REPORT

Tonkin+Taylor

Ground Contamination Assessment - Kyle Park, Hornby

Prepared for
Christchurch City Council
Prepared by
Tonkin & Taylor Ltd
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This report has been prepared for the exclusive use of our client Christchurch City Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Recommendations and opinions in this report are based on data from discrete sampling locations and sampled materials. The nature and continuity of subsoil away from the reported locations are inferred and it must be appreciated that actual conditions could vary from the assumed model.

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1 Introduction

1.1 General

Tonkin & Taylor Ltd (T+T) was commissioned by the Christchurch City Council (CCC) to carry out a ground contamination assessment for the proposed combined Hornby Library, Customer Services and South West Leisure Facility (*the Centre*). The purpose of the ground contamination assessment is to identify ground contamination-related development issues associated with the site of the centre at Kyle Park, Hornby. This work has been completed in accordance with CCC Statement of Work agreement with T+T dated 17 August 2018 and subsequent variations.

Kyle Park is located immediately north of the Hornby Hub shopping mall, which is in south-west Christchurch.

CCC is considering developing the Centre on the eastern part of Kyle Park, with a preferred option for this to be in the eastern corner of the site. Figure 1 below shows the following areas and terms that are used hereafter in this report:

- Kyle Park – red polygon below.
- The *site* (i.e. subject of this investigation and assessment) – green polygon below.
- The *development area* (i.e. preferred location for the centre) – blue polygon below.

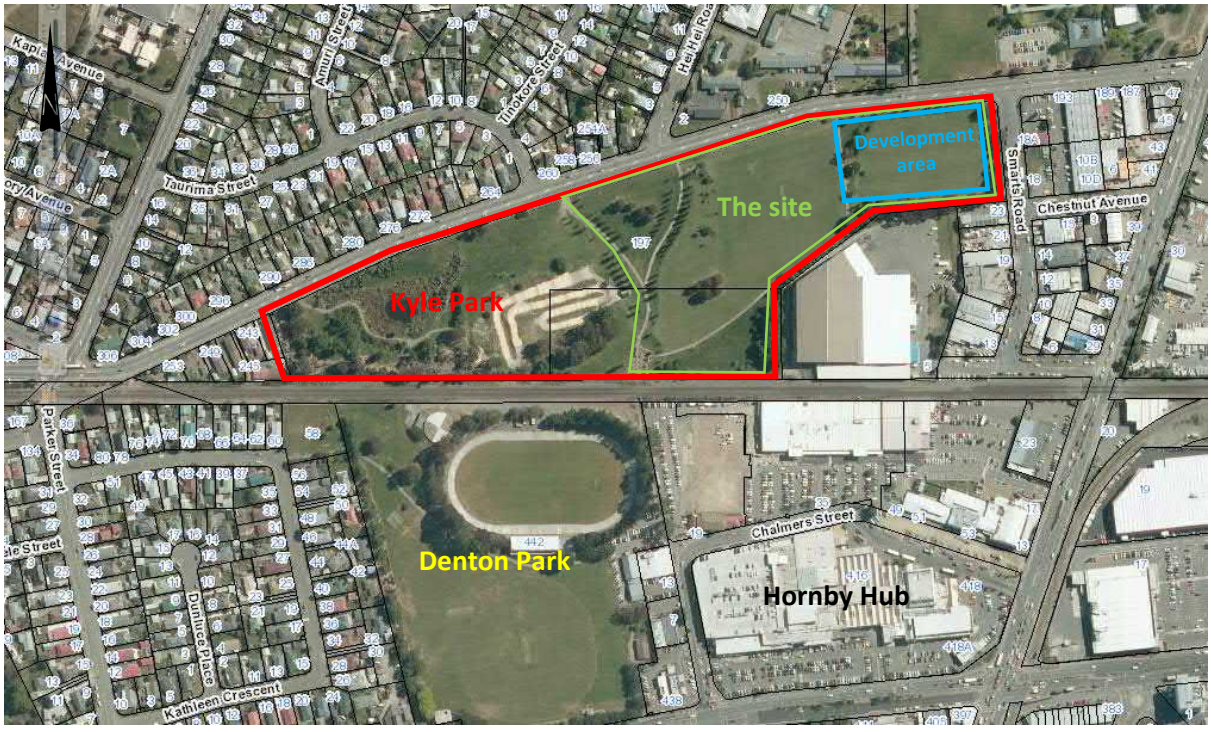

Figure 1 – Kyle Park location (source Canterbury maps - https://apps.canterburymaps.govt.nz/CanterburyHistoricAerialImagery/)

1.2 Project background

Detailed design of the Centre has not been finalised at the time of writing. Concept level design envisages the following:

- Two storey service building and library, including community meeting rooms and offices.
- Leisure facility including swimming pools (fun pool and lane pool), courts and a sport hall (multifunctional).

- Car parking, landscaping areas and footpaths connecting the Centre to the remainder of the park and underpass beneath the railway and connection to the transport links at Hornby Hub.
- Floor level for the Centre will be similar to existing ground levels on the adjacent Waterloo Road.
- Provision of utilities/services to the centre (e.g. water, power, telecommunications) which may include trenching across the current park.
- Based on the design and construction of the QEII recreational centre for CCC, the groundworks for the pool and plant room/services may extend to approximately 3 m depth.

The whole of Kyle Park was formerly a gravel pit (see Section 3) and was backfilled with a mix of uncontrolled fill materials (i.e. domestic, commercial and industrial waste materials). We understand that the CCC requires an understanding of the contaminated land-related implications and constraints associated with developing the Centre here compared to a relatively "clean" site.

A report summarising the findings of a geotechnical investigation of the site, also completed by T+T, has been provided separately to CCC[1].

1.3 Objective and scope of work

The following scope of work has been completed by T+T for the purposes of this ground contamination assessment:

- Review previous T+T reports on the site.
- Review of historical aerial photographs.
- Drilling of 20 boreholes to depths of up to 15.65 m below ground level (bgl).
- Logging the boreholes and collecting representative soil samples for laboratory analysis.
- Laboratory analysis of samples for a range of contaminants of concern based on the historical land use activities on the site.
- Assess the laboratory data against criteria applicable for the development of the Centre including commercial/industrial land use, as well as offsite disposal acceptance criteria.
- Preparation of this report.

1.4 Regulatory compliance

This ground contamination assessment, including the design and supervision of the fieldwork, the investigation management, data assessment and certification have been undertaken by suitably qualified and experienced practitioners (SQEPs) in accordance with the requirements of the NES Soil[2]. The contents of this report constitute a detailed site investigation (DSI) as defined in the NES Soil and described in the NES Users' Guide[3].

[1] T+T – Kyle Park Geotechnical Assessment Report – version 1 (draft) November 2018.
[2] Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations) 2011.
[3] Ministry for the Environment (MfE) – Users' Guide – National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health – April 2012.

2 Site Description

2.1 Site identification

The locations details of Kyle Park, the site and the preferred development area are provided in Table 2.1 below.

Table 2.1 Site details

Street address	197 Waterloo Road, Hornby
Legal description	Lot 1 DP 78681 and Lot DP 34558 (development area located on Lot 1 DP 78681)
Site owner	CCC
Site area	Kyle Park approximately 87 hectares, with the development area being approximately 1.1 hectares within the boundary of Kyle Park
Zoning	Open space community

2.2 Site condition

General photographs of Kyle Park and the development area are presented in Appendix B. In general the whole park comprises grassed open spaces with areas used for cricket and informal football matches, and is crossed by a number of asphalted footpaths. On the western part of Kyle Park (offsite) there is a BMX race track and landscaped areas including a pond/wetland.

Immediately around the site, land uses are:

- Waterloo Road then Hornby High School and residential properties to the north.
- Commercial and industrial properties to the east and south (latter beyond the main south rail line).
- The remainder of Kyle Park and residential properties to the west.

Ground levels within the preferred development area are approximately 2.5 to 3 m lower than Waterloo Road and the rest of Kyle Park to its west. Relative to the 1937 Lyttelton vertical datum (LVD), ground levels for Waterloo Road, the centre of the site and centre of the development area are approximately 39 to 38 mLVD, 38.5 mLVD and 36.2 mLVD, respectively. Spot heights for the site and investigation boreholes (see Section 6) are presented on the CCC survey drawing included in Appendix A.

2.3 Geology, hydrogeology and hydrology

Details of the site setting are summarised below with more detail provided in the T+T Desktop Report[4].

2.3.1 Geology

The published geology[5] of the area indicates that Kyle Park is underlain by alluvial gravel, sand and silt from historic Waimakariri River flood channels. This is collectively referred to as the Yaldhurst Member of the Springston Formation.

[4] T+T reference 53404.002 – Kyle Park, Hornby – Desktop Ground Contamination and Geotechnical Study (September 2015).

[5] Brown, L.J., Weeber, J.H. 1992: Geology of the Christchurch Urban Area. Institute of Geological & Nuclear Sciences Geological Map 1. Scale 1:25 000.

In the vicinity of the site the Springston Formation deposits are expected to be underlain by well-graded gravels known as the Riccarton Gravels. These gravels contain artesian groundwater pressures where capped by a low permeability clayey silt or peat layer(s).

Information relating to the filling of the site is discussed in Section 3.

2.3.2 Hydrogeology

The depth to groundwater is approximately 13 m bgl, which corresponds to an elevation of approximately 24 mLvD, as observed from the groundwater contours available on the Environment Canterbury (ECan) website (https://mapviewer.canterburymaps.govt.nz/). The depth to groundwater is expected to fluctuate in response to rainfall and seasonal variability, which could be of the order of ± 2 m.

2.3.3 Hydrology

At the western end of Kyle Park there is a small wetland/retention/stormwater pond with a water level approximately 10 m higher than the groundwater surface elevation. The closest watercourse to the site is approximately 3 km east. Incident rainfall onsite currently infiltrates directly to ground.

3 Site History and Potential for Contamination

The following is summarised from the T+T Desktop Report, which should be referred to for more detailed information.

3.1 Site history

Kyle Park was formerly a gravel pit known as Smart's Pit (after the site owners) that operated until 1968 when it was purchased by Paparua County Council (a predecessor to CCC) and was then used as a rubbish dump (i.e. landfill). The landfill was operational until the early 1970s and the area became known as Kyle Park in the early 1980s.

Historical aerial photographs[6] of the site show the quarry workings expanding in area from the first available photograph from the early 1940s until the early 1960s when it was then progressively infilled into the mid-1970s (i.e. corroborating the ownership and land use information discussed above). Observation of the 1950s and early 1960s aerial photographs (see Photograph 1 below) identifies areas of water within the base of the pit, which suggests that excavation ceased at around the depth when groundwater was encountered. After infilling ceased some regrading/capping of the site occurred and photographs from the early 1980s onwards show much of Kyle Park as at the present day.

Photograph 1 – early 1960s aerial photograph of Kyle Park– approximate site and development areas shown in green and blue polygons, respectively (source https://apps.canterburymaps.govt.nz/CanterburyHistoricAerialImagery/).

[6] https://apps.canterburymaps.govt.nz/CanterburyHistoricAerialImagery/.

Photograph 2 – early 1980s aerial photograph of Kyle Park – approximate site and development areas shown in green and blue polygons respectively (source https://apps.canterburymaps.govt.nz/CanterburyHistoricAerialImagery/).

CCC property file records note that the site was backfilled with uncontrolled waste including domestic and commercial/industrial materials. The park is not a consented or monitored closed landfill with ECan. Groundwater and/or landfill gas monitoring is not undertaken on site by CCC as part of their closed landfill monitoring programme.

The property file also records a 1999 plan for CCC having installed a landfill gas ventilation unit in the BMX club hut building located west of the site.

3.2 Previous ground investigation

Previous T+T ground investigation works at Kyle Park (including the site)[7] [8] identified the presence of asbestos containing material (ACM) in embankment areas by the railway line. This included the ground on the southern margin of the development area that is currently occupied by trees and shrubbery on a bank that rises up to the neighbouring industrial/commercial property (see Figure 2, Appendix A). Sampling and laboratory analysis of embankment surficial soils and mulch materials recorded levels of asbestos fibres ranging from <0.001 to 0.0059 % weight/weight with the presence of asbestos fines and fibrous asbestos (AF and FA, see Section 4.4.2). Some measured levels exceeded the "all site" land uses criterion.

