
7	SH1_AS_7_150	14:42	soil	NZ guidelines semi quantitive asbestos in soil.
8				
9				
10				

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

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

QUOTATION

Quote Number: 112324
Client Name: BTW Company Ltd - Hamilton Branch
Primary Contact: Dean Sandwell
Charge To: BTW Company Limited
Quote Ref: 210406

Date: 24-Jun-2021
Expires: 24-Dec-2021
From: Martin Cowell
Email: s 9(2)(a)
Priority: High

Sample Type	Details	Qty	Quote Price	Line Total
Soil	Activities expanded below (AsbSoilSQ500ProfileNZG) — New Zealand Guidelines Semi Quantitative Asbestos in Soil ($89.00) The following containers are required for the above analyses: 1 x PSoil500Asb (Plastic jar, ContainerSize: 500 mL)	20	$89.00	$1,780.00
Soil	Activities expanded below (PbRs) — Environmental Solids Sample Preparation ($5.31) — Total Recoverable digestion ($8.84) — Total Recoverable Lead ($5.61) The following containers are required for the above analyses: 1 x GSoil300 (Glass soil jar, ContainerSize: 300 mL)	5	$19.76	$98.80
	Grand Total:		$108.76	$1,878.80

Notes

Quoted prices are in New Zealand Dollars (NZD) and do not include GST.

This quote is subject to our usual terms and conditions, a copy of which is available on request.

Individual dates of testing are not routinely included in the Certificate of Analysis. Please inform the laboratory if you would like this information reported.

NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 2 working days following the day of receipt of the samples at the laboratory. This turnaround time is based on the samples being received at the appropriate laboratory location.

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods that will be 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 will be performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit
Individual Tests		
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2	-
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2	0.4 mg/kg dry wt
New Zealand Guidelines Semi Quantitative Asbestos in Soil		
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g

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

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job Information Summary

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2651414
Contact:	Dean Sandwell	**Date Registered:**	07-Jul-2021 12:55 pm
	C/- BTW Company Ltd - Hamilton Branch	**Priority:**	High
	PO Box 551	**Quote No:**	112324
	New Plymouth 4340	**Order No:**	
		Client Reference:	210406
		Add. Client Ref:	
		Submitted By:	Dean Sandwell
		Charge To:	BTW Company Limited
		Target Date*:	12-Jul-2021 4:30 pm

* As the samples require analysis at a Hill Laboratories location that is different to where they were received, the Target Date for reporting has been extended.

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	SH1_AS_1_150 06-Jul-2021 2:01 pm	Soil	PSoil500Asb	New Zealand Guidelines Semi Quantitative Asbestos in Soil
2	SH1_AS_2_150 06-Jul-2021 1:37 pm	Soil	PSoil500Asb	New Zealand Guidelines Semi Quantitative Asbestos in Soil
3	SH1_AS_3_150 06-Jul-2021 1:25 pm	Soil	PSoil500Asb	New Zealand Guidelines Semi Quantitative Asbestos in Soil
4	SH1_AS_4_150 06-Jul-2021 1:11 pm	Soil	PSoil500Asb	New Zealand Guidelines Semi Quantitative Asbestos in Soil
5	SH1_AS_5_150 06-Jul-2021 12:48 pm	Soil	PSoil500Asb	New Zealand Guidelines Semi Quantitative Asbestos in Soil
6	SH1_AS_6_150 06-Jul-2021 2:52 pm	Soil	PSoil500Asb	New Zealand Guidelines Semi Quantitative Asbestos in Soil
7	SH1_AS_7_150 06-Jul-2021 2:42 pm	Soil	PSoil500Asb	New Zealand Guidelines Semi Quantitative Asbestos 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 Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Wgt of Asbestos as Asbestos Fines in <10mm >2mm Fraction	Measurement on analytical balance, from the <10mm >2mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g dry wt	1-7
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-7
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-7
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1-7
Sample Fraction >10mm	Sample dried at 100 to 105°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-7
Sample Fraction <10mm to >2mm	Sample dried at 100 to 105°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-7
Sample Fraction <2mm	Sample dried at 100 to 105°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-7

