REPORT TITLE	DETAILED SITE INVESTIGATION (DSI) FOR STAGE ONE OF THE PROPOSED DEVELOPMENT AT 84 - 90 HOBSONVILLE ROAD
PREPARED FOR	COVIC FAMILY TRUST C/- CHURCHILL LDS LTD
DATE	14 OCTOBER 2014
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Statement

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

Report prepared on behalf of GSL by:	Report reviewed on behalf of GSL by:	Report authorised on behalf of GSL by:
		
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Thank you for the opportunity to carry out this investigation. Should you have any queries regarding this report please do not hesitate to contact us on 09 476 0454.

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EXECUTIVE SUMMARY

The client proposes that the properties located at 84-90 Hobsonville Rd, Hobsonville, be developed into a motel complex. Historically these properties have been used for the cultivation and commercial sale of roses.

Geosciences Ltd (GSL) conducted a preliminary site investigation (PSI) of the properties in November 2013. This investigation included a search of the property file, a review of the available historic aerial photographs and a visual inspection of the properties. The PSI concluded that there were eight areas of concern requiring further investigation, which were:

- Paddocks, associated with the cultivation of roses;
- Glasshouses/greenhouse associated with the cultivation of roses;
- Potting sheds/implement sheds/packing sheds associated with the cultivation of roses;
- Landscaped ornamental features adjacent the road;
- Landscape modifications and uncertified filling associated with the motocross track construction;
- The presence of non-engineered, unidentified fill material at several site locations; and
- The storage of unknown/unidentified dwellings and equipment on site.

The purpose of this detailed site investigation (DSI) was to investigate the areas of concern identified in the PSI and located within the proposed development area. Using the information gathered during the PSI, GSL designed a conceptual soil sampling plan that required the collection of soil samples from twenty-three sampling locations. The soil samples collected were analysed for the potential contaminants associated with the areas of concern in recognition of the Ministry for the Environment (MfE) Hazardous Activities and Industries List (HAIL).

None of the soil samples taken returned concentrations of potential contaminants that exceeded the MfE '*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health'* (NES) soil contaminant standard for a high-density residential land use. None of the soil samples returned concentrations of potential contaminants that exceeded the Auckland Council Regional Plan: Air, Land, Water (ACRP:ALW) Schedule 10 permitted activity criteria, or the Proposed Auckland Unitary Plan (PAUP) permitted soil acceptance criteria.

Three soil samples returned concentrations of either arsenic, copper, and/or lead, that exceeded the expected naturally occurring background values for non-volcanic soil in the Auckland region. However, statistical analysis of the heavy metal results determined that the average concentration of these metals within soil at the properties is at/or below the soil background range.

Two soil samples returned detectable concentrations of ∑DDT, and one soil sample returned detectable concentrations of total petroleum hydrocarbons (TPHs).

As a result of these findings the proposed development at the properties can therefore be regarded as a permitted activity under Regulation 8 of the NES, provided the proposed development does not exceed 6,905.2m^3 of soil disturbance and no more than 1,381m^3 of soil is

removed offsite per year. If the proposed development cannot meet these conditions, then it can be regarded as a controlled activity under Regulation 9 of the NES.

The proposed development can be regarded as a permitted activity under Section 5.5.41 of the ACRP:ALW and Chapter 4.5, Section 2.1.1 of the PAUP.

Under the NES and the PAUP, the proposed development will require a site management plan that outlines the controls in place to minimise the exposure of humans and the environment to any mobilised contaminants.

Due to the presence of ∑DDT and TPHs in three soil samples, any soil removed from these areas will have to be disposed of as managed fill. Any soil removed from the remainder of the properties can be disposed of as cleanfill.

1 INTRODUCTION

Geosciences Ltd (GSL) has prepared the following report for Churchill LDS Ltd on behalf of Covic Family Trust in accordance with the GSL proposal, Ref: Pro-0494/Jun14, dated 14 June 2014.

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

2 PROPERTY DETAILS

Location:	84 Hobsonville Road, Hobsonville, Auckland
Legal Description:	Pt Lot 3 DP 189398
Size:	4.414 Ha
Zoning:	Countryside/Special Area

Location:	88 Hobsonville Road, Hobsonville, Auckland
Legal Description:	Pt Lot 2 DP 189398
Size:	5.3964 Ha
Zoning:	Countryside/Special Area

Location:	90 Hobsonville Road, Hobsonville, Auckland
Legal Description:	Lot 1 DP 189398
Size:	4 Ha
Zoning:	Countryside/Special Area

The properties described above (hereafter referred to collectively as 'the site') are located between farmland to the north and west and a developed residential area to the south and east (Figure 1). Historically, the site has been dry stock farmland, which has been slowly encroached by the urban growth of the Hobsonville area from the south. In 1979, the site was developed for the cultivation of roses that was the primary land use until approximately 2008, from which time the buildings at the site have generally been used for storage, with the areas under vegetation permitted to grow with minimal maintenance.

3 PROPOSED CHANGE IN LANDUSE AND DEVELOPMENT

It is proposed to develop an approximately 4ha portion of the site into a motel complex. This development will include the demolition of existing site structures and the construction of six blocks of motel units, an office/restaurant and a function centre. The development requires substantial earthworks, the exact volume of which has not been provided. The portion of the site undergoing the change in landuse and development is outlined in Figure 2. It is only this area being investigated as part of this DSI. A copy of the proposed development plan is included in Appendix A.

Geosciences Ltd is not aware of any proposed subdivision or amalgamation of the existing property titles as part of the proposed development.

4 STANDARDS AND REGULATIONS

Because of the proposed change in landuse and development outlined above, it will be necessary to address the requirements of the following applicable standards and regulations for the site.

4.1 NATIONAL ENVIRONMENTAL STANDARD (NES)

The *National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health* (NES) (Reference 3) ensures that land affected by contaminants in soil is appropriately identified and assessed when soil disturbance and/or land development activities take place and, if necessary, remediated or the contaminants contained to make the land safe for human use.

Under the NES, land is considered to be actually or potentially contaminated if an activity or industry on the MfE Hazardous Activities and Industries List (HAIL) has been, is, or is more likely than not to have been, undertaken on the land. Consequently, a development on HAIL land requires a detailed site investigation (DSI) of the piece of land to determine if there is a risk to human health as a result of the former activities.