The presence of ACM and asbestos fibres was also encountered within capping materials (see Section 4.3.1 – these are the materials at ground level on the site) at depths ranging from the ground surface to 0.5 m bgl, with the levels of asbestos marginally exceeding the "all sites" land use criterion (see Section 4.4). Across the site, 25 samples were analysed for asbestos in soil as part of the December 2015 investigation and 9 samples recorded positive results for ACM and/or AF/FA. The ACM included non-fibrous materials such as cement sheeting, low density board and corrugated sheeting.

The embankment areas where the ACM and the AF/FA were identified are being managed by CCC. This includes the application of dust suppressant polymer and fencing the areas off from the remainder of the park to restrict access. For the grassed park areas including the sports fields where asbestos was found in capping materials, recommended management measures included the exclusion of activities with the potential to disturb surficial soils (e.g. minimise vehicular use) along

[7] T+T reference 53404.003 - Kyle Park, Hornby – investigation of asbestos in landscaped garden areas (18 November 2015).
[8] T+T reference 53404.004 – Additional asbestos investigation in soil – Kyle Park, Hornby (7 December 2015).

with procedures to reduce the potential exposure of general Park users and CCC maintenance personnel.

3.3 Known and potential contamination

The site is recorded on the ECan Listed Land Use Register (LLUR) as a landfill site (HAIL[9] category G3). ECan currently categorise the site as "contaminated – other".

With the site being a landfill and its current use as a sports turf, Table 3.1 below lists the potential contaminants of concern, HAIL category and potential extent/magnitude of ground contamination.

Table 3.1 – Land use and potential contaminants of concern

Land use/activity	Potential contaminants	Likelihood, magnitude and possible extent of contamination	HAIL reference
Landfilling	Dependent on original waste composition may include total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), metals, asbestos, pesticides, ammonia, cyanide and volatile organic compounds (VOCs). Potential for landfill gases (including carbon dioxide, methane, depleted oxygen, hydrogen sulphide).	Materials are heterogeneous and the likelihood of ground contamination is high and would likely encompass most of the site. Contamination of the groundwater, via leachate, is also likely. Landfill gas generation possible depending upon composition of waste materials.	Activity G3 – Landfill sites.
Use of pesticides on playing fields.	Metals, herbicides, organophosphates and possibly organochlorides pesticides (OCPs).	The site has been used as a park since the early 1980s and pesticides may have been applied to the playing fields since this time. Low likelihood of contamination, which (if present) would likely to be restricted to surficial soils in the playing field areas. Investigation work for CCC at other parks by T+T have reported low incidence of pesticides in soils associated with this land use.	Activity A10 – Persistent pesticides bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds.

3.4 Preliminary conceptual site model

Based on the inferred nature and extent of contamination and indicative development concepts, a preliminary conceptual site model has been developed. This model describes how those involved in the construction of the Centre and future users of the Centre (receptors), may be exposed (pathways) to ground contamination (sources). The model underpins the site investigation rationale set out in Section 4.

[9] Hazardous activities and industries list – MfE updated 2011.

Table 3.2 – Preliminary conceptual site model

Source	Pathway(s)	Receptor(s)	Assumptions
Landfill material (contaminated soils)	• Direct contact. • Inhalation of dust, vapours, gases. • Ingestion of materials.	• Construction and maintenance workers undertaking ground disturbance. • Possibly centre users, staff if allowed to come into contact with landfill material.	• Significant disturbance during earthworks. • Potential for reuse of contaminated material.
Landfill gases (e.g. methane, carbon dioxide), organic vapours	• Inhalation.	• Centre users and staff, maintenance workers.	• Placement of hard cover over currently unsealed ground.
	• Intrusion through foundations, floor slabs, service penetrations.	• CCC asset – damage to building from explosion.	• Potential for creation of preferential pathways (e.g. piles). • Uncertainty of effect of piling on landfill gas regime.
	• Inhalation of odours, discharges during construction works.	• General public (park users).	

This preliminary conceptual site model is typical of closed landfill sites that T+T has worked on in Christchurch and elsewhere in New Zealand.

4 Site investigation, Laboratory Testing and Data Assessment

4.1 Investigation staging and rationale

Investigation of the site was undertaken in two stages, these being:

- *Stage 1* – Boreholes BH101 to BH115 inclusive – general coverage of the site.
- *Stage 2* – BH116 to BH120 inclusive – targeted/focused investigation of the development area only, as required by CCC.

Whilst the density of the investigation locations is considered appropriate to provide coverage of the site, it does not meet the maximum density recommended by the MfE[10] for identifying contamination hotspots of a given diameter. However, it should be noted that the distribution of contaminants in the landfill material is assumed to be effectively random, and as such likely heterogeneity does not support an investigation methodology based on hotspot identification.

The boreholes were drilled using sonic drilling with a water flush to a maximum depth of 15.65 m bgl. Samples for laboratory analysis were selected based on site observations, including field screening with a photo-ionisation detector (PID) to identify potential volatile contaminants. Selected samples of the materials recovered from the boreholes were scheduled for the contaminants of concern (refer Section 3.3) as guided by the preliminary conceptual site model (refer Section 3.4).

The borehole locations were surveyed by CCC to record their reduced level along with the northing and easting coordinates (see Appendix A).

The borehole locations are shown in Figure 2 in Appendix A.

4.2 Sampling procedures

Soil samples for laboratory analysis were collected by the supervising T+T geologist and contaminated land specialist. The soil sampling was undertaken in general accordance with the procedures of CLMG No. 5 and the Asbestos in Soil Guidelines[11]. Samples were collected as follows:

- For metals, hydrocarbons, pesticides etc.:
  - Freshly gloved hands were used to collect a sample, which was placed immediately into laboratory supplied container(s).
  - Any equipment used to collect samples was decontaminated between sampling events using a phosphate-free detergent (Decon 90) and clean water.
  - Samples were shipped in a chilled container under chain of custody (COC) documentation to Analytica Laboratories Ltd; an IANZ-accredited (International Accreditation New Zealand) facility.
- For semi-quantitative asbestos in soil:
  - With freshly gloved hands samples was collected into 500 mL container for laboratory analysis.
  - Remaining borehole arisings were inspected for the presence of man-made materials including ACMs.
  - Samples were shipped under COC documentation to IANZ-accredited Precise Consulting & Laboratory.

[10] Contaminated Land Management Guideline (CLMG) No. 5 – Site investigation and analysis of soils – MfE (updated 2011).
[11] New Zealand Guidelines for the Assessment and Management of Asbestos in Soil – BRANZ (November 2017).

4.3 Field observations

The fieldwork (drilling, logging and sampling) was undertaken between 19 September and 11 October 2018, with Stage 1 and Stage 2 occurring concurrently.

The following report sub-sections summarise the strata encountered, with borehole logs presented in Appendix C. PID field screening results are also tabulated in this appendix. The range in thickness of the materials encountered, and the reduced levels they were encountered at, are summarised in Table 4.1 below and are illustrated on the cross-sections presented in Figures 3 and 4 (Appendix A). Photographs to illustrate the strata encountered are provided in Appendix B.

Table 4.1 – Summary of stratigraphy

	Reduced level (mLVD)		Thickness (m)	
	Top of strata	**Base of strata**	**From**	**To**
Capping	As per ground level	34 to 38	0.4	0.9
Landfill	34 to 38	25 to 28.5	1.25	11
Natural strata	25 to 28.5	Not fully penetrated	Not fully penetrated – maximum thickness recorded 13.05	

4.3.1 Capping materials

Capping materials comprising sandy silt with variable quantities of gravel materials with fibrous organics and rootlets were encountered in boreholes across the site. These materials ranged in thickness from 0.4 to 0.9 m. They generally graded into the underlying landfill materials with an increasing man-made material content and presence of organic materials rather than exhibiting a distinct change of strata. No evidence was observed of a geotextile fabric separating the capping materials from landfill.

No ACM was observed in the capping materials during the two stages of the 2018 investigation. This is different from the 2015 investigation when ACM fragments were recovered (albeit infrequently) in capping materials from ground level to 0.5 m depth.

4.3.2 Landfill

Landfill materials were encountered in all boreholes and exhibited a highly variable content both laterally and vertically, and this is typical of similar sites investigated by T+T where uncontrolled filling has occurred. The landfill materials encountered in the boreholes comprised of a variable matrix of silt, sand and gravel with differing quantities of man-made materials and/or waste including:

- ACM including cement sheet materials.
- Ash.
- Brick and concrete.
- Ceramic.
- Glass.
- Leather (including parts of a child's shoe).
- Paper.
- Plastic, including food wrapping.
- Roots, wood and partly decomposed vegetative matter.

- Rubber/tyre.
- Sawdust.
- Shell.
- Wire and metal.

Photographs 3 to 6 inclusive (refer Appendix B) illustrate some of the landfill materials observed and sampled across the site. In most cases, the landfill materials in the boreholes were noted to have a high vegetative/organic content, in the order of 50% by volume. The landfill materials were also infrequently noted to have a hydrocarbon odour and the PID site screening recorded volatile organic compounds (VOCs) ranging from 0 to 100 ppm, albeit the majority of readings were <10 ppm. The highest screening value was in material with a strong hydrocarbon odour in BH112 at 9.2 m bgl. Other landfill materials had organic/rotten vegetation odours and at BH101 and BH103 at 72 and 7.4 m bgl respectively, a sweet odour.

BH113 was terminated at 7.6 m bgl after refusal on a buried metal object.

4.3.3 Natural strata

Natural strata were encountered in all boreholes (with the exception of BH113) and comprised of sandy fine to coarse gravels with minor cobbles and trace of silt.

4.3.4 Groundwater

Groundwater strikes were encountered in all the boreholes (except for BH113) at depths ranging from 9.2 to 11.3 m bgl (approximately 29 mLVD and 24.5 mLVD, respectively).

With the exception of BH102 and BH106, groundwater was encountered in natural strata. For these two boreholes, the groundwater was encountered in landfill materials and within 1 m of the boundary with the underlying natural materials.

4.4 Laboratory testing

Representative samples of the capping and landfill materials, and a limited number of samples of natural materials were submitted for laboratory analysis. Individual analysis was based on field observations of material composition, odours and the anticipated contaminants of concern (refer Section 3.3).

Soil samples from all of the boreholes and representative of the capping and landfill materials were collected for laboratory analysis to provide a lateral and vertical assessment of these materials. Samples were scheduled for one or more of the parameters described previously in Section 3.3. Analysis for additional parameters based on PID field screening and observations during the material logging were also scheduled.

The laboratory test results are presented in Appendix D and the assessment of the laboratory data in Appendix E.

4.4.1 Assessment criteria

The laboratory test results have been evaluated against the following human health and environmental assessment criteria for different land uses or activities:

- For metals, hydrocarbons and pesticides - industrial and commercial land use NES Soil soil contaminant standards (SCSs) (based on outdoor worker) for:
  - Construction workers and future maintenance workers (e.g. engaged in repairing buried services).

  - Future site users (e.g. service centre staff, visitors) – considered a conservative criteria for this cohort as on development the site will be hard sealed.
- For re-use of materials on the site (for metal, hydrocarbon and pesticides) - recreational land use NES Soil SCS for use as a park with open public access after the development of the Centre.
- Asbestos in Soil Guidelines:
  - All site uses criteria for asbestos in soil criterion of <0.001% weight/weight asbestos fibres and fibrous asbestos (AF and FA, respectively).
  - Recreational land use criterion for bonded ACM of 0.02 % weight/weight (used as a conservative assessment criteria instead of commercial/industrial land use criterion of 0.05 % weight/weight).
- Offsite soil disposal:
  - Generally, to be disposed as cleanfill, soil must meet local background concentrations of contaminants *at the cleanfill site* and be free of certain man-made materials[12]. Data has been assessed against published background levels[13] at the site to provide an *initial* assessment of the potential for surplus soil to be disposed of as cleanfill.
  - Recreational land use criteria used as acceptance criteria by Burwood Resource Recovery Park (managed fill) (BRRP). BRRP does not accept asbestos materials nor asbestos in soil.

