DETAILED SITE INVESTIGATION

147-151 NAPIER ROAD
HAVELOCK NORTH

PROJECT NO. EAM2313-01

PREPARED FOR
SUN PROPERTIES LIMITED

PREPARED BY
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OCTOBER 2022

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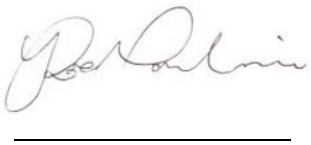

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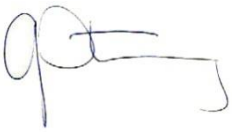

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1 INTRODUCTION

EAM NZ Limited (EAM) has been engaged by Sun Properties Limited to undertake a Detailed Site Investigation (DSI), at 147-151 Napier Road, Havelock North (hereon in referred to as the Site). It is our understanding that the site is proposed for subdivision, and development into residential land.

This DSI has been undertaken to provide a contamination assessment of the Site and to evaluate human health risks at the Site. A phased approach has been adopted for this investigation with an initial investigation, assembling background information to identify potential sources of contamination from past and present activities. This information is then used to develop a conceptual Site model and investigation strategy.

This report provides the following information:

- Background information.
- Site history.
- A conceptual Site model.
- Site visit and sampling
- Laboratory results.
- Conclusions and recommendations.

This investigation has been carried out in accordance with the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES).

1.1 SCOPE

The following scope of work was completed:

- Review of available information from Hastings District Council, namely, the Listed Land Use Register (LLUR), historical aerial photographs, and available environmental reports.
- Review of the environmental setting of the site.
- Collection of soil samples across the investigation area
- Analysis of soil samples at an accredited laboratory for:
    - Heavy metals
    - Organo Chlorine Pesticides
- Preparation of a DSI report, including presentation and interpretation of results in accordance with the requirements of the NESCS and with the current 2021 edition of the MfE Contaminated Land Management Guidelines No. 1 and No. 5.

This assessment has been undertaken by a Suitably Qualified Environmental Practitioner (SQEP) in the field of contaminated land assessments. The SQEP holds a BSc Degree in Environmental Science.

1.2 LIMITATIONS

This report: has been prepared by EAM for SUN PROPERTIES LIMITED and may only be used and relied on by Hastings District Council for the purpose agreed between EAM and SUN PROPERTIES LIMITED as set out in section 1.1 of this report. EAM otherwise disclaims responsibility to any person other than SUN PROPERTIES LIMITED arising in connection with this report. EAM also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by EAM in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. EAM has no responsibility or obligation to update this report to account for events or changes occurring after the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by EAM described in this report (refer section(s) 1.3 of this report). EAM disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the site conditions, such as the location of buildings, services, and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. EAM does not accept responsibility arising from, or in connection with, any change to the site conditions. EAM is also not responsible for updating this report if the site conditions change.

EAM has prepared this report based on information provided SUN PROPERTIES LIMITED and others who provided information to EAM (including Government authorities), which EAM has not independently verified or checked beyond the agreed scope of work. EAM does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Notwithstanding the Report Limitations, we confirm that Hastings District Council can rely on this report for the purposes of determining compliance with the NES guidelines with respect to the development identified in this assessment.

1.3 ASSUMPTIONS

EAM has made the following assumptions during the preparation of this report:

- Information obtained from third parties and SUN PROPERTIES LIMITED is complete and accurate.
- The observed and inferred conditions are representative of the actual conditions associated with HAIL sites and / or other sites not directly assessed.
- That the future land use of the site will remain Residential.

2 SITE DETAILS

2.1 SITE DESCRIPTION

The Site is located at 147-151 Napier Road, Havelock North, with the legal description PT LOTS 2 3 DP 8602 BLK IV TE MATA SD. The site comprises a total area of 0.73Ha.

At present, the site is occupied by large cool stores, and warehouses which have various tenants in the property. Nearly the entire sire is covered in 150mm thick concrete hardstand, except a small, grassed area centrally located in the middle of the site, and the driveway entrance which is compacted gravel.

3 ENVIRONMENTAL SETTING

The topography of the site and surrounding area is low gradient flat land. The S-Map (Landcare Research, 2022) reference site soils as a deep loam over sand, which results in good drainage. It is classified as Recent Soil. Recent soils are described as being weakly developed with a distinct topsoil, but a weak or absent B horizon. They typically occur on alluvial floodplains and young land surfaces. These soils are typical of low-lying areas.

Soils at the site were formed during the early Holocene and form part the Heretaunga Formation. Site geology is described as Tollemache Member, comprising Alluvial gravel, sand, silt and mud and swamp deposits of peat, and river gravel from the Ngaruroro, Tukituki and Tutaekuri rivers.

Groundwater in the Heretaunga plains is source from the Main (Ngaruroro & Tutaekuri) aquifer system which extends to more than 250m depth. The plains are underlain by inter fingered river channel, estuarine and marine quaternary sediments which have occurred during a period of fluctuating sea level changes (Rosen & White, 2001). The major aquifers in the quaternary sediments are primarily river channel and shoreline gravels which have been transported during by the Ngaruroro, Tutaekuri and Tuki Tuki Rivers. These gravel aquifers are separated by impermeable marine muds, clays, silts, and estuarine sediments which create the confined aquifer systems which underlie the eastern two-thirds of the Heretaunga plains aquifer system.