The NES defines five standard landuse scenarios for which soil contaminant standards have been derived. The most sensitive landuse scenario which is applicable to the proposed change in landuse and development at this site is defined by the NES as: *High-density residential: Urban residential with limited soil contact, including small ornamental gardens but no vegetable garden (no homegrown produce consumption); applicable to urban townhouses, flats and ground-floor apartments with small ornamental gardens, but not high-rise apartments.*

4.2 AUCKLAND COUNCIL REGIONAL PLAN: AIR, LAND AND WATER (ACRP:ALW)

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

Chapter 5 of the Auckland Council Regional Plan: Air, Land & Water (ACRP:ALW) (Reference 4) rules deals specifically with contaminated land and determines a need to identify land containing elevated levels of contaminants, including contaminated land, and to assess the degree of its contamination through site investigations.

4.3 PROPOSED AUCKLAND UNITARY PLAN (PAUP)

The Proposed Auckland Unitary Plan (PAUP) (Reference 4), which was formally notified on 30 September 2013, is a combined regional policy statement, regional coastal plan, regional plan and district plan.

Part 3, Chapter 4.5 of the PAUP deals specifically with contaminated land and maintains that Council is required to manage both the use of land containing elevated levels of contaminants and the discharge of contaminants from land containing elevated levels of contaminants.

GSL has considered provisions of the PAUP in this report where they may have an impact on the proposed change in landuse and development.

5 DSI OBJECTIVES

The objectives of this investigation were to assess:

- the soil quality and associated risk to human health and the environment as a result of potential contamination in soil on the site as a result of former HAIL activities;
- the resulting status of the activity under the NES;
- what, if any, contaminated land rules of the ACRP:ALW or the PAUP apply to the proposed subdivision and development; and
- any further work that may be required under the NES, the ACRP:ALW or the PAUP as a result of the soil quality on site.

6 SCOPE OF WORKS

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

- a review of former environmental investigations;
- a site visit for the collection of soil samples;
- the collection of twenty-three discrete soil samples from the site;
- the laboratory analysis of twenty soil samples for horticultural contaminants of concern, which are arsenic, copper, lead, and organochlorine pesticides (OCPs);
- the laboratory analysis of three soil samples for a suite of heavy metals;
- the laboratory analysis of six soil samples for total petroleum hydrocarbons (TPHs); and
- the preparation of a report in accordance with Contaminated Land Management Guideline No. 1 – '*Reporting on Contaminated Sites in New Zealand*' that summarises the results of the intrusive investigation and the need, if any, for any further work.

7 FORMER INVESTIGATIONS

GSL conducted a preliminary site investigation of the site in November 2013, the findings of which are summarised in the GSL report, Ref: *Rep-0359PSI/Nov13*. An excerpt of the Conclusions and Recommendations of that report is attached in Appendix B.

From an historical aerial review of the site and a review of the property file, it appeared that the site had been used for the cultivation and commercial sale of roses since the late 1970s. During

the historic review and site inspection, it was observed that there were a collection of greenhouses/growing houses, implement sheds, and potting sheds present at the site, some of which could be dated back to the establishment of the rose growing operation.

During the site inspection, GSL observed areas of site that had been subject to uncontrolled filling that was being utilised as a motocross track, the storage of a variable collection of equipment and containers, and the presence of unconsented structures.

The former investigation concluded that there were eight areas of concern at the site requiring further investigation, which are:

- paddocks associated with the cultivation of roses;
- glasshouses/greenhouse associated with the cultivation of roses;
- potting sheds/implement sheds/packing sheds associated with the cultivation of roses;
- landscaped ornamental features adjacent the road;
- landscape modifications and uncertified filling associated with the motocross track construction;
- the presence of non-engineered, unidentified fill material at several site locations; and
- the storage of unknown/unidentified dwellings and equipment on site.

The current investigation took into account the findings of the previous GSL report when designing the sampling plan and rationale for the DSI of a portion of the site.

8 SOIL SAMPLING AND ANALYSIS

The area under development consists of approximately four hectares of the total site area. Under the requirements of the CLMG No. 5, an area of this size would normally require samples taken from a minimum of fifty discrete soil sample locations. However, a high proportion of the site has been subject to the homogenous application of fertilisers and pesticides, which can be generally regarded as uniform in distribution (*Gaw, S.K.,* Reference 6), making it possible to reduce the number of samples required for these areas. The area of the motocross track can regarded as generally homogenous disturbed fill material, allowing for the further reduction in the sampling points required.

Based on the above, and the observations and conclusions of the GSL preliminary site investigation, a targeted sampling plan was developed following the rationale below. A copy of the sampling plan is attached as Figure 3.

Soil Sample No.	Location	Indicated Laboratory Analysis[1]
SS1 - SS5	Rose Gardens/Nursery	As, Cu, Pb &OCPs
SS6 - SS9 & SS13 - SS15	Glasshouses/Shadehouses	As, Cu, Pb & OCPs
SS10 - SS12	Former Motocross Tack	Heavy metals & TPHs
SS18 - SS20, SS22, SS23	Packing, Potting & Storage Sheds	As, Cu, Pb, OCPs & TPHs
SS21	Storage Yard Area	As, Cu, Pb, OCPs & TPHs

Notes:

1. As = Arsenic, Cu = Copper, Pb = Lead, Heavy Metals = Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Zinc, OCPs = Organochlorine Pesticides, TPHs = Total Petroleum Hydrocarbons

Soil samples were collected from the top 150mm of the soil surface using a stainless steel foot corer after the removal of any vegetative or impervious cover. Soil samples that were being analysed for volatile compounds were placed into laboratory supplied glass jars, with the remainder of samples placed into resealable plastic zipper bags. All sample bags and jars were labelled with the date, sample identification number, location, and initials of the sampler on the bag.

Sampling equipment was decontaminated between the collection of each sample in accordance with our internal quality control procedures. The sampling protocol followed was in accordance with the *'Contaminated Land Management Guidelines (CLMG) No. 5 – Site Investigation and Analysis of Soils"*. Site photographs taken during sampling are attached in Appendix C.

9 LABORATORY ANALYSIS AND QUALITY CONTROL

Sample bags and jars were placed in a box with a chain of custody form (COC) indicating the analysis to be performed. Soil samples were dispatched to RJ Hill Laboratories Ltd in Hamilton for analysis of the contaminants of concern, which are heavy metals, organochlorine pesticides (OCP's), and total petroleum hydrocarbons (TPHs).

RJ Hill Laboratories are accredited by International Accreditation New Zealand (IANZ) for the analysis undertaken.

9.1 DUPLICATE SAMPLES

The MfE's *CLMG-5 Site Investigation and Analysis of Soils,* requires that one duplicate sample should be collected for every ten samples and submitted to the laboratory as two separate samples (blind field duplicate). In accordance with this guideline, GSL submitted a duplicate sample of soil samples of SS5, SS9 and SS19 to RJ Hill Laboratories as Dup 1, Dup 2, and Dup 3. A comparison of the results from the duplicate soil samples is provided below in Table 1.