4.4.2 Data assessment results

Laboratory data assessment summary tables are presented in Appendix E. In summary, the assessment of the results, including where applicable from previous T+T investigation works (refer Section 3.2) show:

- *Capping material* – isolated exceedances of background concentrations of some metals and PAHs, and infrequent presence of ACMs and low levels of asbestos in soil (above "all site" uses acceptance criteria).
- *Landfill materials*:
  - Presence of ACMs and asbestos fibres as:
    - Chrysotile, amosite and crocidolite fibres (white, brown and blue respectively).
    - ACMs include insulation board, cement sheet and bitumastic materials.
    - Above commercial land use criterion of ACM (up to 3.437 % weight/weight recorded in BH108 at 2.35 m bgl).
    - Above "all site" uses criterion of AF+FA (up to 6.737 % weight/weight recorded in BH108 at 2.35 m bgl).
  - Almost ubiquitous above background concentrations of metals, locally above background levels for PAHs and for the sum of DDT.
  - At a limited number of locations within the mass of landfill materials, above recreational and construction worker criteria for lead and PAHs (expressed as benzo (a) pyrene toxic equivalent).
  - Soil contamination has been identified in landfill materials throughout the vertical and lateral extent of the landfill mass. As uncontrolled fill, the distribution of contamination is essentially random.

[12] MfE - A Guide to the Management of Cleanfills (Section 4) – (2002).
[13] ECan GIS - Trace level 2 - https://mapviewer.canterburymaps.govt.nz/.

- *Natural materials* – the two samples of this stratum that were tested did not record above background levels of metals or PAHs. However, concentrations of TPHs in this material from BH112 at 9.2 m bgl (and coincident with high field screening values) exceeds the construction worker criterion. The chromatograph for this material indicates the TPHs are likely to be a diesel product.
- The contamination of the capping and landfill materials is, based on T+T's experience of investigating other similar sites in New Zealand, generally consistent with that which would be expected for an uncontrolled file site.

4.5 Revised conceptual site model

The preliminary conceptual site model (Section 3.4) has been revised based on the sampling/logging and laboratory testing, and the assessment of the results. The revised model is presented in Table 5.1 below.

Table 4.2 – Conceptual site model

Source	Pathway	Receptor
Capping and landfill materials (contaminated soils – asbestos, lead, PAHs and TPH), all confirmed at concentrations above the relevant assessment criteria. Materials not suitable for disposal as cleanfill.	Direct contact, material ingestion, dust inhalation.	Potentially complete – construction and maintenance workers undertaking ground disturbance activities unless procedures adopted.
		Centre users and staff – pathway potentially complete if contaminated materials reused where direct access is possible.
		Potentially complete for materials disposed offsite to an inappropriate facility and affects to groundwater, workers at the receiving site and public near that site.
	Environmental discharges – odours, dust, sediment, stormwater.	Potentially complete if construction works are not managed so that these materials are retained within the works area.
Landfill gases (e.g. methane, carbon dioxide), organic vapours from fuels. Presence, extent, magnitude not yet known, though presence of landfill gas considered likely.	Inhalation during construction.	Potentially complete for construction and maintenance workers undertaking ground disturbance activities.
		Centre users and staff – pathway complete unless construction includes suitable landfill gas protection and management measures.

	Intrusion through foundations, floor slabs and accumulation in buildings.	CCC asset – damage to building (e.g. from explosion) - pathway complete unless centres design includes suitable landfill gas protection and management measures.

The conceptual site model indicates there are potentially complete source-pathway-receptor linkages for development of the Centre on site. The complete linkages can be managed, in part, by preparing and implementing controls contained in a ground contamination site management plan (GCSMP).

The potentially complete pollutant linkages identified are consistent with those that would be expected at a landfill that has received uncontrolled fill. The earthworks and building controls that would be required to manage exposure to ground contaminants at the site would be similar to those for other contaminated sites and other uncontrolled file sites.

5 Discussion

5.1 Development context

In addition to assessing the potential development implications of constructing the Centre at Kyle Park versus a minimally contaminated site, CCC also wishes to understand whether there are, from a contaminated land perspective, advantages for development in the eastern corner (i.e. the development area) compared to the rest of the site.

The geotechnical assessment of the site indicates that a foundation solution incorporating driven piles is likely to be suitable. This will require excavation for foundations (e.g. ground beams) and some spoil material may be generated during piling (e.g. pre-drilling through obstructions before pile driving). Additional excavation works may be required for the pool and some buried services connecting/servicing the Centre.

The ground investigation works reported in Section 4 have confirmed the capping and landfill materials underlying Kyle Park are significantly contaminated and any development (be it the development area or wider site) is likely to involve contamination-related costs that are greater than those for a relatively "clean" site. For Kyle Park, contamination issues are primarily driven by the presence of asbestos in soils. The most significant contamination-related development issues thus relate to earthworks in these contaminated materials and the controls required to manage the risks posed by the activity(s). Reducing the likely extent of ground disturbance logically reduces the potential for exposure to contamination-related hazards and reduces management related disposal and compliance costs.

Siting the Centre in the eastern corner of the site (i.e. development area), where current ground levels need significant filling to match adjacent ground levels, the earthworks volumes disturbing contaminated capping and landfill materials would be expected to be less than if development were undertaken elsewhere on the site (where a net cut into contaminated material would be expected). Consequently, the contamination-related implications likely be significantly less implications for developing in this area compared to elsewhere on the site. As detailed in Section 5.5, offsite disposal costs for contaminated materials are significant and there are expected to be financial advantages for the development location in this part of the park over elsewhere on the site.

The odorous nature of the landfill material could be a nuisance to neighbours and construction workers. Hence, similarly, limiting the potential disturbance of such material means reducing the potential management of such nuisance. This would suggest that the development area is preferable to elsewhere on the site.

Developing the centre at Kyle Park irrespective of its location on site, is not in T+T's opinion likely to present contamination-related issues that would be considered atypical of a closed uncontrolled fill site. Similar development has occurred on landfill sites in New Zealand and the earthworks and building controls that would be required to manage exposure to ground contaminants at the site would be similar to those for other contaminated sites and other uncontrolled file sites.

5.2 Contaminant distribution

The borehole logs indicate comparable thicknesses of capping and landfill materials across the site. Due to the uncontrolled way in which these materials were deposited, and subsequent regrading works, the distribution of contamination is effectively random. However, soil analytical results indicate that the nature and magnitude of contamination are also broadly similar across the site (i.e. there is no evidence to suggest that contaminant levels within the eastern corner are any higher or lower than elsewhere on the site).

5.3 Remediation or management for future use

Remediation or contamination management is required where contaminant concentrations exceed land use criteria. In the case of developing the centre at Kyle Park, these are commercial/industrial and/or recreational land uses. Remediation and management may include specific actions to reduce, remove or contain contaminants.

Contamination of capping and landfill materials above recreational land use criteria could present a risk to future park users if not properly managed. Capping and landfill materials excavated or brought to ground level through piling and pre-drilling through obstructions should be assumed to be contaminated with asbestos and other contaminants and should not be reused where future park users could have direct contact with them. If materials cannot be retained on site and properly encapsulated, they will need to be disposed offsite at a licensed facility.

Where contaminated materials are re-used on the site or left in situ, a long-term management plan will be required to provide procedures and controls to reduce potential exposure to ground contamination by future maintenance workers disturbing the materials and future site users.

5.4 Construction and maintenance worker health and safety

During the development of the Centre it is likely that construction workers will come into contact with the capping and landfill materials, which presents a human health hazard. The primary hazard is likely to be due to the disturbance of asbestos contaminated materials and the inhalation of asbestos fibres by workers.

Where future development (construction and/or future maintenance) activities will likely involve the disturbance of the capping and landfill materials the following health and safety implications/considerations will apply:

- Disturbance of the contaminated materials, based on the levels of asbestos and ACMs, will need to comply with the Asbestos Regulations[14] as follows:
  - For disturbance of the capping materials, such work will be *asbestos related work* under the Asbestos Regulations. The controls of the GCSMP can include appropriate content to meet with the requirements of the Asbestos Regulations including air monitoring, decontamination of equipment, signage and delineation of working areas etc. Disturbance of these materials would not be notifiable to WorkSafe New Zealand under the Asbestos Regulations.
  - For the landfill materials, the disturbance will be *Class A asbestos works* under the Asbestos Regulations. The work would need to be undertaken by a Class A Licensed Asbestos Removalist following an asbestos removal control plan prepared by them. The works would be notifiable to WorkSafe New Zealand before commencement. This level of control will be applicable during any bulk earthworks with this strata (e.g. trenching for services) as well as pre-drilling for piles where obstructions are encountered.

Undertaking works under the Asbestos Regulations will have cost and time implications for ground disturbance work. The transition from capping to landfill materials is not necessarily visually obvious and implementing asbestos controls will require careful planning and execution. A cautionary approach may be required given the profile of the development within the community, and adoption of Class A controls may be warranted.

[14] Health and Safety at Work (Asbestos) Regulations 2016.

5.5 Soil disturbance, reuse and offsite disposal

The following relates to the reuse of materials for the development of the Centre from a soil contamination perspective, and is based on the reported ground contamination conditions. Based on the materials encountered on site, for reuse:

- *Capping material* and *landfill material* – these materials are not suitable for reuse unless they can be incorporated (encapsulated) into the development where they cannot be disturbed in the future and thus result in direct human contact. Disturbance/contact by future maintenance workers should be avoided, although controls can be communicated via a GCSMP to manage the associated hazards if limited future disturbance cannot be avoided. Retaining (encapsulating) these materials within the landfill mass may be acceptable to CCC and ECan and subject to possible resource consent conditions. Disturbance of the materials should be avoid as far as practicable to avoid odour nuisance.
- *Natural materials* – although highly unlikely to be handled during the development (i.e. based on their considerable depth below the site), these materials are likely to be suitable for reuse.

Materials displaced and not retained on the site will likely require appropriate offsite disposal, such as:

- *Capping and landfill material*
  - Disposal to licensed landfill only.
  - The materials are unsuitable for disposal as cleanfill or to managed fill such as BRRP due to the presence of asbestos and/or metals and hydrocarbons as well as their odorous properties.
  - Based on the levels of asbestos in these materials, disposal offsite to Kate Valley Landfill is the only option available in the general Christchurch area (the levels of non-asbestos parameters precludes their disposal at Plantation Road in Hororata, which is a managed fill that uses residential land use assessment criteria for acceptance purposes).
  - Disposal at Kate Valley Landfill will be contingent on adequate laboratory testing of these materials to demonstrate they comply with this landfill's acceptance criteria, which are based on toxicity characteristic leaching procedure (TCLP) analysis.
  - The requirement for some degree of pre-treatment to stabilise mobile contaminants before being accepted for disposal at Kate Valley Landfill cannot be precluded at this stage.
  - Disposal of asbestos contaminated material costs in the order of $300 tonne (excluding GST and any pre-treatment).
- *Natural materials* – subject to more laboratory testing of these materials, disposal to cleanfill could be possible, although the limited testing to date of this material has reported levels of hydrocarbons that would preclude cleanfill disposal.

The proposed receiving facility (e.g. cleanfill) will require copies of the laboratory data and assessment included in this report for their consideration and approval prior to accepting any materials originating from the site during development of the Centre.

5.6 Consenting

A full ground contamination-related planning assessment should be completed for the development at Kyle Park; however, in principle the following resource consents are likely to be required:

- NES Soil – for soil disturbance and possible offsite disposal of materials (if required).
- City Plan – excavation and disturbance of hazardous materials.

- Land and Water Regional Plan:
  - Discharge of hazardous substances (e.g. encapsulating contaminated landfill materials onsite).
  - Discharge to air (e.g. dust, possibly landfill gases).
  - Construction phase stormwater management.
  - Operational phase stormwater management.
  - Disturbance of hazardous materials and discharge to groundwater.

The planning assessment may identify other consents that will be required.

The preparation of the GCSMP will be required for supporting consent application(s) to demonstrate to the regulatory authorities that the effects of the development can be managed and adequately controlled.

5.7 Further investigation

If construction of the Centre proceeds on the site then a detailed ground gas assessment is required to characterise the landfill gas regime and the potential implications to the development. Good practice requires landfill gas monitoring data is collected over a range of time and atmospheric conditions (in this case at least six months and ideally a year). This assessment will require the drilling of a number of suitable boreholes and installation with landfill gas monitoring standpipes and subsequent monitoring over a period of months. With the monitoring data and characterisation of the landfill gas regime, the assessment of suitable gas protection measures (if any) can be prepared for the Centre.

Further sampling and laboratory analysis of capping and landfill materials by TCLP should be undertaken to determine their suitability for disposal to Kate Valley Landfill.