Groundwater is predominantly sourced for domestic water supply, and irrigation.

4 PROPERTY HISTORY

A desktop study was undertaken to gain an understanding of the history of the site. The review looks to determine potential contaminants which may be present at the site because of past and present land uses. The following information was sourced to establish the history of the site:

Hastings District Council Property Search
- Historical Aerial Photographs
- HAIL review
- Site Visit

4.1 HASTINGS DISTRICT COUNCIL PROPERTY SEARCH

A review of Hastings District Council property records found reference to many files relating to 147-151 Napier Road, Property Number 58860. These refer to the following activities:

- BWF967, 2022, Building Warrant of Fitness
- RMA20200099, Zapata Limited, existing use rights Certificate, AAE
- ABA20161818, Building consent Documents, application for new sewer line

- ABA20111164, Application to erect covered canopy
- ABA8913, Application to Shift Dwelling, 1982
- ABA8966, application, Erect cold store, 1982
- ABA20000974, Erect Portacom ablution block
- RMA Deep freezer storage withdrawn, 1985
- RMA reconstruct cool store, 1984
- RMA Erect Packhouse, 1982
- RMA establish cold store, 1980
- RMA sorting/packing, fresh produce, 1979
- Application to erect zero store, 1980
- ABA8966, specifications and calculations, 1982
- ABA10933 Application for repositioning of blast freezers, 1984
- ABA20032049, Internal alterations
- RMA950365 NR 59 Pack house extension,1995
- RMA specified departure cool stores, 1967
- ABA9600639 Additions to pack house
- RMA950365 Relocated existing building
- ABA9292 Application to erect packing shed, 1982
- ABA951711 Relocate cool store
- ABA10635, Packhouse extension, 1985
- C91, Service connection, 1997

4.2 HISTORICAL AERIAL PHOTOGRAPHS

Historical aerial photographs of the site, from 1949 through to 2022, were sourced from Retrolens, and Hastings District Council. Aerial photographs for the years 1949,1964,1969, 1972, 1980, 1994, 1999, 2004, 2014 and 2022 are presented in Appendix B.

The earliest historical imagery available is from 1949. Two large buildings are in the south-west corner of the property, and the remainder of the site is planted in orchard. Orchard plants are small in shape and size.

The next closest available imagery is from 1964 and shows the presence of two large packhouses or cool stores in the south-eastern end of the property, joined by an overhead roof. A driveway extends from the south-eastern corner of the property to these two buildings and suggests an accessway beneath the awning which adjoins the two buildings.

Centrally located within the site is a small shed, a dwelling, and likely a detached garage. The land surrounding this dwelling and garage is grassed with scattered trees. It appears that concrete hardstand is present around the northern side of cool stores.

A second dwelling is present in the north-eastern corner, along with a rectangular shaped object, which is though to be an implement shed or shopping container.

No significant changes are noted to the site through until 1980.

By 1999, an extension to the cool store in the south-eastern corner is seen, and additional two pack houses are present on the north-west and northern boundary. This agrees with HDC property files for the site.

The dwelling in the north of the site has moved to the north-east boundary, which is likely to have occurred in 1982, as suggested by building consent ABA8913, Application to shift dwelling, 1982. By 1999, the entire site appears covered with concrete hardstand, except for a small, grassed area near the centrally located dwelling.

Imagery from 2004 shows the merging of all buildings on the south-west/ north-western boundary, as they are adjoined with additional building extensions. By this time, the dwelling in the north-east corner has also been removed from the site.

No significant changes are noted to the site through to 2022.

4.3 DISCUSSION WITH PROPERTY OWNER

Discussions with the current owner, Russell Deakin of Sun Properties Limited established that prior to him purchasing the property "a couple of years ago". the facility was owned by Mr Apple. The site has been packhouses since the 1960's, with large extensions to the facility occurring in the 1980's.

The property is currently tenanted by Flock events, who occupy the sheds on the north-western boundary. The southern cool store is tenanted by a hemp medical processing outfit, and the northern cool store is vacant.

The dwelling in the middle of the site has always been used as the site offices.

4.4 HAZARDOUS ACTIVITIES AND INDUSTRIES LIST

In accordance with Appendix C: Hazardous Activities and Industries List (HAIL) of the MfE NES for Assessing and Managing Contaminants in Soil to Protect Human Health, the site is considered HAIL.

Under Section A, Chemical Manufacture, application, and bulk storage:

10. Persistent pesticide bulk storage or use including sports turf, market gardens, orchards, glass houses or spray sheds.

I. Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.

5 CONCEPTUAL SITE MODEL

5.1 RATIONALE

The overall rationale for the site investigation was to determine whether historical activities on the Site may have caused soil contamination that would affect the proposed subdivision for residential land use. The following is an analysis of potential contaminants, receptors, and pathways between potentially contaminated soils, and the proposed Industrial land use.