A relative percentage difference of less than 50% is considered a suitable repeatability standard for blind replicate sampling. The copper and lead results from SS5 exceed 50% variation, indicating there is significant variation in the distribution of these elements within these samples.

The observed copper and lead results may be attributed to the heterogeneous distribution of heavy metals in soil and the physicochemical processes of heavy metal distribution in the soil matrix, which can cause variation in the replicate analysis of two samples from the same sample core.

If the highest variations of copper and lead are extrapolated onto the highest copper and lead concentrations returned by the analysed soil samples, then the 'worst case scenario' for copper and lead concentrations at the site is 305mg/kg and 131mg/kg respectively. These 'worst case scenario' values are still below the NES soil contaminant standard for a high-residential land use.

The arsenic variation of SS9 can be regarded as insignificant due to the low concentration of this element within the sample distorting the variability calculation and for the reasons outlined above.

TABLE 1: DUPLICATE SAMPLE ANALYTICAL RESULTS[1]

	Arsenic	Copper	Lead
SS5	4	188	74
Dup 1	3	99	33
% Variation	28.57%	**62.02%**	**76.64%**
SS9	2	6	10.3
Dup 2	4	9	10.8
% Variation	**66.67%**	40.00%	4.74%
SS19	2	<2	5.4
Dup 3	<2	<2	4.3
% Variation	0.00%	0.00%	22.68%

Notes:

1. All metal concentrations measured in mg/kg.
2. % Variation calculated in accordance with CLMG 5(reference 4) using equation: ((Result 1 – Result 2)/Mean Result) x 100

10 ACCEPTANCE CRITERIA AND RELEVANT GUIDELINES

The NES mandates fourteen soil contaminant standards (SCS) for the protection of human health for organic compounds and inorganic elements for various landuse criteria. The proposed development is a commercial development, however there remains a potential for human contact with soil that would be equivalent to a similar situation encountered in a high-density residential development. Consequently, GSL considers that the NES human health SCS criteria for a high-density residential block should appropriately be applied to the proposed change in landuse and development.

The NES has no specific soil contaminant standard for total petroleum hydrocarbon concentrations but instead acknowledges the Tier 1 criteria as specified in the MfE document,

'Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand' (Reference 7). Where applicable, TPH results have been compared against these criteria.

The ACRP: ALW Schedule 10 permitted activity criteria and the PAUP permitted soil acceptance criteria outline the permitted environmental discharge criteria of Auckland Council for potentially contaminated land.

Results are also compared to the background concentration ranges of inorganic elements in soils in the Auckland Region for non-volcanic soils (Reference 8).

11 ANALYTICAL RESULTS

A comparison of the analytical results with the relevant guideline criteria is provided in Table 2 attached to the back of this report. Copies of the laboratory chain of custody document (COC) and analytical transcripts are attached in Appendix C, while a discussion of the results is provided below.

11.1 HEAVY METALS

All of the soil samples analysed returned concentrations of heavy metals that did not exceed the applicable NES soil contaminant standards, the ACRP:ALW Schedule 10 permitted activity criteria, and the PAUP permitted activity soil acceptance criteria.

The following samples returned concentrations of heavy metals that were elevated above the background ranges for volcanic soil of the Auckland region:

- SS5 – Copper and lead exceedances
- SS17 – Arsenic and copper exceedances
- SS22 – Copper exceedance

11.2 95% UPPER CONFIDENCE LEVEL (UCL)

Statistical analysis of the heavy metal results, in accordance with Section 5.4 of the MfE document, *"Contaminated Land Management Guidelines (CLMG) No. 5 – Site Investigation and Analysis of Soils"* indicates that the apparent arsenic exceedance of SS17, the apparent copper exceedances of SS5, SS17, and SS22, and the apparent lead exceedance of SS5, are all statistical outliers.

A 95% UCL analysis of the arsenic, copper and lead results determined the following:

- The mean for arsenic does not exceed 5.86mg/kg;
- The mean for copper does not exceed 42.31mg/kg; and
- The mean for lead does not exceed 19.46mg/kg

Consequently, these non-compliances can be regarded as statistically insignificant. The statistical summary sheets for these calculations are attached to this report in Appendix E.

11.3 ORGANOCHLORINE PESTICIDES (OCP'S)

Soil samples SS1 and SS17 returned detectable concentrations ΣDDT that did not exceed either the applicable NES soil contaminant standards, the ACRP:ALW Schedule 10 permitted activity criteria, or the PAUP permitted activity soil acceptance criteria.

11.4 TOTAL PETROLEUM HYDROCARBONS (TPHS)

Soil sample SS23 returned detectable concentrations of TPHs that did not exceed the applicable MfE Petroleum Guidelines soil contaminant standard.

12 CONCLUSIONS AND RECOMMENDATIONS

Previous investigations revealed that the site has been historically used for the cultivation and commercial sale of roses since the 1970s. A previous investigation by GSL identified up to eight areas of concern, of which, five were located within the proposed area of development. These were:

- Rose Gardens/Nursery
- Glasshouses/Shadehouses
- Former Motocross Track
- Packing, Potting & Storage Sheds
- Storage Yard Area

GSL designed a conceptual soil sampling model in relation to the area of the proposed development, that encompassed the above areas of concern and accounted for differing potential contaminants associated with them.

Consequently, twenty-three discrete soil samples were collected from areas within the proposed development that had been identified as potentially contaminated during previous investigations of the site. These samples were analysed for the primary contaminants of concern associated with the former HAIL activities in accordance with the MfE guidelines.

None of the samples analysed returned contaminants of concern that exceeded the applicable NES soil contaminant standards, the ACRP:ALW Schedule 10 permitted activity criteria, or the PAUP permitted activity soil acceptance criteria.

Three soil samples (SS5, SS17, SS22) returned concentrations of either, arsenic, copper, or lead that exceeded the background values for non-volcanic soil of the Auckland region. A 95% UCL of these analytical results, as permitted by CLMG No. 5, determined that these exceedances were statistically insignificant, and that the average concentration of arsenic, copper, and lead, within the soil at the site is within the non-volcanic soil background ranges.

Two soil samples (SS1, SS17) returned detectable concentrations of ∑DDT, and one soil sample (SS23) returned detectable concentrations of TPHs. These detectable concentrations of ∑DDT and TPHs are incidental points of contamination, and do not represent gross contamination at the site. At the concentrations found, there is no risk to human or environmental health, but the presence

of these compounds will preclude the soil from being disposed of cleanfill and will require disposal as managed fill.