To aid with selecting and specifying foundation materials (e.g. pile materials) further testing of landfill materials for selected parameters should be undertaken including pH, sulphate and chloride. This information can be used by geotechnical and structural engineers for selection of suitable pile material(s) to work in a landfill environment.

6 Conclusions

Kyle Park is a former gravel pit that was backfilled with uncontrolled landfill materials in the late 1960s and early 1970s. The investigation of the site in 2015 and 2018 confirms that the landfill materials are variable in composition and include a high proportion of organic material. During logging of the samples recovered from the boreholes, landfill materials exhibited organic odours. Laboratory testing of the capping and landfill materials has shown they can contain high levels of asbestos, metals and PAHs and will require controls during ground disturbance activities to protect construction workers and the environment. Options for the offsite disposal of capping and landfill materials are limited and subject to further testing. Presently only disposal to Kate Valley Landfill is suitable (subject to further testing), incurring higher cartage and disposal costs (approximately $300 tonne excluding GST) compared to disposal to other managed fills and/or cleanfill.

The findings of this investigation indicate disturbance of the capping and landfill materials will need to be undertaken as asbestos related or Class A asbestos works under the Asbestos Regulations. Working under the requirements of the Asbestos Regulations will incur additional costs and will effect productivity of ground works.

The high proportion of organic material observed in the landfill materials during this investigation indicates there is a potential for landfill gas generation from this stratum. If development of the centre proceeds on the site, a landfill gas assessment programme should be commenced as early as possible to identify what landfill gas protection and management measures will be needed.

Trenching for services/utilities to the Centre across the site will disturb and displace capping and landfill materials. These will require either encapsulation within the development area or offsite disposal to a suitable landfill. Controls to manage contaminated land-related risks to construction workers, park users and the environment will need to be implemented during this work.

A planning assessment for development on the site for ground contamination-related resource consents will be required; it is likely a number of resource consents specific to the landfilling materials encountered on the site will be necessary. Preparation of a ground contamination site management plan will be needed to support consent application(s) to show that appropriate controls and procedures can be used during construction to appropriately manage risks to human health and the environment.

Locating the Centre on the development area within Kyle Park is considered a preferential option from a contaminated land perspective, compared to elsewhere on the site. Within the development area the future construction work is expected to involve less bulk earthworks disturbing the contaminated capping and landfill materials given that this area requires infilling over the top of the contaminated materials.

Developing the centre at Kyle Park irrespective of its location on site, is not in T+T's opinion likely to present contamination-related issues that would be considered atypical of a closed uncontrolled fill site. Similar development has occurred on landfill sites in New Zealand and the earthworks and building controls that would be required to manage exposure to ground contaminants at the site would be similar to those for other contaminated sites and other uncontrolled file sites.

Appendix A: Figures

- Figure 2 – Site Plan
- Figure 3 – Cross Section A-A’
- Figure 4 – Cross Sections B-B’ and C-C’
- CCC survey drawing reference RPS2301-01 (November 2018)

APPROXIMATE A3 SCALE 1:2,500

0 50 100 150 (m)

Notes:

1. Aerial image sourced from LINZ Data Service, CC-BY 4.0. Imagery date: summer period 2015-16. Copyright Mapbox OpenStreetMap.
2. Cross-section transects: top number refers to Section title, bottom number refers to Figure number.

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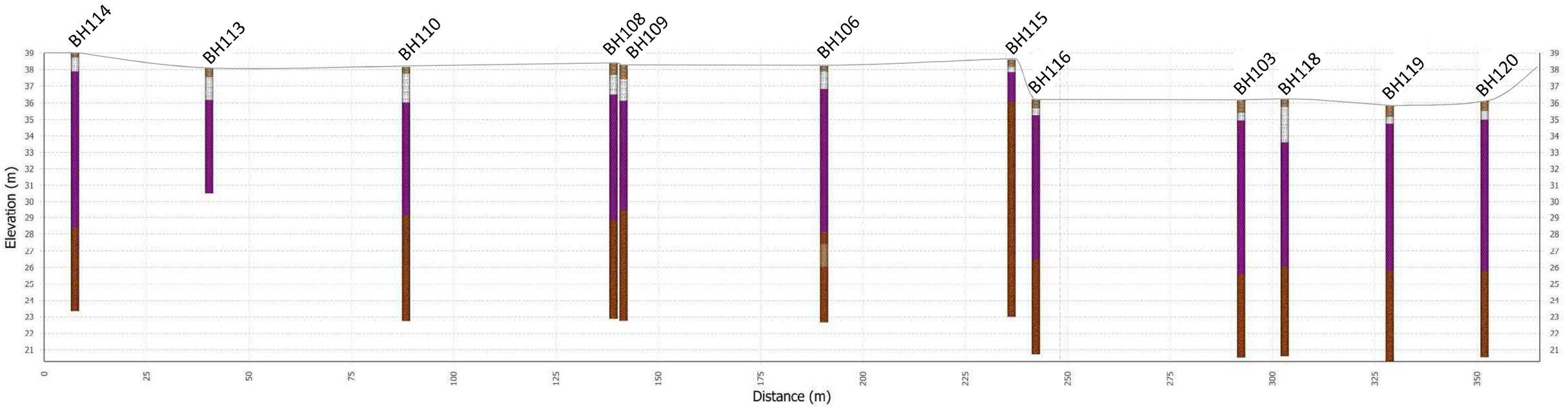
DRAWN	KPS	11/18
DRAFTING CHECKED		
APPROVED		
FILE : 1003207.0000-F2		
APPROX. SCALE (AT A3 SIZE) AS SHOWN		
PROJECT No. 1003207.0000		

CHRISTCHURCH CITY COUNCIL
KYLE PARK
WATERLOO ROAD, HORNBY
INVESTIGATION LOCATION PLAN

FIG. No. Figure 2

REV. 1



Section 1

LEGEND

- Cap material
- Transition material
- Fill
- Natural
- Indicative ground level

Notes:
1. Elevation in metres above Christchurch City Datum.
2. Distance in horizontal metres from southern section start point.

0 10 20 30 40 50 60 70 80 90 100
H (1:1000)
V (1:250)
0 10 20

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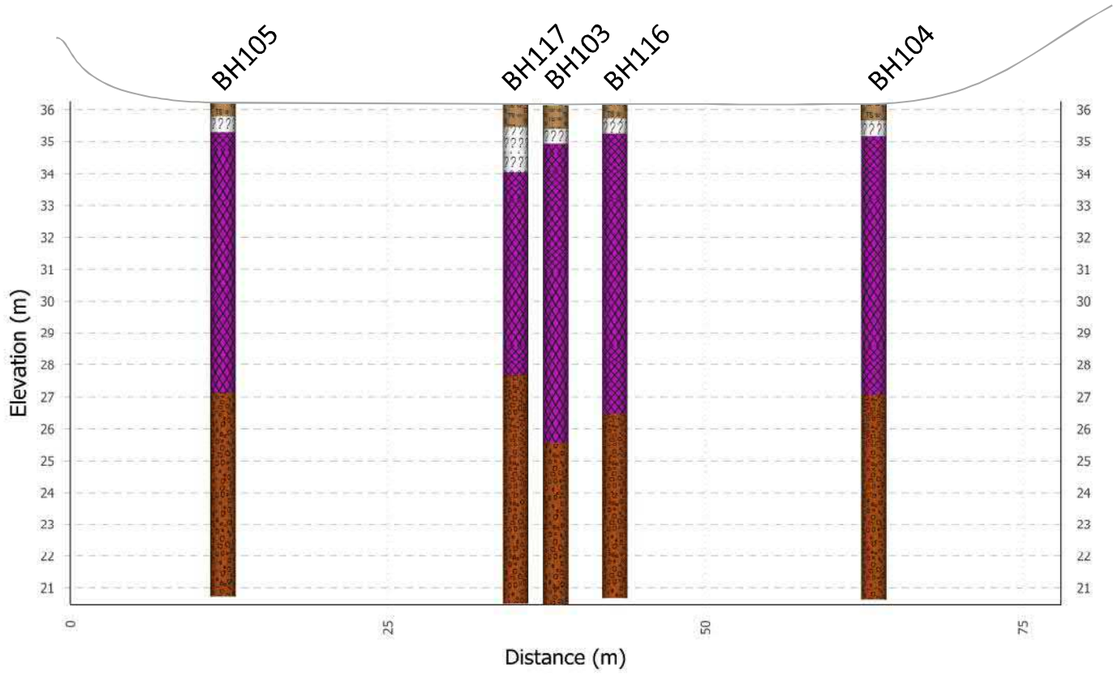
DRAWN	KPS	11/18
DRAFTING CHECKED		
APPROVED		
FILE : 1003207.0000-F3-F4		
APPROX. SCALE (AT A3 SIZE) AS SHOWN		
PROJECT No. 1003207.0000		

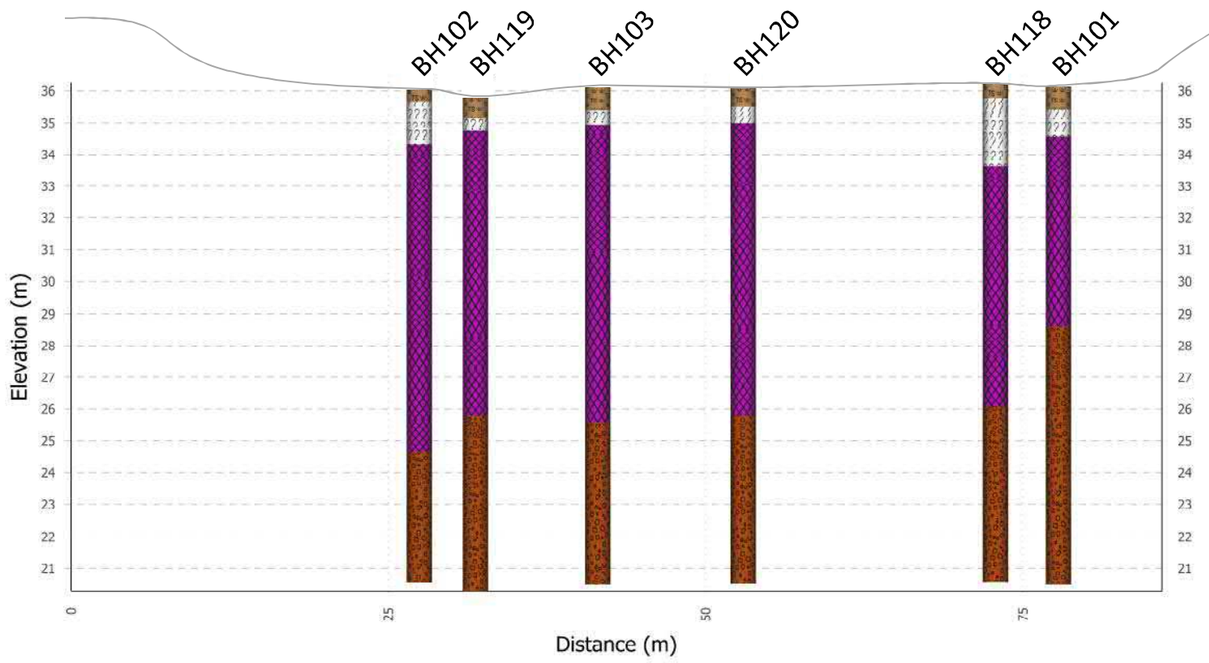
CHRISTCHURCH CITY COUNCIL
KYLE PARK
WATERLOO ROAD, HORNBY
CROSS-SECTION 1

FIG. No. Figure 3
REV. 1

Section 2



Section 3



LEGEND

- Cap material
- Transition material
- Fill
- Natural
- Indicative ground level

Notes:
1. Elevation in metres above Christchurch City Datum.
2. Distance in horizontal metres from southern section start point.

H (1:500)
V (1:200)

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DRAWN	KPS	11/18
DRAFTING CHECKED		
APPROVED		
FILE : 1003207.0000-F3-F4		
APPROX. SCALE (AT A3 SIZE) AS SHOWN		
PROJECT No. 1003207.0000		

CHRISTCHURCH CITY COUNCIL
KYLE PARK
WATERLOO ROAD, HORNBY
CROSS-SECTIONS 2 & 3

FIG. No. Figure 4

REV. 1

Note:
All Survey Data Provided using GPS with Height accuracy +/- 30mm.