5.1.1 HAZARDOUS SUBSTANCES AND POTENTIAL CONTAMINANTS OF CONCERN

For the purposes of this investigation, the following contaminants were considered.

- Metals
- Organochlorine Pesticides

Metals occur naturally in the soil environment from the process of weathering of parent materials. Soils may become contaminated by the accumulation of metals and through leaded paints, land application of fertilisers, animal manures, sewage, pesticides, leaching from treated timber and wastewater irrigation. Most metals do not undergo microbial or chemical degradation hence, their total concentration in soils persists forever. Metals are associated with human illness, particularly nervous system damage from long term exposure in humans.

The main source of contamination in former orchard sites is from historic Organo-Chlorine and Arsenate pesticides, and copper.

Arsenate pesticides were widely used in New Zealand, principally against the codling moth and snow-white linden moth. They were used mainly on apples, but also on other fruit trees, garden crops, turfgrasses, and against mosquitoes. Historically, extensive use of the horticultural pesticides, lead arsenate ($PbAsO_4$), calcium arsenate ($CaAsO_4$), magnesium arsenate ($MgAsO_4$), zinc arsenate ($ZnAsO_4$), zinc arsenate [$Zn(AsO_2)_2$] and Paris Green [$Cu(CH_3COO)_2.3Cu(AsO_2)_2$] in orchards has contributed to soil arsenic contamination (Peryea and Creger 1994). Arsenate pesticides were phased out in the early 1970's, however, Lead arsenate was still being used in New Zealand in 1976 albeit on a small and diminishing scale (Gaw, 2003).

A range of products containing copper was historically and is currently used as fungicides.

DDT substituted arsenate pesticides in 1947 when it was found that residues remained in the products despite washing their surfaces. DDT is the most well-known organochlorine pesticide. It was approved for use in New Zealand following World War II and from 1964 onwards the use of DDD was controlled through the NZ Agricultural Chemicals Regulations and could only be used via permit (Gaw, 2003).

5.1.2 POTENTIALLY RELEVANT SENSITIVE HUMAN AND ECOLOGICAL RECEPTORS

The site is proposed for residential land use (10% produce), which is considered one of the more sensitive of land uses. The MFEs National Environmental Standard (NESCS) for soil contaminants, considers that residential landowners may use the land for activities such as vegetable gardening or fruit trees. These activities pose a risk to the consumer/landowner's where contaminated soils are involved in an exposure pathway.

The following potential receptors were identified as being relevant to the Site:

- Earthworks, construction, maintenance, and excavation contractors who may encounter potentially contaminated soil during the proposed works via inhalation (dusts).
- Future residents at the Site via inhalation (dusts) and/or ingestion of contaminated soil.

5.1.3 EXPOSURE PATHWAYS

A human health risk can only occur when there is a direct link between contaminant source and receptor. Potential complete pathways for this Site may include:

- Dermal (skin) contact with soil, for gardening, construction.
- Direct contact and inhalation of dusts and soil during construction and site works.
- Consumption of foods grown in contaminated soils.
- Consumption of soils, particularly by small children.

6 FIELD INVESTIGATION

6.1 RATIONALE OF SAMPLE COLLECTION

Sampling locations across the Site were established using reference to the "Contaminated Land Guidelines No. 5" (MfE 2021). These guidelines set out (in Table B1; p91), indicate the *"number of samples required to detect hotspot with 95 percent confidence"*.

Samples were systematically collected from seventeen locations across the site, with the locations presented in Figure 3, Appendix A. Due to the presence of large warehouses with thick

concrete foundations, soil sampling could not be achieved beneath buildings. Sampling beneath these buildings will be required upon their removal.

Samples were collected using a mechanical soil augur and collected from the 0-150mm, 300mm and 500mm depth intervals in each location. Two duplicate samples were collected during sampling for statistical accuracy and precision of results.

Samples were collected directly into laboratory supplied containers and were placed in a chilly bin with ice packs for transport. Samples were couriered to an IANZ accredited laboratory (Hills Laboratories) under standard chain of custody procedures.

6.2 SITE LITHOLOGY

Site soils were observed to be consistent across the site as light brown, fine silty sand to approximately 500-600mm, and light brown sandy silts from 500-600mm to the base of the hole at around 1.0m depth.

6.2.1 FIELD QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Quality Assurance and Quality Control procedures undertaken during sampling included the following:

- Changing of disposable gloves after each sample.
- Decontamination and rinsing of augur between each sample.
- Collection of soil samples in new, clean, appropriately labelled sample bags and jars.
- 10% Duplicate analysis (collection of two duplicates).
- Use of chain of custody procedures and forms.
- Use of IANZ accredited laboratories with in-house QA/QC procedures for the analyses requested.

7 ASSESSMENT CRITERIA

The following soil assessment criteria have been selected for the site.

7.1 THE NATIONAL ENVIRONMENTAL STANDARD FOR ASSESSING AND MANAGING CONTAMINANTS IN SOIL TO PROTECT HUMAN HEALTH (NESCS)

The NESCS sets national standards for contaminants in soil to protect human health. It contains a national set of soil contaminant standards (SCS) for 12 priority contaminants for five standard land use scenarios. The land use category selected for this investigation was Residential (10% Produce) as described in the NES CS User Guide.