The areas of impacted soil requiring managed fill disposal are identified in Figure 4. If soil removed from these areas is to be removed and disposed offsite, then the top 200mm of surface soil shall be removed and disposed of as managed fill. This excavation depth is justified due to the low-level incidental contamination of these three areas most likely limited to the soil surface only. The area of excavation identified in Figure 4 is determined by either the location of the neighbouring clean soil samples, the extent of the identified HAIL area, and/or the 25m hot spot detection radius of soil sample as outlined in CLMG No. 5.

Any remaining soil to be removed from outside of these areas can be disposed of as cleanfill.

12.1 POTENTIAL CONTAMINATION / SOURCE – PATHWAY – RECEPTOR

For a potential contamination issue to exist there must be a source – pathway – receptor relationship in effect. Under the NES, the MfE document *Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health* (Reference 9) acknowledges that the NES soil contaminant standards (SCS) have considered the pathway / receptor relationship in determining the SCS based on each landuse scenario e.g. Residential 10%, Commercial/Industrial worker or Recreation etc.

The Auckland Council developed permitted activity environmental discharge criteria (Schedule 10) are based upon the pathway – receptor relationship for the general environment. Due to the range of possible contamination sources and the varying pathway – receptor relationships applicable, the Council also refers to a number of additional soil quality guidelines or criteria that may be applicable such as the *Tier 1 Soil Acceptance criteria in the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand*. Consequently, this report considers the presence of potential sources of contamination relevant to these guidelines and criteria.

The results of the investigation indicate that while portions of the property have been impacted by the former HAIL activities that have been conducted at the site, any potentially impacted soil does not pose a risk to human or environmental health.

12.2 THE NATIONAL ENVIRONMENTAL STANDARDS (NES)

The targeted soil sampling and analysis plan undertaken by GSL as part of this investigation did not return any concentrations of potential contaminants that exceeded the NES soil contaminant standards for the end land use of the proposed development.

The results of soil sampling returned concentrations of heavy metals at within the expected naturally occurring background ranges for non-volcanic soil of the Auckland region. However, the presence of detectable concentrations of ∑DDT in two samples, and TPHs in one sample requires that the provisions of the NES be addressed.

For the proposed development to be regarded as a permitted activity under the NES, it must meet the requirements outlined under NES Regulation 8. As part of these requirements, Regulation 8(3) limits any soil disturbance as part of a permitted activity to $25m^3$ per $500m^2$ p.a. of the piece of land, and no more than $5m^3$ per $500m^2$ p.a. of soil is to be removed from the piece of land. To

meet these requirements, the volume of soil disturbed during the proposed development cannot exceed 6,905.2m^3 and no more than 1,381.04m^3 of soil can be removed per year.

While indicative earthworks plans have been provided to GSL, no calculated volumes for either soil disturbance or soil removal were included in these plans. A review of the plans indicates that the intended earthworks may exceed the permitted soil disturbance volumes. If this is the case, the proposed development can be regarded as a controlled activity under Regulation 9 of the NES.

As a result of the history of the site, and the findings of this investigation, Auckland Council will likely require the provision of a suitable site management plan detailing the control measures that will be used to protect humans from potential exposure to contaminants during the development works.

GSL has not been informed if any change to the land title boundaries is proposed because of this development. If it is intended to further subdivide or amalgamate the existing property titles, further investigations may be required.

12.3 THE AUCKLAND COUNCIL REGIONAL PLAN (ARP:ALW)

The proposed development can be regarded as a permitted activity under Section 5.5.41 of the ACRP:ALW as soil at the site either is within the non-volcanic soil background range for the Auckland region or is below the permitted activity criteria specified in Schedule 10 ACRP:ALW.

12.4 THE PROPOSED AUCKLAND UNITARY PLAN (PAUP)

For the same reasons outlined for the ACRP:ALW above, the proposed development can be regarded as a permitted activity under Chapter 4.5, Section 2.1.1 of the PAUP. As a condition of this activity status, adequate controls must be implemented to minimise discharges of contaminants to the environment, this can be achieved through a site management plan.

12.5 FURTHER INVESTIGATIONS REQUIRED / RECOMMENDATIONS

As a result of the findings detailed above, and to meet the requirements of the NES and the PAUP, the following further works will be required:

- The preparation of a site management plan that will outline the site management practices and soil disposal methods that will be employed throughout the duration of the works to reduce the potential risks to human health and the environment.

13 REFERENCES

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

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

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

4. Auckland Regional Council (2007) — *Auckland Council Regional Plan: Air, Land and Water, Chapter 5, Contaminated Land*, Auckland.

5. Auckland Council (2013) – *Proposed Auckland Unitary Plan*, Auckland, New Zealand.

6. Gaw, S. K. (2002) - *Pesticide Residues in Horticultural Soils in the Auckland Region*, Auckland Regional Council Working Report No. 96. Auckland Regional Council, Auckland.

7. Ministry for the Environment (rev 2011) - *Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand.* Ministry for the Environment, Wellington, New Zealand.

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

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

10. Auckland Council (2011) - *Auckland Council GIS Viewer*. http://maps.aucklandcouncil.govt.nz/aucklandcouncilviewer/

14 LIMITATIONS

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

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

TABLES

TABLE 2A: ANALYTICAL RESULTS[1]

	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	∑DDT	TPH
SS1	6	-	-	13	26	-	-	**0.049**	-
SS2	7	-	-	14	22	-	-	ND	-
SS3	3	-	-	12	24	-	-	ND	-
SS4	<2	-	-	6	8.8	-	-	ND	-
SS5	4	-	-	**188**	**74**	-	-	ND	-
SS6	<2	-	-	13	10.8	-	-	ND	-
SS7	<2	-	-	6	6.5	-	-	ND	-
SS8	<2	-	-	7	8.4	-	-	ND	-
SS9	2	-	-	6	10.3	-	-	ND	-
SS10	<2	<0.10	10	3	7.4	2	6	-	ND
SS11	<2	<0.10	<2	<2	2.3	<2	<4	-	ND
SS12	<2	0.26	7	11	10.0	2	44	-	ND
NES [2]	45	230	>10,000	>10,000	500	NL	NL	240	>20,000
ACRP: ALW[3] and PAUP[4]	100	7.5	400	325	250	105	400	12/0.7[5]	2.15
Soil Background[6]	0.4 - 12	<0.1 – 0.65	2 -55	1 – 45	<1.5 - 65	0.9 – 35	9 - 180	NA	NA

TABLE 3B: ANALYTICAL RESULTS[1]