WATERLOO RD

SMARTS RD

BH101
X: 383716.40
Y: 805721.78
GL 36.16

BH102
X: 383717.11
Y: 805671.38
GL 36.07

BH103
X: 383658.72
Y: 805685.40
GL 36.14

BH104
X: 383613.65
Y: 805710.53
GL 36.17

BH105
X: 383615.26
Y: 805659.25
GL 36.34

BH106
X: 383558.10
Y: 805667.63
GL 38.23

BH107
X: 383528.95
Y: 805706.23
GL 38.61

BH108
X: 383541.27
Y: 805609.96
GL 38.43

BH109
X: 383509.64
Y: 805643.59
GL 38.31

BH110
X: 383488.74
Y: 805592.17
GL 38.22

BH111
X: 383502.07
Y: 805532.84
GL 38.61

BH112
X: 383443.55
Y: 805664.27
GL 38.48

BH113
X: 383433.87
Y: 805580.73
GL 38.12

BH114
X: 383440.80
Y: 805524.80
GL 39.00

BH115
X: 383579.39
Y: 805712.12
GL 38.66

BH116
X: 383607.74
Y: 805690.14
GL 36.20

BH117
X: 383645.30
Y: 805672.26
GL 36.19

BH118
X: 383668.62
Y: 805716.77
GL 36.23

BH119
X: 383695.26
Y: 805675.80
GL 35.85

BH120
X: 383717.95
Y: 805696.93
GL 36.10

Nail 201
RL 38.195

Nail 202
RL 38.775

Nail 203
RL 38.930

Nail 207
RL 39.300

K 38.33 K 38.39 K 38.54 K 38.72 K 38.82 K 38.88 K 38.95 K 39.00 K 39.05 K 39.12

FP 38.45 FP 38.62 FP 38.79 FP 38.88 FP 39.01 FP 39.06 FP 39.09 FP 39.17

K 38.18 K 38.03

FP 38.20 FP 38.08 FP 38.17 FP 38.11 FP 38.25 FP 38.31 FP 38.30 FP 38.38 FP 38.20 FP 38.48 FP 38.47 FP 38.44 FP 38.36 FP 38.40 FP 38.49 FP 38.63 FP 38.86 FP 38.51 FP 38.14 FP 38.30 FP 38.21 FP 38.34 FP 38.40

Part Lot 4 DP 905m² CB793/52

Lot 1 DP 19287 1017m² CB792/87

Lot 3 DP 306538 30m²

Lot 1 DP 78681 70429m² CB45A/841

Lot 2 DP 38571 504m² CB19A/186

Lot 4 DP 29202 1009m² CB11F/1014

905m² CB26A/486

Lot 2 DP 350640 965m² 207155

CB45/576

Lot 3 DP 350640 2063m² 207156

Lot 1 DP 350640 2063m² 207154

Lot 1 DP 34558 19830m² CB14A/1325 CB48B/948

Lot 2 DP 83523 1043m² CB48B/948

Lot 2 DP 83523 1043m² CB48B/949

Lot 1 DP 50964 1302m² CB29F/842

Lot 2 DP 50964 541m² CB30B/1215 CB30B/1216

GEOSPATIAL REGISTRATION OF AERIAL IMAGERY MAY NOT BE IN TERMS OF LAND XML BOUNDARY DATA
BOUNDARY LOCATIONS SUBJECT TO CADASTRAL SURVEY

12d Working Folder: S:\Project RPS\02301 - Kyle Park\12d\Survey\F11390

ISSUE	AMENDMENT	SIGNED	DATE

Christchurch City Council

TECHNICAL SERVICES & DESIGN

HEIGHT DATUM	CCD Post Jan 2014		NAME	SIGNED	DATE
ORIGIN BM	BM0140 (EHBT)	SURVEYED BY	D Babbage		November 2018
RL	19.342	PROCESSED BY	D Babbage		November 2018
SURVEY LB	GNSS	CHECKED BY			
COORD DATUM	Mt Pleasant 2000	NORTHING		EASTING	
ORIGIN					
SITE TBM					
12D FILE REF	F11390	PRINTED ON	Wed Nov 07 11:50:09 2018		

PROJECT TITLE

Kyle Park

DRAWING TITLE

Bore Locations

SAP/WBS NUMBER: 721/120/9/9/3/3

SCALES: 1:500

FILE NUMBER: RPS2301

ORIGINAL SHEET SIZE: A1

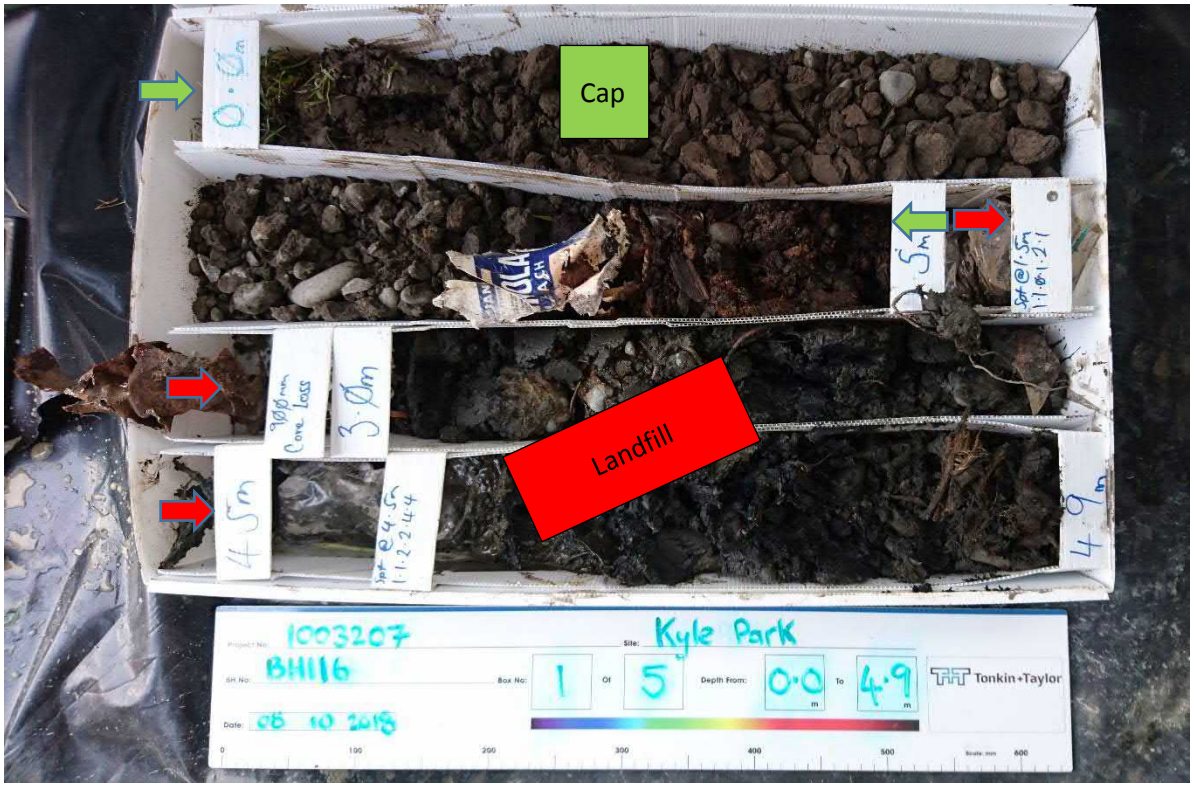
DRAWING NUMBER: RPS2301- 01

SHEET: 1 OF 1

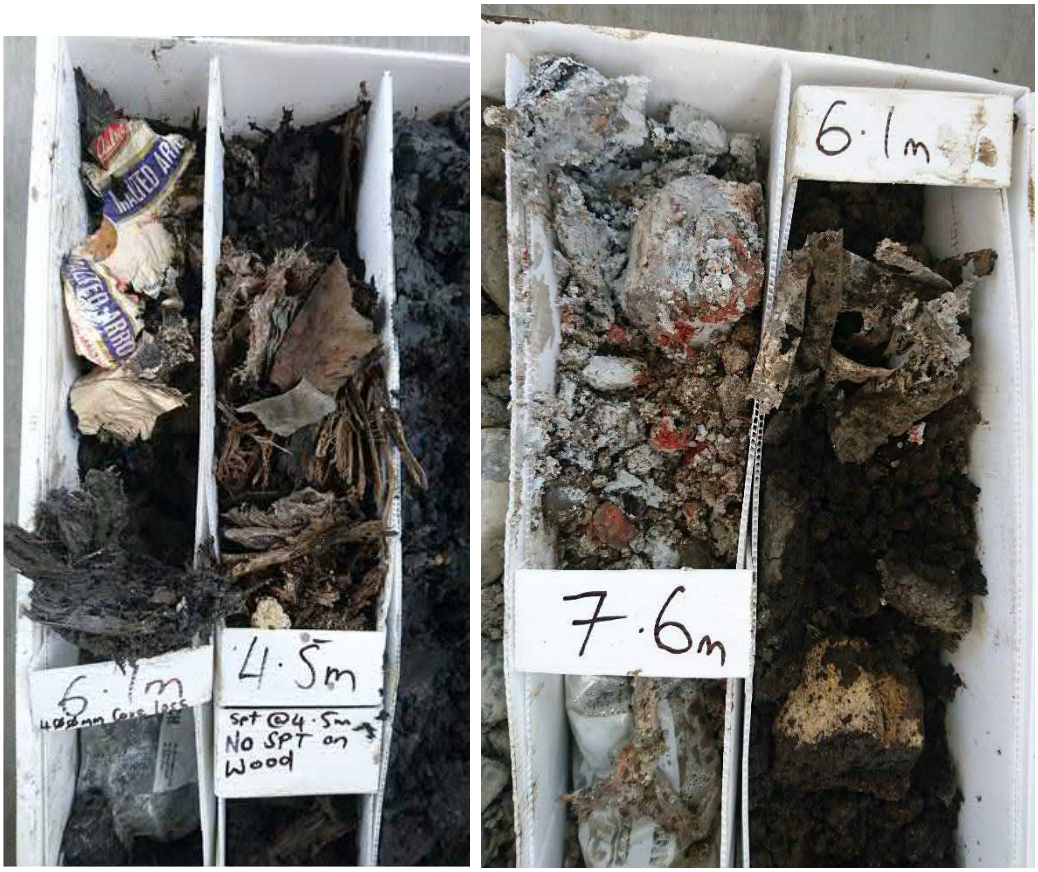
Appendix B: Photographs

Photograph 1 –centre of the site looking south-west.

Photograph 2 – development area looking easterly (Waterloo Road left of frame).