7.2 THE NATIONAL ENVIRONMENTAL PROTECTION MEASURE

In the absence of New Zealand specific risk-based human health criteria for beryllium, nickel and zinc, the Australian National Environment Protection Measure 2013 (NEPM) guidelines have been adopted for this investigation. The intention of the NEPM is to enable safe use of contaminated land to ensure that contaminated land is appropriately assessed prior to development. The NEPM covers a range of land uses. For the purposes of this assessment, the NEPM Health-based

Investigation Level A (Residential land use) have been selected based on the land use and Site attributes.

7.3 BACKGROUND CONCENTRATIONS OF HEAVY METALS

Established background concentrations are based on the analysis of soil sample sets collected from major soil types in the Hawkes Bay Region for selected heavy metals. If concentrations of contaminants are found to be at or less than typical background concentrations, then the NES CS does not apply.

7.4 ECOLOGICAL SOIL GUIDELINE VALUES

To assess potential risk to environmental receptors, the criteria for Residential / Recreational area developed for protection of ecological receptors from the updated, Development of soil guideline values for the protection of ecological receptors (Eco-SGVs): Technical Document (Manaaki Whenua Landcare Research, 2019) were used. Criteria were selected assuming a typical soil, aged contamination source, and a residential land use.

8 ANALYTICAL RESULTS

The following sections discusses the analytical results by analyte and compares against the adopted human health guideline criteria. In this case, the most appropriate SCS is likely to be those for the NES land use scenario of rural residential (10% Produce). The NES description of this land use is as follows:

"Standard residential Lot, for single dwelling sites with gardens, including homegrown produce consumption (10 percent)".

The analytical results are summarised in Table 1 in Appendix D, along with the laboratory reports. The results of analysis have been compared directly against appropriate (where available) Soil Contaminant Standards (SCS) from the NES Priority contaminants list (MfE, 2012).

8.1 BACKGROUND SOIL CONCENTRATIONS

Arsenic, copper, lead and zinc concentrations at the site are significantly elevated above background levels within the site. Sample locations TP3, TP4, TP5, TP6 and TP11 reported background concentrations.

Arsenic is elevated in eleven of the seventeen sample locations, with concentrations ranging between 14mg/kg and 67mg/kg, which exceeds the uncontaminated background soil value of 9mg/kg.

Copper concentrations are elevated in six locations, ranging from 35mg/kg to 101mg/kg, above the uncontaminated background soil value of 32mg/kg.

Lead concentrations are elevated in seven sample locations, at concentrations ranging from 33mg/kg to 171 mg/kg, which exceed the uncontaminated background soil values of 27mg/kg.

Zinc is elevated in TP2 and TP16, with concentrations of 160 mg/kg and 111 mg/kg, respectively, above the background value of 105mg/kg.

Cadmium, chromium, and nickel concentrations are at background levels within all sample locations.

This comparison allows for further assessment of consenting requirements under the NES and provides information regarding disposal options for off-site spoil.

8.2 METALS/METALLOIDS

Soil metal analysis was compared with the NES standards for residential (10% produce).

Soil arsenic concentrations are elevated above the NES residential standards of 20mg/kg in thirteen of the seventeen sample locations from the 0-150mm depth interval. Concentrations at this depth range between 28mg/kg and 67 mg/kg.

All sample locations which reported exceedance at surface 0-150mm were analysed at the 300mm and 500mm depth intervals. Of these thirteen locations, sample locations TP1 (500mm), TP2(300mm), TP9(300mm) and TP13 (300mm), reported exceedance. Except for TP1, which reported an increase at depth, TP2, TP9 and TP13 show a general decrease in concentration with depth.

Concentrations of cadmium, chromium, copper, lead, nickel, and zinc reported by the laboratory are within the NES residential standards.

8.3 ORGANOCHLORINE PESTICIDES

Two, three-part composite samples were analysed for OCP, from samples TP1, TP3, TP5 and TP6, TP7 and TP9. Trace concentrations of OCP were reported of DDE and DDT in both samples at concentrations well below the NES standards for residential land use (10 % produce). All other analytes were reported below the laboratory detection limits.

8.4 ECOLOGICAL SOIL GUIDELINE VALUES

Arsenic concentrations within TP13 0-150mm depth exceed of the Landcare Updated Development of Soil Guideline Values for Protection of Ecological Receptors (Eco-SGVs). The sample reported a concentration of 67mg/kg, which exceeds the Eco-SGV of 60 mg/kg.

8.5 QUALITY ASSURANCE AND QUALITY CONTROL

Duplicate analysis was completed as a means for determining uncertainty, accuracy, and precision of laboratory analysis. Four duplicate samples were collected during sampling at the same sample location and depth interval as TP1 0-150mm, TP6 0-150 mm, and labelled as TP1a, and TP6a.

The RPD between samples was calculated according to the following formula:

$$RPD = \frac{(Result\ No.1 - Result\ No.2)\ x\ 100}{(Mean\ of\ result\ No.1 + result\ No.2)}$$

The typical data quality objective is for an RPD to be within 30 – 50% (MfE, 2021). The RPD results are highly reliable and accurate.