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1-7
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1-7
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-7
Asbestos in ACM as % of Total Sample	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-7
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-7
Asbestos as Fibrous Asbestos as % of Total Sample	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-7
Weight of Asbestos as Asbestos Fines (Friable)	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-7
Asbestos as Asbestos Fines as % of Total Sample	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-7
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-7

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ANALYSIS REQUEST

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

T 0508 HILL LAB (44 555 2
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job No: **265 1411**

Date Recv: 06-Jul-21 17:04

Received by: Ben Kingston

3126514110

Quote No 112324

Primary Contact Dean Sandwell 268298

Submitted By Dean Sandwell 268298

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

- [x] Email Primary Contact
- [x] Email Submitter
- [ ] Email Client
- [ ] Email Other s 9(2)(a)
- [ ] 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 Laboratories
Date & Time: 6/7/21 / 16:45
Tick if you require COC to be emailed back
Name: NAreysha Lammers
Signature:

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

Condition *Temp:* 15.0
- [ ] Room Temp
- [ ] Chilled
- [ ] Frozen

- [ ] Sample & Analysis details checked

Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

All samples collected 6/7/21

Hold cold all samples on this page.

Priority
- [ ] Low
- [ ] Normal
- [x] 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, 2 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types

Soil (Soil)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required	
1	SH1_AS_1_300	15:29	soil	NZ guidelines semi quantitive asbestos in soil	Hold cold
2	SH1_AS_2_300	15:19			
3	SH1_AS_3_300	15:12			
4	SH1_AS_4_300	15:06			
5	~~SH1_AS_5_300~~	—			
6	~~SH1_AS_6_300~~	—			
7	SH1_AS_7_300	15:41	soil	NZ guidelines semi quantitive asbestos in soil.	Hold cold
8					
9					
10					

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R J Hill Laboratories Limited
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Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
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E mail@hill-labs.co.nz
W www.hill-laboratories.com

QUOTATION

Quote Number: 112324
Client Name: BTW Company Ltd - Hamilton Branch
Primary Contact: Dean Sandwell
Charge To: BTW Company Limited
Quote Ref: 210406

Date: 24-Jun-2021
Expires: 24-Dec-2021
From: Martin Cowell
Email: s 9(2)(a)
Priority: High

Sample Type	Details	Qty	Quote Price	Line Total
Soil	Activities expanded below (AsbSoilSQ500ProfileNZG) — New Zealand Guidelines Semi Quantitative Asbestos in Soil ($89.00) The following containers are required for the above analyses: 1 x PSoil500Asb (Plastic jar, ContainerSize: 500 mL)	20	$89.00	$1,780.00
Soil	Activities expanded below (PbRs) — Environmental Solids Sample Preparation ($5.31) — Total Recoverable digestion ($8.84) — Total Recoverable Lead ($5.61) The following containers are required for the above analyses: 1 x GSoil300 (Glass soil jar, ContainerSize: 300 mL)	5	$19.76	$98.80
	Grand Total:		$108.76	$1,878.80

Notes

Quoted prices are in New Zealand Dollars (NZD) and do not include GST.

This quote is subject to our usual terms and conditions, a copy of which is available on request.

Individual dates of testing are not routinely included in the Certificate of Analysis. Please inform the laboratory if you would like this information reported.

NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 2 working days following the day of receipt of the samples at the laboratory. This turnaround time is based on the samples being received at the appropriate laboratory location.