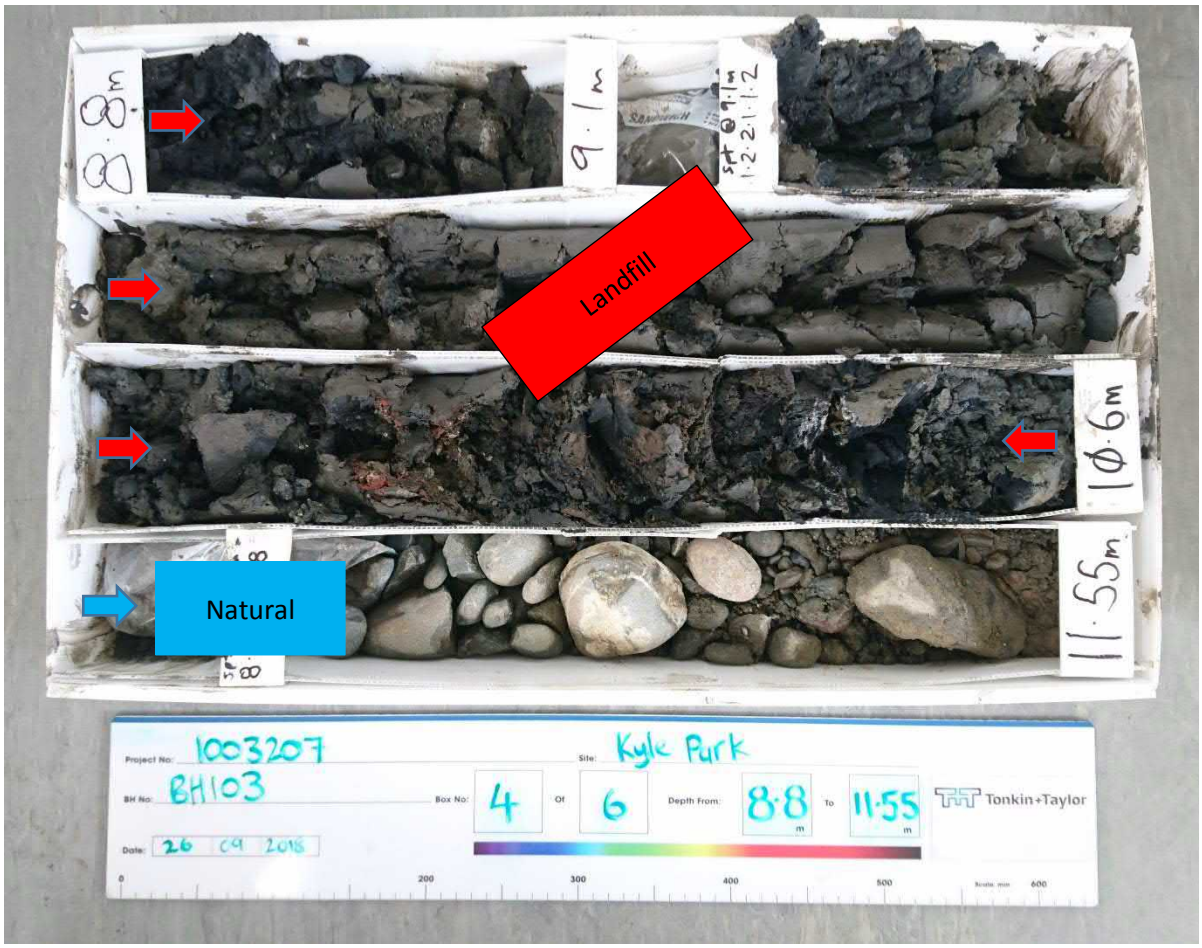


Photograph 3 – example of capping materials and their transition into landfill materials.



Photograph 4 – examples of landfill materials.

Photograph 5 – example of asbestos containing material (cement board materials) (Borehole 111 at 0.7 m bgl).



Photograph 6 - example of landfill and natural material change.

Appendix C: Borehole Logs and Field Screening Data

BOREHOLE LOG

BOREHOLE No.: **BH101**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179231.00 mN 1561662.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 20/09/2018 HOLE FINISHED: 20/09/2018
R.L.:	36.16m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL Box 1, 0.0-3.8m Box 2, 3.8-6.0m			66	PQ HFS				36			M	F				Capping material: Sandy SILT with amorphous organics; dark brown. "Firm", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium.
								35	1		M-W					Transition material: Sandy fine to coarse GRAVEL with minor silt and trace cobbles; brown. Moist to wet, well graded. Contains some coal (0.75 to 0.8m only); gravel, subangular to subrounded; sand, fine to medium.
			73	PQ HFS				34	2		W					1.0 to 1.5m - no recovery.
																No SPT @ 1.5m (bouncing).
			100	SPT		7/8 6/3 2/1 **N=12**		33	3			MD				Fill: organic and/or granular soils mixed with refuse.
			100	PQ HFS				32	4							2.6 to 3.0m - no recovery.
			100	SPT		2/1 4/4 2/2 **N=12**		31	5							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
			100	PQ HFS												
			100	SPT		1/3 2/2 3/3 **N=10**		30	6							
			100	PQ HFS				29	7							
NATURAL Box 3, 6.0-8.4m			100	SPT		4/2 2/2 1/2 **N=7**		28	8			L				Silty sandy fine to coarse GRAVEL with trace cobbles; dark brownish grey. Loose, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
			71	PQ HFS												8.1 to 8.3m - no recovery.
			100	SPT		13/13 10/12 16/12 for 65mm **N>=50** Bouncing		27	9		M-W	VD				9.1m - grey; moist to wet, very dense.
Box 4, 8.4-10.9m		20/09/2018 10.6 m bgl	100	PQ HFS				26	10							
			100	SPT		7/5 6/6 14/18 **N=34** Solid		25	11		W-S	D				Sandy fine to coarse GRAVEL with minor silt and trace cobbles; brown. Dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
			100	PQ HFS												10.6 to 11.05m - no recovery from SPT; sample obtained from overcore.
Box 5, 10.9-13.5m			100	SPT		8/12 16/18 16 for 55mm **N>=50** Solid Bouncing		24	12			VD				12.2m - very dense. 12.2 to 12.56m - no recovery from SPT; sample obtained from overcore.
			100	PQ HFS				23	13							
			100	SPT		4/4 5/6 10/15 **N=36** Solid		22	14							13.7 to 14.15m - no recovery from SPT; sample obtained from overcore.
Box 6, 13.5-15.7m			100	PQ HFS												
			0	SPT		3/5 7/9		21	15			D				15.2m - dense. 15.2 to 15.65m - no recovery from SPT.
						15/18 **N=49** Solid		20	16							End of borehole at 15.65 m bgl (target depth).

COMMENTS:

Hole Depth 15.65m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:33:16 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: **BH102**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179181.00 mN 1561663.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 20/09/2018 HOLE FINISHED: 20/09/2018
R.L.:	36.07m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL			80	PQ HFS				35	1		M	S				Capping material: SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium.
			100	SPT		2/1 2/1 0/0 **N=3**					M-W					Transition material: Sandy fine to medium GRAVEL with some silt, brown to dark brown. "Loose", wet, well graded. Contains minor coal; organic odour; gravel, subangular to subrounded; sand, fine to coarse.
			14	PQ HFS				34	2			F-St				0.7m - sandy SILT with some gravel; brown. "Soft to firm", moist to wet, low plasticity, very slow dilatancy.
			100	SPT		4/4 6/5 17/7 **N=35**		33	3							0.95m - thin rust layer.
			9	PQ HFS				32	4							1.0m - "firm to stiff", trace glass.
			59	PQ HFS				31	5							1.2 to 1.5m - no recovery.
			100	SPT		2/1 1/1 1/1 **N=4**		30	6							1.5 to 1.95m - no recovery from SPT; sample obtained from overcore.
			61	PQ HFS				29	7							1.5m - gravelly, trace cobble.
			100	SPT		1/1 1/1 1/1 **N=4**		28	8							Fill: organic and/or granular soils mixed with refuse.
			100	PQ HFS				27	9							2.1 to 3.0m - no recovery.
			100	SPT		1/1 1/1 0/2 for 65mm **N>=50**		26	10							3.55 to 4.5m - no recovery.
			52	PQ HFS				25	11							No SPT @ 4.5m (wood).
		20/09/2018 11.0 m bgl	100	SPT		7/10 12/18 20 for 65mm **N>=50** Bouncing		24	12							5.9 to 6.1m - no recovery.
NATURAL			100	PQ HFS				23	13		W	VD				Sandy fine to coarse GRAVEL with minor silt and trace cobbles; brownish grey. Very dense, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
			100	SPT		17/33 for 75mm **N>=50** Solid Bouncing		22	14		W-S					7.2 to 7.6m - no recovery.
			100	PQ HFS				21	15							7.6 to 8.05m - no recovery from SPT; sample obtained from overcore.
			0	SPT		8/19 36/14 for 20mm **N>=50** Solid Bouncing		20	16							10.1 to 10.4m - no recovery.
						7/13 19/31 for 75mm **N>=50** Solid Bouncing										Sandy fine to coarse GRAVEL with minor silt and trace cobbles; brownish grey. Very dense, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
																12.2 to 12.35m - no recovery from SPT; sample obtained from overcore.
																12.7m - brown; wet to saturated.
																13.7 to 13.95m - no recovery from SPT; sample obtained from overcore.
																15.2 to 15.5m - no recovery from SPT.
																End of borehole at 15.5 m bgl (target depth).

Box 1, 0.0-4.5m
Box 2, 4.5-7.6m
Box 3, 7.6-10.4m
Box 4, 10.4-12.7m
Box 5, 12.7-15.5m

For a general description of the landfill materials see the Geotechnical Assessment Report.
Detailed field observations of the landfill material are available on request.

COMMENTS:

Hole Depth 15.5m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:33:22 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: **BH103**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179195.00 mN 1561605.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 21/09/2018 HOLE FINISHED: 21/09/2018
R.L.:	36.14m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL

ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	Description and Additional Observations
FILL		93	PQ HFS				36		M	S	Capping material: SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low to moderate plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium.
		100	SPT		2/1 1/1 1/1 **N=4**		35	1		L	Transition material: Sandy fine to coarse GRAVEL with some silt, amorphous organics; dark brown. Loose, moist, well graded; low to moderate plasticity, no dilatancy. Organic odour; gravel, subangular to subrounded; sand, fine to medium.
		71	PQ HFS				34	2	W-S		Fill: organic and/or granular soils mixed with refuse.
Box 1, 0.0-3.5m		100	SPT		2/1 0/1 2/1 **N=4**		33	3			1.4 to 1.5m - no recovery. 2.0m - wet to saturated. 2.7 to 3.0m - no recovery.
		100	PQ HFS				32	4			
		56	PQ HFS				31	5			No SPT @ 4.5m (steel). 4.5 to 5.2m - no recovery.
Box 2, 3.5-6.5m		100	SPT		13/2 2/1 1/1 **N=5**		30	6			For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
		100	PQ HFS				29	7			
Box 3, 6.5-8.8m		100	SPT		2/2 1/1 1/1 **N=4**		28	8			
		100	PQ HFS					9			
		100	SPT		1/2 2/1 1/2 for 65mm **N>=50**		27				
	21/09/2018 10.9 m bgl	100	PQ HFS				26	10			
Box 4, 8.8-11.8m		82	SPT		8/10 12/8 8/8 **N=28**		25	11		D	Sandy fine to coarse GRAVEL with minor cobbles and trace silt; brownish grey. Dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
		100	PQ HFS					12			
NATURAL		33	SPT		8/9 125/10 18/10 for 70mm **N>=50** Bouncing		24		S	VD	12.2m - cobbles absent; brown. Very dense, saturated. 12.2 to 12.65m - no recovery from SPT; sample obtained from overcore.
		100	PQ HFS				23	13			13.7 to 14.15m - no recovery from SPT; sample obtained from overcore.
		55	SPT		7/13 14/12 14/10 for 70mm **N>=50** Solid Bouncing		22	14			
Box 5, 11.6-15.6m		100	PQ HFS					15			
		0	SPT		6/11 15/15 10/10 for 50mm **N>=50** Solid Bouncing		21				15.2 to 15.63m - no recovery from SPT.
							20	16			End of borehole at 15.63 m bgl (target depth).

COMMENTS:

Hole Depth 15.63m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:33:28 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: **BH104**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179220.00 mN 1561559.00 mE

R.L.: 36.17m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 26/09/2018

HOLE FINISHED: 26/09/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL / ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Box	WATER	CORE RECOVERY (%)	METHOD	TESTS	RL (m)	DEPTH (m)	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	Description and Additional Observations
FILL	Box 1, 0.0-3.0m		80	PQ HFS		36		M	S	Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			44	SPT	2/0 0/1 1/1 **N=3**	35	1			
			61	PQ HFS		34	2	M-W		Transition material: SILT with some sand and trace gravel; brown mottled greyish brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace red plastic; sand, fine to medium; gravel, fine to medium, subangular to subrounded. 0.6 to 0.9m - no recovery.
	Box 2, 3.0-6.0m		100	SPT	3/3 2/2 1/2 **N=7**	33	3			Fill: organic and/or granular soils mixed with refuse.
			61	PQ HFS		32	4			1.7 to 1.95m - no recovery. 2.1m - moist to wet. 2.6 to 3.0m - no recovery.
			100	SPT	1/3 10/40 for 70mm **N>=50** Bouncing	31	5			4.8 to 5.0m - no recovery.
			88	PQ HFS		30	6			For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
	Box 3, 6.0-9.4m		100	PQ HFS		29	7			
			0	SPT	2/1 0/0 1/2 **N=3**	28	8			7.6 to 8.05m - no recovery in SPT.
			47	PQ HFS		27	9			8.55 to 9.1m - no recovery.
NATURAL		26/09/2018 10.4 m bgl	100	SPT	3/2 3/4 5/5 **N=17** Solid			W-S	MD	Sandy fine to coarse GRAVEL with minor cobbles and trace silt; bluish grey. Medium dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
			100	PQ HFS		26	10	S	L	9.1 to 9.55m - no recovery from SPT; sample obtained from overcore.
			44	SPT	2/1 2/2 2/2 **N=8**	25	11			10.0m - reddish brown; saturated, loose. 10.8 to 11.05m - no recovery.
	Box 4, 9.4-12.7m		100	PQ HFS		24	12			12.0m - trace to minor silt, trace cobbles; brownish grey.
			100	SPT	9/12 10/10 12/6 **N=38**				D	12.2m - dense.
			100	PQ HFS		23	13			12.7m - sandy, trace to minor silt; brown.
			100	SPT	7/13 19/11 10/10 **N>=50**	22	14		VD	13.7m - very dense.
	Box 5, 12.7-15.6m		100	PQ HFS		21	15			
			0	SPT	9/17 21/23 6 for 70mm **N>=50** Solid Bouncing					15.2 to 15.1m - no recovery from SPT.
						20	16			End of borehole @ 15.51m bgl (target depth).