8.6 RISK ASSESSMENT

A hazard – pathway – receptor pollution linkage is considered to aid assessment of risk associated with results of the site investigation.

For contaminated soils to pose a risk to a receptor, a complete pathway must exist between the contamination source and the identified receptor(s). If there is an incomplete pathway, then there is no risk. In this instance the results show significant risk to human health because of elevated arsenic concentrations present in site soils.

9 CONCLUSIONS AND RECOMMENDATIONS

EAM was engaged to undertake a Detailed Site Investigation of 147-151 Napier, Road, Havelock North, proposed for residential development. The objectives of the investigation were to evaluate:

1. The type, extent, and level of contamination, if any, within the proposed development site
2. Whether contaminants of concern identified present an unacceptable risk to human health or identified environmental receptors.
3. Whether the soils remaining on-site are suitable for the proposed end use.

A detailed site history was undertaken to review the historical land use of the site. The Site has been used as an orchard from at least 1949 before being converted into a cool store and packhouse operation. It has been used as a packaging facility until 2020.

This investigation identified two potential site activities included on the HAIL (Ministry for the Environment, 2011):

- Section A, Chemical Manufacture, application, and bulk storage: (10) Persistent pesticide bulk storage or use including sports turf, market gardens, orchards, glass houses or spray sheds.
- Section H: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment – There was considered potential for lead-based paint on existing and historical buildings which were present at the site from at least 1949, which has the potential to weather and contaminate site soils.

Due to the known and potential HAIL activities at the site, soil samples from seventeen locations were collected systematically across the site, and analysed for heavy metals, and OCP.

Laboratory analysis results and comparison with relevant NZ guidelines indicate that:

- Arsenic, lead, copper, and zinc concentrations are identified above the range of regional background concentrations across the whole site. Soils at the site are not considered to be “clean”.
- Arsenic concentrations at the site are elevated above the NES residential standards (10% produce) of 20 mg/kg, in thirteen of the seventeen surface samples. Concentrations which exceed the standard range from 27mg/kg to 67mg/kg mg/kg.
- Arsenic concentrations are present at elevated concentrations above NES residential standards at 300mm depth, in TP2, TP9 and TP13. Arsenic contamination extends to 500mm depth in TP1, reporting 28mg/kg in the 500mm depth sample.
- TP13 surface sample (0-150mm) exceeds of the Landcare Updated Development of Soil Guideline Values for Protection of Ecological Receptors (Eco-SGVs) for arsenic (60mg/kg) reporting a concentration of 67mg/kg.
- OCP concentrations were reported at trace levels by the laboratory and are within the NES standards for residential land use (10% produce).

At present, Elevated metals of arsenic are above NES residential standards, and it is therefore highly likely that the site poses a risk to human health risk, unless addressed through remediation.

It must be understood that approximately one third of the site was unable to be sampled due to the presence of existing buildings and cool stores. Further soil analysis will be required beneath these buildings upon their removal. Based on the size and depth of building foundations, it is

possible that soil from the footprints of these buildings may have already been previously relocated from the site at the time of development in earlier decades. The results of this additional soil assessment will be required for incorporation into a Remedial Action Plan, for site development. We would expect remediation to be possible and for the site to be redeveloped for residential purposes. We consider it appropriate for a condition of consent to be imposed to require the preparation of a Remedial Action Plan, including validation procedures, to be implemented prior to site works.

Based on the exceedance of background soil concentrations, and ecological soil guideline values, off site disposal options, should they be required as part of development will require planning, consideration, and possible resource consent approval.

10 REFERENCES

MfE 2021 Contaminated Land Management Guidelines No.1 Reporting on Contaminated Sites in New Zealand. Ministry for the Environment.

MfE 2012 Users' Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health. Ministry for the Environment.

MfE 2021 Contaminated Land Management Guidelines No.5; Site Investigation and Analysis of Soil. Ministry for the Environment.

Hawkes Bay Region: Background Soil Concentrations for Managing Soil Quality, Landcare Research, 2014.

https://soils-maps.landcareresearch.co.nz (2020)

NZGS. (2005). New Zealand Geotechnical Society December 2005 - Guidelines for the classification and description of soil and rock for engineering purposes.

Historic Pesticide Residues in Horticultural and Grazing Soils in the Tasman District. S. K. Gaw, 2003.

Peryea FJ, Creger TL (1994). Vertical distribution of lead and arsenic in soils contaminated with lead arsenate pesticide residues. *Water Air and Soil Pollution*, 297-306

APPENDIX A-FIGURES

FIGURE 1. SITE LOCATION PLAN
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FIGURE 2. SAMPLE LOCATIONS SHOWING NES RESIDENTIAL EXCEEDANCE IN RED

APPENDIX B -AERIAL PHOTOGRAPHY

1949-SOURCE, HDC

1964- SOURCE, RETROLENS

1969- SOURCE, RETROLENS

1974- SOURCE, RETROLENS

1980-SOURCE, RETROLENS

1999- SOURCE, HDC

2004- SOURCE, HDC

2014- SOURCE, HDC

APPENDIX C- SITE PHOTOGRAPHS

Above. Sheds on north-western boundary

Top. Cool store on south-eastern corner. **Middle**. Sheds. **Bottom**. Office, lunch area

Top. Office (former dwelling) in centre of site. **Middle**. Looking south. **Top**. Northern cool store

Top. Driveway access from Napier Road. **Middle**. Office. **Bottom.** Central area of the site.