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods that will be 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 will be performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil		
Test	**Method Description**	**Default Detection Limit**
Individual Tests		-
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2	0.4 mg/kg dry wt
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2	
New Zealand Guidelines Semi Quantitative Asbestos in Soil		0.1 g
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	

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

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T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job Information Summary

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2651411
Contact:	Dean Sandwell	**Date Registered:**	07-Jul-2021 1:00 pm
	C/- BTW Company Ltd - Hamilton Branch	**Priority:**	High
	PO Box 551	**Quote No:**	112324
	New Plymouth 4340	**Order No:**	
		Client Reference:	210406
		Add. Client Ref:	
		Submitted By:	Dean Sandwell
		Charge To:	BTW Company Limited
		Target Date:	09-Jul-2021 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	SH1_AS_1_300 06-Jul-2021 3:29 pm	Soil	PSoil500Asb	Hold
2	SH1_AS_2_300 06-Jul-2021 3:19 pm	Soil	PSoil500Asb	Hold
3	SH1_AS_3_300 06-Jul-2021 3:12 pm	Soil	PSoil500Asb	Hold
4	SH1_AS_4_300 06-Jul-2021 3:06 pm	Soil	PSoil500Asb	Hold
5	SH1_AS_7_300 06-Jul-2021 3:41 pm	Soil	PSoil500Asb	Hold

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ANALYSIS REQUEST

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

Job No: **265 1412**

Date Recv: 06-Jul-21 17:04

T 0508 HILL LAB (44 555 2
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Received by: Ben Kingston

3126514122

Quote No 112324

Primary Contact Dean Sandwell 268298

Submitted By Dean Sandwell 268298

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

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 s 9(2)(a)
☐ 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 Laboratories
☑ *Tick if you require COC to be emailed back*
Date & Time: 6/7/21 16:45
Name: Nakeysha Summers
Signature: Nsumm

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

Condition ☐ Room Temp ☐ Chilled ☐ Frozen *Temp:* 15.0

☐ Sample & Analysis details checked
Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

All samples collected 6/7/21.

Hold cold all samples on this page.

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, 2 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types

Soil (Soil)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	SH1_AS_8_150	14:18	Soil	NZ guidelines semi quantitive asbestos in soil. Hold cold
2	SH1_AS_9_150	13:55		
3	SH1_AS_10_150	13:44		
4	SH1_AS_11_150	13:20		
5	SH1_AS_12_150	13:09		
6	SH1_AS_13_150	12:56		
7	SH1_AS_14_150	14:55	Soil	NZ guidelines semi quantitive asbestos in soil. Hold cold
8				
9				
10				

Hill Laboratories
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R J Hill Laboratories Limited
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E mail@hill-labs.co.nz
W www.hill-laboratories.com

QUOTATION

Quote Number: 112324
Client Name: BTW Company Ltd - Hamilton Branch
Primary Contact: Dean Sandwell
Charge To: BTW Company Limited
Quote Ref: 210406

Date: 24-Jun-2021
Expires: 24-Dec-2021
From: Martin Cowell
Email: s 9(2)(a)
Priority: High

Sample Type	Details	Qty	Quote Price	Line Total
Soil	Activities expanded below (AsbSoilSQ500ProfileNZG) — New Zealand Guidelines Semi Quantitative Asbestos in Soil ($89.00) The following containers are required for the above analyses: 1 x PSoil500Asb (Plastic jar, ContainerSize: 500 mL)	20	$89.00	$1,780.00
Soil	Activities expanded below (PbRs) — Environmental Solids Sample Preparation ($5.31) — Total Recoverable digestion ($8.84) — Total Recoverable Lead ($5.61) The following containers are required for the above analyses: 1 x GSoil300 (Glass soil jar, ContainerSize: 300 mL)	5	$19.76	$98.80
	Grand Total:		$108.76	$1,878.80

Notes

Quoted prices are in New Zealand Dollars (NZD) and do not include GST.

This quote is subject to our usual terms and conditions, a copy of which is available on request.

Individual dates of testing are not routinely included in the Certificate of Analysis. Please inform the laboratory if you would like this information reported.

NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 2 working days following the day of receipt of the samples at the laboratory. This turnaround time is based on the samples being received at the appropriate laboratory location.

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods that will be 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 will be performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil		
Test	**Method Description**	**Default Detection Limit**
Individual Tests		
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2	-
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2	0.4 mg/kg dry wt
New Zealand Guidelines Semi Quantitative Asbestos in Soil		
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job Information Summary

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2651412
Contact:	Dean Sandwell	**Date Registered:**	07-Jul-2021 1:03 pm
	C/- BTW Company Ltd - Hamilton Branch	**Priority:**	High
	PO Box 551	**Quote No:**	112324
	New Plymouth 4340	**Order No:**	
		Client Reference:	210406
		Add. Client Ref:	
		Submitted By:	Dean Sandwell
		Charge To:	BTW Company Limited
		Target Date:	09-Jul-2021 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	SH1_AS_8_150 06-Jul-2021 2:18 pm	Soil	PSoil500Asb	Hold
2	SH1_AS_9_150 06-Jul-2021 1:55 pm	Soil	PSoil500Asb	Hold
3	SH1_AS_10_150 06-Jul-2021 1:44 pm	Soil	PSoil500Asb	Hold
4	SH1_AS_11_150 06-Jul-2021 1:20 pm	Soil	PSoil500Asb	Hold
5	SH1_AS_12_150 06-Jul-2021 1:09 pm	Soil	PSoil500Asb	Hold
6	SH1_AS_13_150 06-Jul-2021 12:56 pm	Soil	PSoil500Asb	Hold
7	SH1_AS_14_150 06-Jul-2021 2:55 pm	Soil	PSoil500Asb	Hold

Hill Laboratories
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

Job No: 265 1410
Date Recv: 06-Jul-21 17:03
Received by: Ben Kingston

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

T 0508 HILL LAB (44 555 2
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Quote No 112324

Primary Contact Dean Sandwell 268298

Submitted By Dean Sandwell 268298

Client Name BTW Company Ltd - Hamilton Branch 268297

Address C/- BTW Company Limited, PO Box 551
New Plymouth 4340

Phone s 9(2)(a) *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To BTW Company Limited 40949

Client Reference 210406

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 s 9(2)(a)
☐ 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 Laboratories
Date & Time: 6/7/21 16/45
Name: Nargysta Lammas
Signature: Namas
☐ *Tick if you require COC to be emailed back*

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

Condition ☐ Room Temp ☐ Chilled ☐ Frozen *Temp:* 13.6

☐ Sample & Analysis details checked
Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

All samples collected 6/7/21.

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, 2 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types

Soil (Soil)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	SH2_AS_1_150	11:41	soil	NZ guidelines semi quantitive asbestos in soil.
2	SH2_AS_2_150	12:07		"
3	SH2_AS_3_150	11:53		
4	SH2_AS_4_150	11:28		NZ guidelines semi quantitive asbestos in soil.
5	Pb_1_150	11:44		Total recoverable lead
6	Pb_2_150	12:06		"
7	Pb_3_150	11:55		"
8	Pb_4_150	11:30	soil	Total recoverable lead.
9				
10				

Hill Laboratories
TRIED, TESTED AND TRUSTED

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Private Bag 3205
Hamilton 3240 New Zealand

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T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job Information Summary