COMMENTS:

Hole Depth 15.51m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:33:33 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: **BH105**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179169.00 mN 1561561.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 26/09/2018 HOLE FINISHED: 26/09/2018
R.L.:	36.34m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Box	WATER	CORE RECOVERY (%)	METHOD	TESTS	RL (m)	DEPTH (m)	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	Description and Additional Observations
FILL	Box 1, 0.0-3.0m		93	PQ HFS		36	1	M	S	Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded. 0.35m - yellowish brown.
			100	SPT	2/1 0/0 1/0 **N=1**	35			L	
			100	PQ HFS		34	2			Transition material: sandy fine to coarse GRAVEL with minor to some silt, amorphous organics; dark brown. "Loose", moist, well graded. Contains trace glass, white paint/plaster chips; organic odour; gravel, subangular to subrounded; sand, fine to medium.
			100	SPT	1/1 3/2 2/2 **N=9**	33	3			Fill: organic and/or granular soils mixed with refuse. 1.4 to 1.5m - no recovery.
	Box 2, 3.0-6.1m		100	PQ HFS		32	4			
			100	SPT	3/3 2/2 2/2 for 70mm **N>=50**	31	5			For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
			100	PQ HFS		30	6			
			100	SPT	1/2 2/2 1/2 **N=7**	29	7	W		6.5m - wet.
	Box 3, 6.1-9.1m		100	PQ HFS		28	8			
			100	SPT	4/4 3/7 3/1 **N=14**	27	9	W-S	VD	Sandy fine to coarse GRAVEL with minor silt and trace cobbles; brown. Very dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
NATURAL		26/09/2018 10.3 m bgl	100	PQ HFS	3/4 4/16 20/10 for 10mm **N>=50** Bouncing	26	10	S		9.7m - greyish brown; saturated.
	Box 4, 9.1-12.2m		100	PQ HFS	20/30 for 70mm **N>=50** Solid Bouncing	25	11			10.6 to 11.05m - no recovery from SPT; sample obtained from overcore. 10.8m - trace silt; bluish grey.
			100	SPT	12/19 25/25 for 70mm **N>=50** Solid Bouncing	24	12			12.0m - brownish grey.
			100	PQ HFS		23	13			12.2m - trace to minor silt; brown. 12.2 to 12.35m - no recovery from SPT; sample obtained from overcore.
			100	SPT	11/17 18/18 14 for 60mm **N>=50** Solid Bouncing	22	14			13.7 to 14.06m - no recovery from SPT; sample obtained from overcore.
	Box 5, 12.2-15.5m		100	PQ HFS		21	15			15.2 to 15.49m - no recovery from SPT.
			0	SPT	13/21 27/23 for 65mm **N>=50** Solid Bouncing	20	16			End of borehole @15.49m bgl (target depth).

COMMENTS:

Hole Depth 15.49m

Scale 1:83

Rev.: A

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Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH106**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179177.00 mN 1561504.00 mE

R.L.: 38.23m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 27/09/2018

HOLE FINISHED: 27/09/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL

ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL			100	PQ HFS			Box 1, 0.0-2.6m	38	0		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	SPT		3/2 2/2 2/2 N=8		37	1							
			71	PQ HFS				36	2							Transition material: SILT with some sand and trace gravel; brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace brick; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	SPT		2/1 3/2 2/2 N=9		35	3							Fill: organic and/or granular soils mixed with refuse. 2.7 to 3.0m - no recovery.
			76	PQ HFS			Box 2, 2.6-5.8m	34	4							
			100	SPT		1/2 2/1 0/1 N=4		33	5							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
			100	PQ HFS				32	6							
			100	SPT		2/4 4/4 6/4 N=18		31	7							
			100	PQ HFS			Box 3, 5.8-8.0m	30	8							
		27/09/2018 9.2 m bgl	100	SPT		2/2 6/4 3/3 N=16		29	9							
			100	PQ HFS				28	10							
			100	SPT		9/9 11/7 5/5 N=28		27	11		S	L				9.9 to 10.1m - no recovery.
			80	PQ HFS			Box 4, 8.0-10.8m	26	12							Fine to coarse GRAVEL with trace sand and silt; brownish grey. Loose, saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 10.3m - sandy.
			100	SPT		10/6 3/3 2/2 N=10		25	13							
NATURAL			4	PQ HFS				24	14							Silty fine to medium SAND; grey. Loose, saturated, poorly graded. 11.1 to 12.2m - no recovery.
			100	SPT		12/12 15/20 15 for 20mm N>=50 Bouncing		23	15			VD				Sandy fine to coarse GRAVEL with trace cobbles and silt; brownish grey. Very dense, saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 12.2 to 12.52m - no recovery from SPT; sample obtained from overcore.
			100	PQ HFS			Box 5, 10.8-14.7m	22	16							
			100	SPT		4/5 8/12 12/12 N=44 Solid						D				13.2m - minor silt; brown. 13.7m - dense. 13.7 to 14.15m - no recovery from SPT; sample obtained from overcore.
			100	PQ HFS			Box 6, 14.7-15.6m									
			0	SPT		6/8 15/15 18/2 for 5mm N>=50 Solid Bouncing						VD				15.2m - very dense. 15.2 to 15.58m - no recovery from SPT. End of borehole @ 15.58m bgl (target depth).

COMMENTS:

Hole Depth 15.58m

Scale 1:83

Rev.: A

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BOREHOLE LOG

BOREHOLE No.: **BH107**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179215.00 mN 1561475.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 27/09/2018 HOLE FINISHED: 27/09/2018
R.L.:	38.61m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL / ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	RL (m)	DEPTH (m)	TESTS	SAMPLES	CASING	WATER	FLUID LOSS (%)	CORE RECOVERY (%)	METHOD	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Box 1, 0.0-2.6m FILL	38	1						100	PQ HFS		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
											W	L				
	37	2	2/3 3/2 2/1 **N=8**					100	SPT							Transition material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown mottled light grey and orange. "Soft", moist, low plasticity, very slow dilatancy. Contains trace brick; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
								90	PQ HFS							
	36	3						100	SPT							0.65m - organic sandy fine to coarse GRAVEL with minor to some silt; brown to dark brown. "Loose", wet, well graded. Contains trace brick; organic odour; gravel, angular to subrounded; sand, fine to coarse; organics, amorphous.
			3/3 2/2 1/2 **N=7**													0.9m - trace white paint/plaster chips.
	35	4						85	PQ HFS							1.05m - light grey and orange bands.
	34	5						75	PQ HFS		M	VD				Fill: organic and/or granular soils mixed with refuse.
Box 2, 2.6-6.1m																2.9 to 3.0m - no recovery.
																4.35 to 4.5m - no recovery. No SPT at 4.5m (wood).
	33	6	15/15 12/12 14/12 **N>=50** Bouncing					100	SPT							Sandy fine to coarse GRAVEL with minor to some silt and amorphous organics; dark brownish grey. Very dense, moist, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
								100	PQ HFS							5.2m - trace silt, organics absent; grey.
	32	7									W					5.3m - minor cobbles.
																5.7 to 6.1m - no recovery.
Box 3, 6.1-9.1m	31	8	14/16 16/14 12/8 for 70mm **N>=50** Solid Bouncing					66	SPT							7.0m - trace cobbles; grey, wet.
								100	PQ HFS							7.6 to 7.85m - no recovery from SPT; 200mm sample obtained from overcore. 7.85 to 8.0m - sand and silt absent.
	30	9														
			16/18 18/18 14 for 65mm **N>=50** Solid Bouncing			27/09/2018 10.1 m bgl		2	SPT							9.1 to 9.47m - no recovery from SPT; 170mm sample obtained from overcore. 9.3m - minor silt.
NATURAL	29	10						100	PQ HFS							
																For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
Box 4, 9.1-11.9m	28	11	24/26 for 75mm **N>=50** Solid Bouncing													
	27	12						100	PQ HFS							12.2 to 12.35m - no recovery from SPT; sample obtained from overcore.
			30/20 for 70mm **N>=50** Solid Bouncing													
	26	13														
	25	14	10/10 14/12 14/10 for 70mm **N>=50** Solid Bouncing					100	SPT							13.7m - brown.
Box 5, 11.9-14.6m								100	PQ HFS							13.7 to 14.15m - no recovery from SPT; sample obtained from overcore.
Box 6, 14.6-15.5m	24	15	18/27 32/18 for 40mm **N>=50** Solid Bouncing					0	SPT							15.2 to 15.47m - no recovery from SPT.
	23	16														End of borehole @ 15.47m bgl (target depth).

COMMENTS:

Hole Depth 15.47m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:33:48 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: **BH108**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179119.00 mN 1561487.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 02/10/2018 HOLE FINISHED: 02/10/2018
R.L.:	38.43m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL																ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.		FLUID LOSS (%) 25 50 75	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
FILL	Box 1, 0.0-2.6m			100	PQ HFS		8/42 for 50mm **N>=50** Bouncing		38 37	1		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded. 0.3m - brown mottled light yellowish brown.
				100	PQ HFS				36	2		W-S					Transition material: SILT with some sand and trace gravel; brown mottled light yellowish brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace brick, white paint chips, and timber; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
				100	SPT		2/3 3/3 1/2 **N=9**		35	3							Fill: organic and/or granular soils mixed with refuse. 2.4m - wet to saturated.
	Box 2, 2.6-6.5m			100	PQ HFS				34	4							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
				100	SPT		2/1 0/1 1/2 **N=4**		33	5							
				82	PQ HFS				32	6							5.9 to 6.1m - no recovery.
				100	SPT		1/1 3/5 9/3 **N=20**		31	7							6.7 to 7.6m - no recovery (rubbish blocking barrel). No SPT @ 7.6m.
				14	PQ HFS				30	8							
	Box 3, 6.5-10.2m			73	PQ HFS				29	9							8.7 to 9.1m - no recovery.
				100	SPT		8/10 6/5 5/5 **N=21**		28	10			VD				
		02/10/2018 10.7 m bgl		100	PQ HFS				27	11							Sandy fine to coarse GRAVEL with minor cobbles and silt; brownish grey mottled orange. Very dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 9.7m - reddish orange. 9.8m - bluish grey. 11.0m - grey.
				100	SPT		13/13 20/22 8 for 5mm **N>=50** Bouncing		26	12							
NATURAL	Box 4, 10.2-13.1m			100	PQ HFS				25	13							12.2 to 12.43m - no recovery from SPT; sample obtained from overcore. 12.7m - trace silt; bluish grey.
				100	SPT		10/21 26/14 for 5mm **N>=50** Solid Bouncing		24	14							13.7 to 14.15m - no recovery from SPT; sample obtained from overcore. 14.0m - brown. 15.2 to 15.57m - no recovery from SPT.
	Box 5, 13.1-15.6m			100	PQ HFS				23	15							
				0	SPT		4/6 9/7 11/18 **N=45** Solid 5/7 14/16 20 for 65mm **N>=50** Solid Bouncing		22	16							End of borehole @ 15.57m bgl (target depth).