Above. Soil cores.

APPENDIX D- LABORATORY ANALYSIS AND REPORTS

TABLE 1. SUMMARY OF SOIL METAL RESULTS (mg/kg)

Sample Name:	Arsenic mg/kg	Cadmium mg/kg	Chromium mg/kg	Copper mg/kg	Lead mg/kg	Nickel mg/kg	Zinc mg/kg
TP1 0-150mm	48	< 0.10	12	9	14.9	10	45
TP2 0-150mm	40	0.2	15	48	171	11	160
TP3 0-150mm	4	< 0.10	12	8	14.4	10	52
TP4 0-150mm	8	< 0.10	18	13	19.1	11	81
TP5 0-150mm	8	< 0.10	12	14	15.2	9	45
TP6 0-150mm	10	< 0.10	13	27	24	10	54
TP7 0-150mm	27	< 0.10	12	49	56	8	51
TP8 0-150mm	20	< 0.10	10	8	11.7	8	39
TP9 0-150mm	53	< 0.10	15	30	47	12	63
TP10 0-150mm	17	< 0.10	10	8	15.6	8	39
TP11 0-150mm	4	< 0.10	9	5	6.6	7	33
TP12 0-150mm	32	< 0.10	15	35	54	13	65
TP13 0-150mm	67	0.14	14	101	210	11	82
TP14 0-150mm	39	0.11	15	44	143	12	80
TP15 0-150mm	19	0.13	9	15	33	6	46
TP16 0-150mm	38	< 0.10	14	62	143	10	111
TP17 0-150mm	10	< 0.10	14	24	77	10	79
TP1a 150mm	55	< 0.10	13	10	17.2	10	46
TP6a 150mm	9	< 0.10	13	25	22	11	53
TP1 300mm	15	< 0.10	12	8	12	10	42
TP2 300mm	28	0.19	16	32	97	12	187
TP7 300mm	14	< 0.10	11	16	17.8	8	37
TP8 300mm	3	< 0.10	9	5	7.9	7	36
TP9 300mm	44	< 0.10	17	25	40	14	67
TP12 300mm	9	< 0.10	15	40	26	13	64
TP13 300mm	32	< 0.10	16	49	100	14	73
TP14 300mm	17	< 0.10	17	24	102	14	75
TP1 500mm	28	< 0.10	13	11	19.2	10	47
TP2 500mm	11	< 0.10	16	16	31	13	80
TP7 500mm	4	< 0.10	9	7	9.1	7	33
TP8 500mm	3	< 0.10	10	5	7.7	8	38
TP9 500mm	16	< 0.10	18	17	28	15	71
TP12 500mm	6	< 0.10	13	10	13.8	11	47
TP13 500mm	4	< 0.10	12	8	11	10	43
TP14 500mm	14	< 0.10	19	20	35	16	74
HB Uncontaminated Background Soil	9	0.7	24	32	27	17	105
NES Residential (10% produce)[1]	20	3	460	>10,000	210		
NEPM Residential A [2]						400	7400
Landcare Eco SGV's [3]	60	12	390	240	900	NGV	300

Exceeds Hawkes Bay Uncontaminated Background Soil

123 Exceeds Ecological SGV's

RED Exceeds NES Residential

[1]-MfE, June 2011. Resource Management (National Environmental Standard for Assessing and managing contaminants in Soil to Protect Human Health) Regulations 2011

[2]-National Environmental Protection (Assessment of Site Contamination) Measure, 1999 Landcare Updated

[3] Development of Soil Guideline Values for Protection of Ecological Receptors (Eco SGVs). Assumes residential/recreational area, aged source, typical soil

TABLE 2. SUMMARY OF ORGANO-CHLORINE PESTICIDES (mg/kg)