Client:	BTW Company Ltd - Hamilton Branch	**Lab No:**	2651410
Contact:	Dean Sandwell	**Date Registered:**	07-Jul-2021 1:02 pm
	C/- BTW Company Ltd - Hamilton Branch	**Priority:**	High
	PO Box 551	**Quote No:**	112324
	New Plymouth 4340	**Order No:**	
		Client Reference:	210406
		Add. Client Ref:	
		Submitted By:	Nakeysha Lammers
		Charge To:	BTW Company Limited
		Target Date:	09-Jul-2021 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	SH2-AS-1-150 06-Jul-2021 11:41 am	Soil	PSoil500Asb	
2	SH2-AS-2-150 06-Jul-2021 12:07 pm	Soil	PSoil500Asb	
3	SH2-AS-3-150 06-Jul-2021 11:53 am	Soil	PSoil500Asb	
4	SH2-AS-4-150 06-Jul-2021 11:28 am	Soil	PSoil500Asb	
5	Pb-1-150 06-Jul-2021 11:44 am	Soil	GSoil300	Total Recoverable Lead
6	Pb-2-150 06-Jul-2021 12:06 pm	Soil	GSoil300	Total Recoverable Lead
7	Pb-3-150 06-Jul-2021 11:55 am	Soil	GSoil300	Total Recoverable Lead
8	Pb-4-150 06-Jul-2021 11:30 am	Soil	GSoil300	Total Recoverable Lead

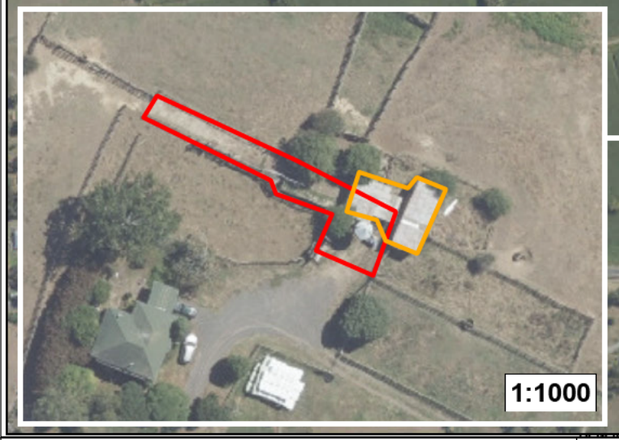
Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	5-8
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	5-8
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	5-8
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	5-8

APPENDIX E PIECE OF LAND DEMARCATION



Crown Land
SO 3037
BLK XVI
Newcastle SD
Drainage Reserve 5.03 m wide

O'Brien Rd
Shara'leigh Pl
Farnborough Dr
Elenora Cl
Eliza Pl
Max Lndg
Everton Pl
Highgrove Dr
Harrogate Pl
Wimbledon Cl
Wembley Cl
Twickenham Pl
Rosehill Pl
Kentucky Cres
Caulfield Pl
Derby St
Lochinver Dr
Ben Lomond Pl
Pointon Gld
Limousin Pl
Ayrshire Dr
Angus Pl
Brymer Rd
Hereford Pl
Guernsey Pl
Jersey Pl
Friesian Pl
Bruton Pl
David St
Hamblyn Cres
Newcastle Rd
Blomfield St
Velma Cres
Carew St
Silhouette Way
Western Heights Dr
Ellicott Rd
Prospect Pl
Sunset Cl
Sunny Dale
West Ridge Dr
Parkview Ave
Stirling Pl
Whatawhata Rd

Legend

Site Extent

HAIL Classification

I, A.8. CCA Treated Timber, Sheep Spray Operations

I. CCA Treated Timber

E.1. Confirmed ACM

BTW COMPANY
SURVEYING | ENGINEERING | PLANNING & ENVIRONMENT

1. Coordinates are in terms of New Zealand Transverse Mercator

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Unverified HAIL activities are not presented.

0 30 60 120 180 240 Meters
1:7,500

0 5 10 20 30 40 Meters
1:1,000

NO	DATE	BY	CHKD

REVISIONS

LOCATION	ROTOKAURI	DRAWN	C. GRAHAM 09/06/21
PROJECT No.	210406	CHECKED	G.JOHNSTON 09/06/21
		SCALE	1:7,500
		ORIGINAL SIZE	A3

BRYMER FARMS LIMITED

TITLE
BRYMER ROAD
PIECE OF LAND DEMARCATION

DRAWING No	SHEET	REVISION
210406-101-GIS	1	0