	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	∑DDT	TPH
SS13	<2	-	-	3	3.9	-	-	ND	-
SS14	10	-	-	31	9.7	-	-	ND	-
SS15	<2	-	-	13	4.4	-	-	ND	-
SS16	6	-	-	13	8.3	-	-	ND	-
SS17	**37**	-	-	**58**	12.1	-	-	**0.027**	-
SS18	<2	-	-	8	8.9	-	-	ND	ND
SS19	2	-	-	<2	5.4	-	-	ND	ND
SS20	<2	-	-	6	5.6	-	-	ND	ND
SS21	3	-	-	17	37	-	-	ND	ND
SS22	5	-	-	**121**	8.1	-	-	ND	ND
SS23	<2	-	-	3	6.0	-	-	ND	**230**
NES [2]	45	230	>10,000	>10,000	500	NL	NL	240	>20,000
ACRP: ALW[3] and PAUP[4]	100	7.5	400	325	250	105	400	12/0.7[5]	2.15
Soil Background[6]	0.4 - 12	<0.1 – 0.65	2 -55	1 – 45	<1.5 - 65	0.9 – 35	9 - 180	NA	NA

Notes:

1. All metal concentrations measured in mg/kg.
2. National Environmental Standards (NES) for assessing and managing contaminants in soil to protect human health – Residential 10% Produce (Reference 3).
3. Auckland Regional Council (2007) — Auckland Council Regional Plan: Air, Land and Water, Chapter 5, Contaminated Land, Auckland (Reference 4).
4. Auckland Council (2013) – Proposed Auckland Unitary Plan, Auckland, New Zealand (Reference 5).
5. The criteria of 12 mg/kg apply to land that is not being redeveloped. The criteria of 0.7 mg/kg apply to land that is being redeveloped during the redevelopment phase only. (Reference 5)
6. Auckland Regional Council Technical Publication No.153 (2001) (Reference 7).
7. Values in **BOLD** exceed the NES criteria, values in **BOLD** exceed the ACRP:ALW criteria, Values in **BOLD** exceed the Background Ranges.
8. NA = Not applicable / NL = No Limit / ND= not detected

FIGURES

SITE LOCATION

FIGURE 1. SITE LOCALITY

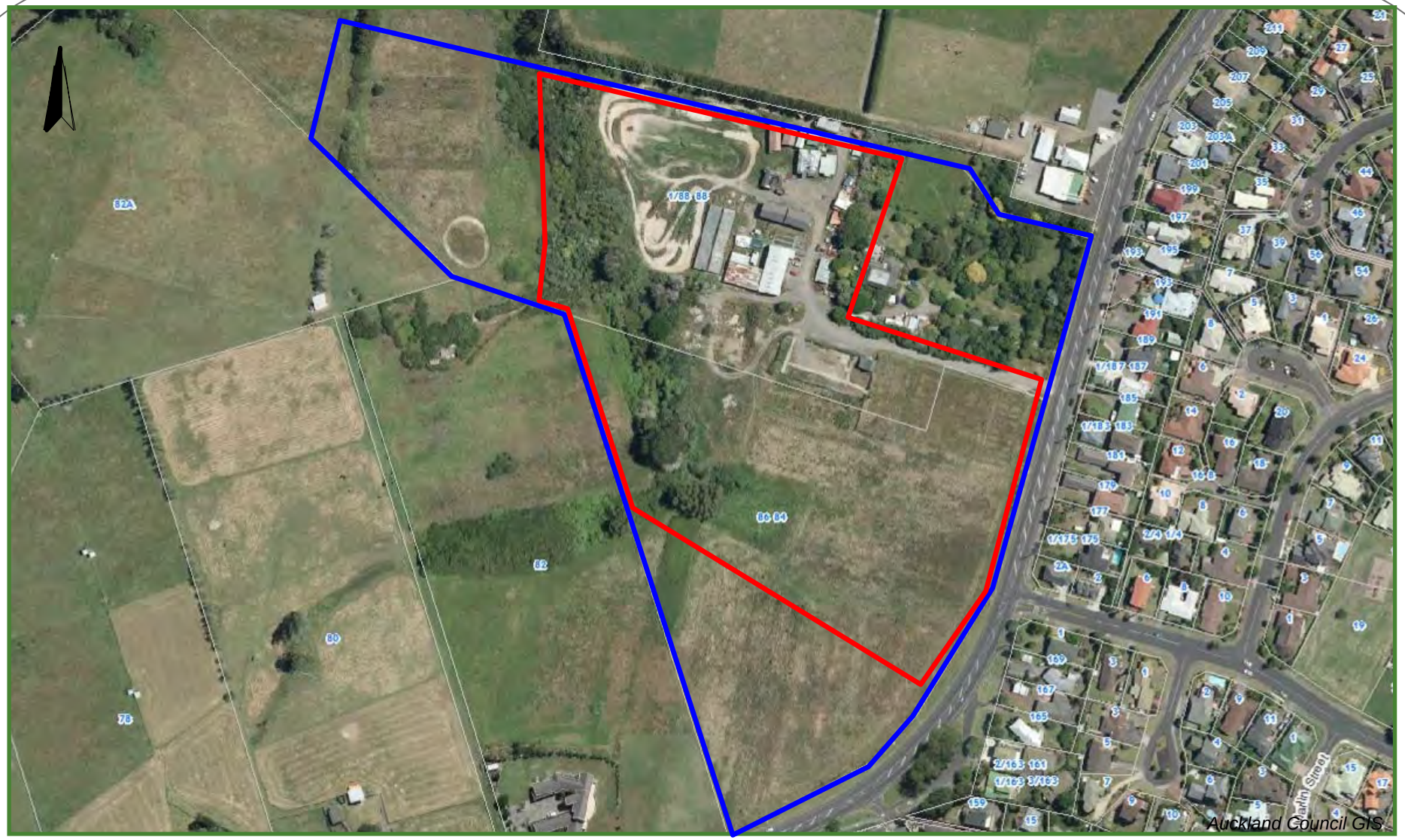

FIGURE 2. AREA OF INVESTIGATION

SITE LOCATION AREA UNDER INVESTIGATION

FIGURE 3: SAMPLING MAP

FIGURE 4. AREAS OF MANAGED FILL

SITE LOCATION
SS1 SAMPLING POINTS
AREAS OF MANAGED FILL
NON-HAIL AREA

APPENDIX A PROPOSED SCHEME PLAN

KEY - PAVINGS

- Site road surface to have topdress gravel or other visual/safety surface
- Shared surface to site circulation areas paved in sets or blocks
- Car park spaces in contrasting finish
- Footpaths through site - exposed aggregate/shell concrete
- Private patios for motel units
- Brick paved paths leading to homestead villa

scale 0 5 10 20 30m

N

Block G
Block F
Block C
Block E
Block B
Block D
Block A
Pool
Fire & bbq
Alfresco Seating
Restaurant
Store
Office
Service Entry
Lawn
Marquee Area
Deck
Function Centre
Service Area
Proposed Road
Hobsonville Road to be widened
Entry
R