OCP	Units	Composite of TP1 0-150mm, TP3 0-150mm and TP5 0-150mm	Composite of TP6 0-150mm, TP7 0-150mm and TP9 0-150mm	NZ STANDARDS
Aldrin	mg/kg	< 0.012	< 0.012	2.6 [1]
alpha-BHC	mg/kg	< 0.012	< 0.012	
beta-BHC	mg/kg	< 0.012	< 0.012	
delta-BHC	mg/kg	< 0.012	< 0.012	
gamma-BHC (Lindane)	mg/kg	< 0.012	< 0.012	
cis-Chlordane	mg/kg	< 0.012	< 0.012	
trans-Chlordane	mg/kg	< 0.012	< 0.012	50 [2]
2,4'-DDD	mg/kg	< 0.012	< 0.012	
4,4'-DDD	mg/kg	< 0.012	< 0.012	
2,4'-DDE	mg/kg	< 0.012	< 0.012	
4,4'-DDE	mg/kg	0.048	0.012	
2,4'-DDT	mg/kg	< 0.012	< 0.012	
4,4'-DDT	mg/kg	0.021	< 0.012	
Total DDT Isomers	mg/kg	< 0.08	< 0.07	70 [1]
Dieldrin	mg/kg	< 0.012	< 0.012	2.6 [1]
Endosulfan I	mg/kg	< 0.012	< 0.012	270 [2]
Endosulfan II	mg/kg	< 0.012	< 0.012	
Endosulfan sulphate	mg/kg	< 0.012	< 0.012	
Endrin	mg/kg	< 0.012	< 0.012	10 [2]
Endrin aldehyde	mg/kg	< 0.012	< 0.012	
Endrin ketone	mg/kg	< 0.012	< 0.012	
Heptachlor	mg/kg	< 0.012	< 0.012	6 [2]
Heptachlor epoxide	mg/kg	< 0.012	< 0.012	
Hexachlorobenzene	mg/kg	< 0.012	< 0.012	10 [2]
Methoxychlor	mg/kg	< 0.012	< 0.012	300 [2]

[1]-MfE, June 2011. Resource Management (National Environmental Standard for Assessing and managing contaminants in Soil to Protect Human Health) Regulations 2011
[2]-National Environmental Protection (Assessment of Site Contamination) Measure, 1999 Landcare Updated

TABLE 3. RELATIVE PERCENTILE DIFFERENCES (%)

Sample Name:	Arsenic mg/kg	Cadmium mg/kg	Chromium mg/kg	Copper mg/kg	Lead mg/kg	Nickel mg/kg	Zinc mg/kg
TP1 0-150mm	48	< 0.10	12	9	14.9	10	45
TP1a 150mm	55	< 0.10	13	10	17.2	10	46
Mean	52	<0.10	13	10	16	10	46
RPD%	-14	<0.10	-8	-11	-14	0	-2
TP6 0-150mm	10	< 0.10	13	27	24	10	54
TP6a 150mm	9	< 0.10	13	25	22	11	53
Mean	10	<0.10	13	26	23	11	54
RPD %	11	0	0	8	9	-10	2

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Certificate of Analysis

Client:	EAM NZ Limited	**Lab No:**	3080247	SPv2
Contact:	Karen Toulmin	**Date Received:**	21-Sep-2022	
	C/- EAM NZ Limited	**Date Reported:**	03-Oct-2022	**(Amended)**
	233B Thompson Road	**Quote No:**	72316	
	RD 10	**Order No:**		
	Hastings 4180	**Client Reference:**	147 Napier Road	
		Submitted By:	Karen Toulmin	

Sample Type: Soil

	Sample Name:	TP1 0-150mm	TP2 0-150mm	TP3 0-150mm	TP4 0-150mm	TP5 0-150mm
	Lab Number:	3080247.1	3080247.2	3080247.3	3080247.4	3080247.5
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	48	40	4	8	8
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.20	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	12	15	12	18	12
Total Recoverable Copper	mg/kg dry wt	9	48	8	13	14
Total Recoverable Lead	mg/kg dry wt	14.9	171	14.4	19.1	15.2
Total Recoverable Nickel	mg/kg dry wt	10	11	10	11	9
Total Recoverable Zinc	mg/kg dry wt	45	160	52	81	45

	Sample Name:	TP6 0-150mm	TP7 0-150mm	TP8 0-150mm	TP9 0-150mm	TP10 0-150mm
	Lab Number:	3080247.6	3080247.7	3080247.8	3080247.9	3080247.10
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	10	27	20	53	17
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	13	12	10	15	10
Total Recoverable Copper	mg/kg dry wt	27	49	8	30	8
Total Recoverable Lead	mg/kg dry wt	24	56	11.7	47	15.6
Total Recoverable Nickel	mg/kg dry wt	10	8	8	12	8
Total Recoverable Zinc	mg/kg dry wt	54	51	39	63	39

	Sample Name:	TP11 0-150mm	TP12 0-150mm	TP13 0-150mm	TP14 0-150mm	TP15 0-150mm
	Lab Number:	3080247.11	3080247.12	3080247.13	3080247.14	3080247.15
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	32	67	39	19
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	0.14	0.11	0.13
Total Recoverable Chromium	mg/kg dry wt	9	15	14	15	9
Total Recoverable Copper	mg/kg dry wt	5	35	101	44	15
Total Recoverable Lead	mg/kg dry wt	6.6	54	210	143	33
Total Recoverable Nickel	mg/kg dry wt	7	13	11	12	6
Total Recoverable Zinc	mg/kg dry wt	33	65	82	80	46

	Sample Name:	TP16 0-150mm	TP17 0-150mm	TP1a 150mm	TP6a 150mm	TP1 300mm
	Lab Number:	3080247.16	3080247.17	3080247.18	3080247.19	3080247.20
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	38	10	55	9	15
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	14	14	13	13	12
Total Recoverable Copper	mg/kg dry wt	62	24	10	25	8
Total Recoverable Lead	mg/kg dry wt	143	77	17.2	22	12.0
Total Recoverable Nickel	mg/kg dry wt	10	10	10	11	10
Total Recoverable Zinc	mg/kg dry wt	111	79	46	53	42

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.