NOTES:

KEY - PLANTING

- existing tree on land to be purchasd by Auckland Transport
- existing tree on site, to be removed
- existing tree on site to be retained - approx canopy spread as shown
- existing Canary Is. palm to be retained

PROPOSED PLANTING

- Specimen tree to mark entrances and road frontage
- Medium sized tree selected for foliage, suitable canopy and low maintenence requirements
- specimen shrubs
- specimen accent plants for key locations on site
- low clipped hedge feature to contain and emphasise ornamental garden areas
- mass planting to form buffer at site boundary
- mixed herbaceous planting for pollinating insects, colour and seasonal interest
- Ground cover planting of shrubs and grasses
- mixed shrub and herbaceous planting for pollinating insects, colour and seasonal interest
- R — Rain garden : planting area also functions as rain garden to take run off from selected car park and road areas

DRAFT

Rev.	Date	Revisions/Issues

nick robinson
landscape architecture + urban design
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www.nickrobinson.co
PO Box 60-468, Titrangi, Auckland 0642

Client
Covic Family Trust

Project Title
Motel Development 84 - 90 Hobsonville Road

Drawing Title
Sketch Site layout

Drawn:	Project ID
NR	HBS.01
Reviewed:	Scale 1:250 at A1 1:500 at A3
Date: 21 March 14	Drawing No. SD.01

APPENDIX B FORMER INVESTIGATION

The paddocks to the west and south were accessed and are heavily overgrown with grass / bushes at times more than 1m tall. It appears that the shrubs / roses were left in place following the closure of the company and have since grown wild across the area. Plastic bags, presumably originally being part of the rose plants root bulb packaging are visible within, and on top of, the ground in many areas (Appendix D: Plate 12). An access track continues off the property to a collapsed shed which appears to have been used as part of the site operations, however as this area is not on the land titles under investigation this is not relevant as a potentially contaminated area under the scope of this investigation. It should be noted however that the shed may have been the location of fertiliser or pesticide storage for the Bell Rose company.

The circular image on the aerial photography appears to be bare earth and its nature and purpose are not clear and there appears to be no noticeable access track into this area. The reason for lack of vegetation cover to this circle is not clear.

It is evident from the site inspection that nursery operations extended across the majority of the site at one time. Significant alterations to the site have occurred since the liquidation of the company.

14 CONCLUSIONS

From an historical aerial review of the site, a site visit and information gathered from the property file it appears that the site has been used for the cultivation and commercial sale of roses since at least the late 1970s, though the exact timeframe of rose cultivation on the site is not known.

The cultivation of roses appears to have been widespread across the three identified properties, with the exception of the area defined as the residential dwelling and ornamental gardens located at number 88 Hobsonville Road, where there is no evidence of any HAIL activities and is an area for which it can be considered that the NES does not apply and should therefore be excluded from any further intrusive investigations.

At least one glasshouse / plastic tunnel greenhouse has been present on site prior to 1996 and possibly since the late 1970s. Further commercial structures identified as implement sheds, potting sheds and plastic greenhouses were constructed on site at varying times since the early 1980s.

No horticultural pesticide spraying preparation areas, spray sheds or bulk storage areas have been successfully defined as a result of this investigation although some anecdotal evidence suggests at least one possible location exists off the current site. It should be noted that this does not preclude the possibility that the packing shed or implement shed may have also doubled as a chemical storage and mixing area during the time of commercial operations. The investigation of the interior of these buildings will be required as part of any further detailed site investigations if these areas are to be developed in the future.

Since the liquidation of the company during the mid-1990s the site has largely grown into disrepair and has been subject to a degree of unknown, uncontrolled, and unidentified activities including the removal of some structures, the storage of equipment and containers, some uncontrolled filling / driveway construction, and the erection of at least one unknown building for which no consent appears to be on file with the council. Any further investigation will be required to take these factors into account during the design of any soil sampling strategy.

14.1. THE NATIONAL ENVIRONMENTAL STANDARDS (NES)

Under the NES, land is considered to be actually or potentially contaminated if an activity or industry on the Hazard Activities and Industries List (HAIL) has been, is, or is more likely than not to have been, undertaken on the land.

This historical desktop investigation, including a review of the property file held by council, has identified that a large portion of the site has been used for horticultural activities extensively since the 1970's.

This investigation has also identified that the area of the residential dwelling and surrounding ornamental gardens adjacent Hobsonville Road, has not been the site of any historic or current HAIL activities and can therefore be excluded from any further investigations as it does not meet the criteria of a piece of land to which the NES applies (refer Appendix F).

As a result, any subdivision, soil disturbance, or development projects conducted on any of the three properties where historic HAIL activities have been identified (refer Appendix F), will be required to address the requirements of the NES, and a detailed site investigation including the analysis of representative soil samples for the presence of potential contaminants of concern will be required. Following the analysis of the soil samples further actions may be required under the requirements of the NES which may include the remediation of areas of contaminated soil and / or on-going site management and monitoring.

14.2. THE AUCKLAND COUNCIL REGIONAL PLAN (ARP:ALW) RULES & THE PROPOSED AUCKLAND UNITARY PLAN (PAUP)

Following the results of the detailed site inspection required by the NES, it is possible that, although the site may be found to be compliant with the soil contaminant standards of the NES for Human health, it may not meet the environmental discharge criteria of the ACRP:ALW or the proposed Auckland Unitary Plan. As a result, further actions may be required by council which may include the remediation of areas of contaminated soil and / or on-going site management and monitoring.

14.3. POTENTIAL AREAS OF CONCERN

The following potential areas of concern have been identified on site:

- Paddocks associated with the cultivation of roses (generally widespread and uniform pesticide / fertiliser use);
- Glasshouses / greenhouses associated with the cultivation of roses (generally widespread and uniform pesticide / fertiliser use);
- Potting sheds / implement sheds / packing sheds associated with horticultural activities on site (generally small hotspots of potential pesticide / fertiliser contamination);
- Landscaped ornamental features adjacent road (possible non-uniform targeted pesticide / fertiliser use);
- Landscape modifications and uncertified filling associated with the construction of a motocross track (possible non-uniform heavy metal, petroleum and hydrocarbon contamination);
- Landscape modifications and uncertified filling associated with the removal of greenhouses and storage of building rubble in the area (possible non-uniform heavy metal, petroleum and hydrocarbon contamination);
- The presence of non-engineered, unidentified, fill material at several locations across the site; and
- The storage of unknown / unidentified dwellings and equipment on site (unknown).

Given the complex, though well defined, multiple sources of potential contamination on site, any soil sampling strategy is likely to require a variety of strategies and techniques associated with each area.

APPENDIX C SITE PHOTOGRAPHS

PLATE 1: Looking east from SS1 towards former rose cultivation area

PLATE 2: Looking west over SS19 located the footprint if a former glasshouse

PLATE 3: Looking west from SS11 located within the motocross track.

PLATE 4: Overlooking SS6, located under compacted gravel

APPENDIX D LABORATORY TRANSCRIPTS

Hill Laboratories
BETTER TESTING BETTER RESULTS

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Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Geosciences Limited	**Lab No:**	1330322 SPv1
Contact:	Brodie Rowse	**Date Registered:**	24-Sep-2014
	C/- Geosciences Limited	**Date Reported:**	07-Oct-2014
	PO Box 35366	**Quote No:**	
	Browns Bay	**Order No:**	
	AUCKLAND 0753	**Client Reference:**	0507 84-90 Hobsonville Rd
		Submitted By:	Brodie Rowse

Sample Type: Soil

		Sample Name:	SS1	SS2	SS3	SS4	SS5
		Lab Number:	1330322.1	1330322.2	1330322.3	1330322.4	1330322.5
Individual Tests							
Total Recoverable Arsenic	mg/kg dry wt		6	7	3	< 2	4
Total Recoverable Copper	mg/kg dry wt		13	14	12	6	188
Total Recoverable Lead	mg/kg dry wt		26	22	24	8.8	74
Organochlorine Pesticides Screening in Soil							
Aldrin	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt		< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt		0.032	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt		0.017	< 0.010	< 0.010	< 0.010	< 0.010
Dieldrin	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

		Sample Name:	SS6	SS7	SS8	SS9	SS10
		Lab Number:	1330322.6	1330322.7	1330322.8	1330322.9	1330322.10
Individual Tests							
Dry Matter	g/100g as rcvd		-	-	-	-	63
Total Recoverable Arsenic	mg/kg dry wt		< 2	< 2	< 2	2	-
Total Recoverable Copper	mg/kg dry wt		13	6	7	6	-
Total Recoverable Lead	mg/kg dry wt		10.8	6.5	8.4	10.3	-

Sample Type: Soil						
Sample Name:		SS6	SS7	SS8	SS9	SS10
Lab Number:		1330322.6	1330322.7	1330322.8	1330322.9	1330322.10
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	-	-	-	-	< 2
Total Recoverable Cadmium	mg/kg dry wt	-	-	-	-	< 0.10
Total Recoverable Chromium	mg/kg dry wt	-	-	-	-	10
Total Recoverable Copper	mg/kg dry wt	-	-	-	-	3
Total Recoverable Lead	mg/kg dry wt	-	-	-	-	7.4
Total Recoverable Nickel	mg/kg dry wt	-	-	-	-	2
Total Recoverable Zinc	mg/kg dry wt	-	-	-	-	6
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	-
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	-	-	-	< 11
C10 - C14	mg/kg dry wt	-	-	-	-	< 30
C15 - C36	mg/kg dry wt	-	-	-	-	< 50
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	-	-	< 80

Sample Name:		SS11	SS12	SS13	SS14	SS15
Lab Number:		1330322.11	1330322.12	1330322.13	1330322.14	1330322.15
Individual Tests						
Dry Matter	g/100g as rcvd	83	82	-	-	-
Total Recoverable Arsenic	mg/kg dry wt	-	-	< 2	10	< 2
Total Recoverable Copper	mg/kg dry wt	-	-	3	31	13
Total Recoverable Lead	mg/kg dry wt	-	-	3.9	9.7	4.4
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.26	-	-	-
Total Recoverable Chromium	mg/kg dry wt	< 2	7	-	-	-
Total Recoverable Copper	mg/kg dry wt	< 2	11	-	-	-
Total Recoverable Lead	mg/kg dry wt	2.3	10.0	-	-	-
Total Recoverable Nickel	mg/kg dry wt	< 2	2	-	-	-
Total Recoverable Zinc	mg/kg dry wt	< 4	44	-	-	-
Organochlorine Pesticides Screening in Soil						

Sample Type: Soil						
Sample Name:		SS11	SS12	SS13	SS14	SS15
Lab Number:		1330322.11	1330322.12	1330322.13	1330322.14	1330322.15
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	-	-	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Dieldrin	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	< 8	-	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	-	-	-
C15 - C36	mg/kg dry wt	< 40	< 40	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	-	-	-

Sample Name:		SS16	SS17	SS18	SS19	SS20
Lab Number:		1330322.16	1330322.17	1330322.18	1330322.19	1330322.20
Individual Tests						
Dry Matter	g/100g as rcvd	-	-	81	78	83
Total Recoverable Arsenic	mg/kg dry wt	6	37	< 2	2	< 2
Total Recoverable Copper	mg/kg dry wt	13	58	8	< 2	6
Total Recoverable Lead	mg/kg dry wt	8.3	12.1	8.9	5.4	5.6
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	0.027	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		SS16	SS17	SS18	SS19	SS20
Lab Number:		1330322.16	1330322.17	1330322.18	1330322.19	1330322.20
Organochlorine Pesticides Screening in Soil						
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	-	< 8	< 9	< 8
C10 - C14	mg/kg dry wt	-	-	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	-	-	< 40	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	< 70	< 70	< 70

Sample Name:		SS21	SS22	SS23	DUP 1	DUP 2
Lab Number:		1330322.21	1330322.22	1330322.23	1330322.24	1330322.25
Individual Tests						
Dry Matter	g/100g as rcvd	82	85	81	-	-
Total Recoverable Arsenic	mg/kg dry wt	3	5	< 2	3	4
Total Recoverable Copper	mg/kg dry wt	17	121	3	99	9
Total Recoverable Lead	mg/kg dry wt	37	8.1	6.0	33	10.8
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	-	-
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	< 8	< 8	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	-	-
C15 - C36	mg/kg dry wt	< 40	< 40	230	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	230	-	-

Sample Type: Soil						
Sample Name:		DUP 3				
Lab Number:		1330322.26				
Individual Tests						
Total Recoverable Arsenic	mg/kg dry wt	< 2	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	< 2	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	4.3	-	-	-	-