Sample Type: Soil						
Sample Name:		TP2 300mm	TP7 300mm	TP8 300mm	TP9 300mm	TP12 300mm
Lab Number:		3080247.21	3080247.26	3080247.27	3080247.28	3080247.31
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	28	14	3	44	9
Total Recoverable Cadmium	mg/kg dry wt	0.19	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	16	11	9	17	15
Total Recoverable Copper	mg/kg dry wt	32	16	5	25	40
Total Recoverable Lead	mg/kg dry wt	97	17.8	7.9	40	26
Total Recoverable Nickel	mg/kg dry wt	12	8	7	14	13
Total Recoverable Zinc	mg/kg dry wt	187	37	36	67	64

Sample Name:		TP13 300mm	TP14 300mm	TP1 500mm	TP2 500mm	TP7 500mm
Lab Number:		3080247.32	3080247.33	3080247.35	3080247.36	3080247.41
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	32	17	28	11	4
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	16	17	13	16	9
Total Recoverable Copper	mg/kg dry wt	49	24	11	16	7
Total Recoverable Lead	mg/kg dry wt	100	102	19.2	31	9.1
Total Recoverable Nickel	mg/kg dry wt	14	14	10	13	7
Total Recoverable Zinc	mg/kg dry wt	73	75	47	80	33

Sample Name:		TP8 500mm	TP9 500mm	TP12 500mm	TP13 500mm	TP14 500mm
Lab Number:		3080247.42	3080247.43	3080247.46	3080247.47	3080247.48
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	16	6	4	14
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	10	18	13	12	19
Total Recoverable Copper	mg/kg dry wt	5	17	10	8	20
Total Recoverable Lead	mg/kg dry wt	7.7	28	13.8	11.0	35
Total Recoverable Nickel	mg/kg dry wt	8	15	11	10	16
Total Recoverable Zinc	mg/kg dry wt	38	71	47	43	74

Sample Name:		Composite of TP1 0-150mm, TP3 0-150mm and TP5 0-150mm	Composite of TP6 0-150mm, TP7 0-150mm and TP9 0-150mm
Lab Number:		3080247.50	3080247.51
Individual Tests			
Dry Matter	g/100g as rcvd	84	85
Organochlorine Pesticides Screening in Soil			
Aldrin	mg/kg dry wt	< 0.012	< 0.012
alpha-BHC	mg/kg dry wt	< 0.012	< 0.012
beta-BHC	mg/kg dry wt	< 0.012	< 0.012
delta-BHC	mg/kg dry wt	< 0.012	< 0.012
gamma-BHC (Lindane)	mg/kg dry wt	< 0.012	< 0.012
cis-Chlordane	mg/kg dry wt	< 0.012	< 0.012
trans-Chlordane	mg/kg dry wt	< 0.012	< 0.012
2,4'-DDD	mg/kg dry wt	< 0.012	< 0.012
4,4'-DDD	mg/kg dry wt	< 0.012	< 0.012
2,4'-DDE	mg/kg dry wt	< 0.012	< 0.012
4,4'-DDE	mg/kg dry wt	0.048	0.012
2,4'-DDT	mg/kg dry wt	< 0.012	< 0.012
4,4'-DDT	mg/kg dry wt	0.021	< 0.012
Total DDT Isomers	mg/kg dry wt	< 0.08	< 0.07
Dieldrin	mg/kg dry wt	< 0.012	< 0.012
Endosulfan I	mg/kg dry wt	< 0.012	< 0.012
Endosulfan II	mg/kg dry wt	< 0.012	< 0.012
Endosulfan sulphate	mg/kg dry wt	< 0.012	< 0.012
Endrin	mg/kg dry wt	< 0.012	< 0.012
Endrin aldehyde	mg/kg dry wt	< 0.012	< 0.012
Endrin ketone	mg/kg dry wt	< 0.012	< 0.012

Sample Type: Soil			
Sample Name:		Composite of TP1 0-150mm, TP3 0-150mm and TP5 0-150mm	Composite of TP6 0-150mm, TP7 0-150mm and TP9 0-150mm
Lab Number:		3080247.50	3080247.51
Organochlorine Pesticides Screening in Soil			
Heptachlor	mg/kg dry wt	< 0.012	< 0.012
Heptachlor epoxide	mg/kg dry wt	< 0.012	< 0.012
Hexachlorobenzene	mg/kg dry wt	< 0.012	< 0.012
Methoxychlor	mg/kg dry wt	< 0.012	< 0.012

Analyst's Comments

Amended Report: This certificate of analysis replaces report '3080247-SPv1' issued on 27-Sep-2022 at 4:19 pm.
Reason for amendment: At the client's request, testing has been added.

Summary of Methods

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

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-21, 26-28, 31-33, 35-36, 41-43, 46-48
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	1-21, 26-28, 31-33, 35-36, 41-43, 46-48
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	50-51
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	50-51
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1, 3, 5-7, 9

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

Testing was completed between 22-Sep-2022 and 03-Oct-2022. 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