Analyst's Comments

Appendix No.1 - Total Petroleum Hydrocarbon Chromatograms

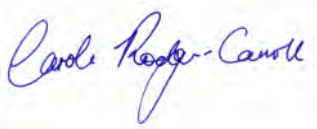
SUMMARY OF METHODS

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 clean 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.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
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%.	-	1-26
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	10-12
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	0.010 - 0.04 mg/kg dry wt	1-9, 13-23
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	10-12, 18-23
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	10-12, 18-23
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-26
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	1-9, 13-26
Total Recoverable Copper	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-9, 13-26
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	1-9, 13-26

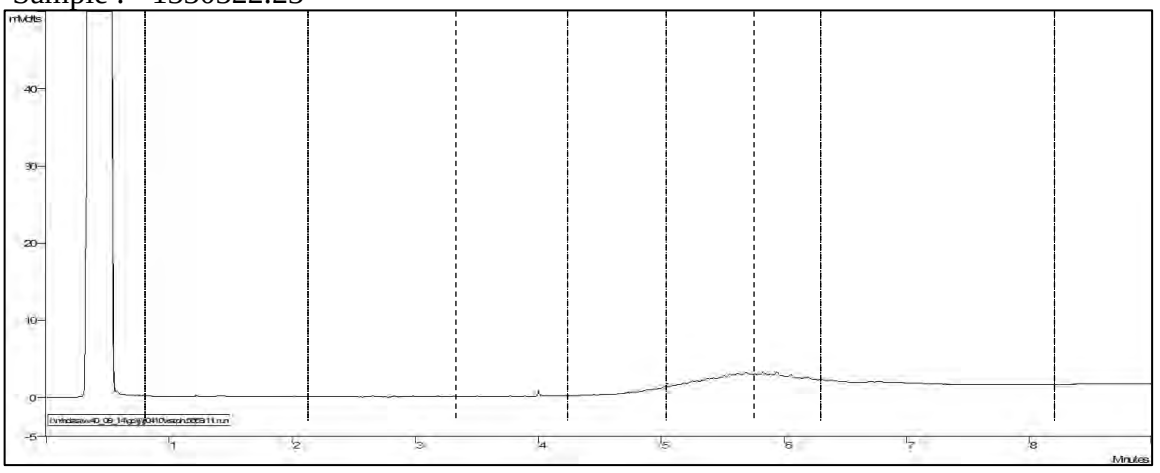
These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.



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

Sample : 1330322.23



C7 C10 C15 C20 C25 C30 C34 C44

APPENDIX E 95% UCL CALCULATION SUMMARY

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95% Upper Confidence Arsenic$_{Average}$ Calculation For Arsenic

Parameter	*Normal Distribution*	*Lognormal Distribution*	*Recommended Distribution*	*Units*
Analyte threshold	0.3	0.3	**0.3**	mg/kg
UCL $_{average}$	7.37	5.86	**5.86**	mg/kg
No. of samples	23	23	**23**	
Mean	4.74	3.14	**3.14**	mg/kg
Estimated Mean	4.74	4.19	**4.19**	mg/kg
Standard deviation	7.35	2.10	**2.10**	mg/kg
Suggested no. of extra samples needed	17	4	**4**	
Distribution	-	-	**lognormal**	

Distribution Test Summary Using Coeffiecient Of Variation
Distribution test result (as per NSW EPA guidelines) - lognormal
Distribution test result (as per Gilbert) - normal

95% Upper Confidence limits
The statistical analysis indicates that there is a 95% probability that the arithmetic average concentration of the contamination will not exceed 5.8620 mg/kg

References: NSW EPA, *Contaminated Sites, Sampling Design Guidelines* , September 1995
Gilbert, R.O., 1987, *Statistical Methods For Environmental Pollution Monitoring* , Van Nostrand Reinhold, New York

Note: Where the laboratory reported a result below the method detection limit, a value equal to the detection limit was substituted for the purposes of statistical calculation.

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95% Upper Confidence Copper$_{Average}$ Calculation For Copper

Parameter	*Normal Distribution*	*Lognormal Distribution*	*Recommended Distribution*	*Units*
Analyte threshold	0.3	0.3	**0.3**	mg/kg
UCL $_{average}$	39.93	42.31	**42.31**	mg/kg
No. of samples	23	23	**23**	
Mean	24.17	10.47	**10.47**	mg/kg
Estimated Mean	24.17	20.57	**20.57**	mg/kg
Standard deviation	44.00	3.25	**3.25**	mg/kg
Suggested no. of extra samples needed	22	1	**1**	
Distribution	-	-	**lognormal**	

Distribution Test Summary Using Coeffiecient Of Variation

Distribution test result (as per NSW EPA guidelines) - lognormal
Distribution test result (as per Gilbert) - lognormal

95% Upper Confidence limits

The statistical analysis indicates that there is a 95% probability that the arithmetic average concentration of the contamination will not exceed 42.3107 mg/kg

References: NSW EPA, *Contaminated Sites, Sampling Design Guidelines* , September 1995
Gilbert, R.O., 1987, *Statistical Methods For Environmental Pollution Monitoring* , Van Nostrand Reinhold, New York

Note: Where the laboratory reported a result below the method detection limit, a value equal to the detection limit was substituted for the purposes of statistical calculation.

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95% Upper Confidence Lead$_{Average}$ Calculation For Lead

Parameter	*Normal Distribution*	*Lognormal Distribution*	*Recommended Distribution*	*Units*
Analyte threshold	0.3	0.3	**0.3**	mg/kg
UCL $_{average}$	19.46	19.33	**19.46**	mg/kg
No. of samples	23	23	**23**	
Mean	13.91	9.87	**13.91**	mg/kg
Estimated Mean	13.91	13.48	**13.91**	mg/kg
Standard deviation	15.51	2.17	**15.51**	mg/kg
Suggested no. of extra samples needed	9	1	**9**	
Distribution	-	-	**normal**	

Distribution Test Summary Using Coeffiecient Of Variation
Distribution test result (as per NSW EPA guidelines) - normal
Distribution test result (as per Gilbert) - normal

95% Upper Confidence limits
The statistical analysis indicates that there is a 95% probability that the arithmetic average concentration of the contamination will not exceed 19.4608 mg/kg

References: NSW EPA, *Contaminated Sites, Sampling Design Guidelines* , September 1995
Gilbert, R.O., 1987, *Statistical Methods For Environmental Pollution Monitoring* , Van Nostrand Reinhold, New York

Note: Where the laboratory reported a result below the method detection limit, a value equal to the detection limit was substituted for the purposes of statistical calculation.