COMMENTS:

Hole Depth 15.57m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:33:54 PM - Produced with Core-GS by GeRoc

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH109**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179153.00 mN 1561456.00 mE

R.L.: 38.31m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 28/09/2018

HOLE FINISHED: 28/09/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL

ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Box	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	Description and Additional Observations
FILL	Box 1, 0.0-2.6m		100	PQ HFS				38	0	M	S	Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	SPT		5/4 3/4 3/1 **N=11**		37	1	W		0.6m - orange and black mottles. 0.8m - wet.
			100	PQ HFS				36	2	M-W		Transition material: layered organic silty fine to medium SAND with minor gravel, and organic sandy SILT; dark grey. Wet; sharp organic odour.
	Box 2, 2.6-5.6m		100	SPT		2/4 3/9 38 for 70mm **N>=50** Bouncing		35	3			Fill: organic and/or granular soils mixed with refuse. Moist to wet.
			100	PQ HFS				34	4			
			100	SPT		2/4 4/2 2/4 **N=12**		33	5			
			100	PQ HFS				32	6			
	Box 3, 5.6-8.9m		100	SPT		1/0 1/1 1/1 **N=4**		31	7			
			100	PQ HFS				30	8			
			100	SPT		0/0 1/0 1/1 **N=3**		29	9	S	VD	Sandy fine to coarse GRAVEL with minor silt and amorphous organics; dark grey. Very dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 9.8m - organics absent; greyish brown.
NATURAL		28/09/2018 10.3 m bgl	100	PQ HFS				28	10			
			100	SPT		3/15 20/15 15 for 75mm **N>=50** Bouncing		27	11	W		10.6m - grey; wet. 10.6 to 10.91m - no recovery from SPT; sample obtained from overcore.
	Box 4, 8.9-11.7m		100	PQ HFS				26	12			
			1164	SPT		7/10 15/18 17 for 5mm **N>=50** Solid Bouncing		25	13			12.2 to 12.51m - no recovery from SPT; sample obtained from overcore. 12.3m - greyish brown.
			100	PQ HFS				24	14	S	D	13.7m - trace silt; reddish brown. Saturated, dense. 14.8m - minor silt.
	Box 5, 11.7-14.6m		100	SPT		6/12 15/22 13 for 10mm **N>=50** Solid Bouncing		23	15			
			71	PQ HFS								14.9 to 15.2m - no recovery. 15.2m - very dense. 15.2 to 15.57m - no recovery from SPT.
	Box 6, 14.6-15.6m		0	SPT		4/4 6/9 13/18 **N=46** Solid 5/9 13/17 20 for 65mm **N>=50** Solid Bouncing		22	16			End of borehole @ 15.51m bgl (target depth).

For a general description of the landfill materials see the Geotechnical Assessment Report.
Detailed field observations of the landfill material are available on request.

COMMENTS:

Hole Depth 15.57m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:34:00 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: **BH110**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179101.00 mN 1561435.00 mE

R.L.: 38.22m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 01/10/2018

HOLE FINISHED: 01/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL / ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	RL (m)	DEPTH (m)	TESTS	CORE RECOVERY (%)	METHOD	WATER	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	Description and Additional Observations
FILL	38	0		100	PQ HFS		M	S	Capping material: SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium.
	37	1					W		0.4m - minor gravel; dry to moist, "firm to stiff". Gravel, fine to coarse, subangular to subrounded.
			2/5 9/7 7/6 **N=29**	100	SPT				Transition material: SILT with some sand, minor gravel, amorphous organics; brown to dark brown. "Firm to stiff", moist, low plasticity, very slow dilatancy. Contains trace brick and timber; organic odour; sand, fine to medium.
Box 1, 0.0-2.8m	36	2		100	PQ HFS				1.0m - interbedded silty fine to medium SAND with minor gravel, fine to medium SAND, and organic sandy SILT. Wet.
			2/1 1/1 2/2 **N=6**	100	SPT				Fill: organic and/or granular soils mixed with refuse. Moist to wet.
	35	3							
	34	4		100	PQ HFS				
			2/1 0/1 2/3 **N=6**	0	SPT				4.5 to 5.0m - no recovery from SPT; sample not recovered from overcore.
Box 2, 2.8-6.1m	33	5							
				100	PQ HFS				For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
	32	6	1/7 4/3 4/3 **N=14**	100	SPT				
	31	7		100	PQ HFS				
			4/2 3/3 3/4 **N=13**	100	SPT				7.6 to 8.05m - no recovery in SPT.
Box 3, 6.1-8.6m	30	8		100	PQ HFS				8.55 to 9.1m - no recovery.
	29	9					S	D	
			3/5 4/5 7/19 **N=50**	100	SPT				Sandy fine to coarse GRAVEL with minor cobbles and trace silt; bluish grey. Dense, saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
	28	10		100	PQ HFS				9.4 to 9.6m - wood pieces.
Box 4, 8.6-11.1m						01/10/2018 11.1 m bgl			9.6m - minor cobbles, trace silt.
	27	11	35/15 for 60mm **N>=50** Solid Bouncing	100	PQ HFS			VD	10.6m - very dense. 10.6 to 10.74m - no recovery from SPT; sample obtained from overcore. 12.0m - minor silt, trace cobbles; greyish brown.
NATURAL	26	12	20/37 50 for 55mm **N>=50** Solid Bouncing	100	SPT				12.2 to 12.41m - no recovery from SPT; sample obtained from overcore. 12.6m - brown. 13.1m - orange-brown.
Box 5, 11.1-13.7m	25	13		100	PQ HFS				
			15/25 20/22 8 for 40mm **N>=50** Solid Bouncing	100	SPT				13.7 to 14.04m - no recovery from SPT; sample obtained from overcore.
	24	14		100	PQ HFS				
Box 6, 13.7-15.5m	23	15	11/17 24/26 for 65mm **N>=50** Solid Bouncing	0	SPT				15.2 to 15.49m - no recovery from SPT.
	22	16							End of borehole @ 15.49m bgl (target depth).

COMMENTS:

Hole Depth 15.49m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:34:05 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: **BH111**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179042.00 mN 1561448.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 04/10/2018
		DRILL METHOD: SNC	HOLE FINISHED: 04/10/2018
R.L.:	38.61m		DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL																ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.		FLUID LOSS (%) 25 50 75	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
									38	0		M	S				Capping material: SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium. 0.35m - trace gravel, fine to medium, subangular to subrounded.
				86	PQ HFS					1		M-W					Fill: organic and/or granular soils mixed with refuse.
				100	SPT		1/1 0/1 2/3 **N=6**		37								1.0m - moist to wet.
	Box 1, 0.0-3.0m			100	PQ HFS					2							1.3 to 1.5m - no recovery.
				83	PQ HFS				36	3							No SPT @ 3.0m (core slipped out of barrel).
				100	SPT		1/2 1/2 3/5 **N=11**		35	4							4.25 to 4.5m - no recovery.
FILL	Box 2, 3.0-5.9m			100	PQ HFS				34	5							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
				100	SPT		2/2 2/6 5/3 **N=16**		33	6							
				100	PQ HFS				32	7							
				100	SPT		4/3 4/6 4/5 **N=19**		31	8		W-S					7.4m - wet to saturated.
	Box 3, 5.9-8.9m			100	PQ HFS				30	9			VD				Sandy fine to coarse GRAVEL with trace to minor silt and trace cobbles; yellowish brown. Very dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
			20/09/2018 10.4 m bgl	100	SPT		11/20 50 for 65mm **N>=50** Bouncing		29	10							
				100	PQ HFS				28	11							10.6m - greyish brown. 10.6 to 10.83m - no recovery from SPT; sample obtained from overcore.
	Box 4, 8.8-11.1m			100	SPT		13/27 42/8 for 2mm **N>=50** Solid Bouncing		27	12							
NATURAL				100	PQ HFS				26	13							12.2 to 12.65m - no recovery from SPT; sample obtained from overcore.
	Box 5, 11.1-13.7m			100	SPT		7/7 8/12 15/15 **N>=50** Solid		25	14							13.7m - saturated, medium dense. 13.7 to 14.15m - no recovery from SPT; sample not obtained.
				0	SPT		6/6 8/5 3/3 **N=19** Solid		24	15		S	MD				
	Box 6, 13.7-15.7m			95	PQ HFS				23	16							15.2 to 15.65m - no recovery from SPT; sample obtained from overcore.
				0	SPT		5/4 5/7 7/6 **N=25** Solid										End of borehole @ 15.65m bgl (target depth).

COMMENTS:

Hole Depth 15.65m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:34:11 PM - Produced with Core-GS by GeRoc

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH112**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179173.00 mN 1561390.00 mE

R.L.: 38.48m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 04/10/2018

HOLE FINISHED: 04/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL

ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL			100	PQ HFS			Box 1, 0.0-2.5m	38	1		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	SPT		1/3 3/3 2/2 **N=10**		37	2		D-M	L				Transition material: sandy fine to coarse GRAVEL with trace silt; brown. "Loose", dry, well graded. Gravel, angular to subrounded; sand, fine to coarse. 0.6m - minor to some silt, trace wood fibres; moist. 0.95 to 1.05m - orange mottles. 1.5m - organic; dark brown to black. Organics amorphous and fibrous.
			100	PQ HFS				36	3							
			53	PQ HFS			Box 2, 2.5-6.1m	35	4							Fill: organic and/or granular soils mixed with refuse. No SPT @ 3.0m (wood). 3.8 to 4.5m - no recovery.
			100	SPT		1/1 1/1 1/1 **N=4**		34	5							
			100	PQ HFS				33	6							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
			100	SPT		3/4 2/2 2/2 **N=8**		32	7							
			100	PQ HFS				31	8							
			100	SPT		4/6 8/7 6/5 **N=26**		30	9		W-S	VD				
			61	PQ HFS			Box 3, 6.1-9.4m	29	10		S					Sandy fine to coarse GRAVEL with minor cobbles and trace silt, amorphous organics; dark brownish grey. Very dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 8.6m - organics absent.
			100	PQ HFS		7/43 for 65mm **N>=50** Bouncing		28	11							8.7 to 9.1m - no recovery.
		04/10/2018 10.8 m bgl	100	SPT		18/18 25/25 for 75mm **N>=50** Solid Bouncing		27	12							9.2m - silty; golden brown staining, petrol odour. Silt is plastic. 9.3m - trace silt. 9.6 to 9.8m - bluish grey; saturated. Strong petrol odour. 10.5m - bluish grey. 10.6 to 10.9m - no recovery from SPT; sample obtained from overcore. 10.8 to 11.2m - silty; golden brown staining, petrol odour. Silt is plastic. 11.0m - trace silt; bluish grey.
NATURAL			100	PQ HFS			Box 4, 9.4-12.5m	26	13							
			100	SPT		7/10 18/12 14/6 for 25mm **N>=50** Solid Bouncing		25	14							12.2 to 12.6m - no recovery from SPT; sample obtained from overcore. 12.7m - brown.
			100	PQ HFS				24	15							13.7 to 14.08m - no recovery from SPT; sample obtained from overcore.
			100	SPT		10/17 15/10 20/5 for 5mm **N>=50** Solid Bouncing	Box 5, 12.5-15.2m	23	16							SPT not recorded @ 15.2m.
				PQ HFS				22								End of borehole @ 15.2m bgl (target depth).

COMMENTS:

Hole Depth 15.2m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:34:15 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: **BH113**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179090.00 mN 1561380.00 mE

R.L.: 38.12m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 02/10/2018

HOLE FINISHED: 02/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL / ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL			100	PQ HFS				37	1		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded. 0.2m - sandy; brown mottled yellowish brown.
Box 1, 0.0-2.5m			100	SPT		1/1 2/2 5/4 **N=13**		36	2			F-St				Transition material: Gravelly sandy SILT; brown. Moist, low plasticity. Contains trace brick; gravel, fine to coarse, subangular to subrounded; sand, fine to coarse. 0.8m - gravel absent; dark brown. "Firm to stiff". 1.2 to 1.4m - trace sand; grey mottled orange and dark brown. Moderate plasticity, no dilatancy. 1.4m - trace gravel, medium to coarse, subangular to subrounded.
			100	PQ HFS				35	3							Fill: organic and/or granular soils mixed with refuse.
			100	SPT		1/1 1/1 1/1 **N=4**		34	4							No SPT @ 4.5m (wood).
			100	PQ HFS				33	5							5.1 to 6.1m - no recovery (timber blocked barrel).
Box 2, 2.5-6.6m			50	PQ HFS				32	6		S					6.1m - saturated. 6.55 to 6.95m - no recovery.
Box 3, 6.6-7.6m			100	SPT		2/1 3/4 4/4 **N=15**		31	7		W					6.95m - wet.
			61	PQ HFS												End of borehole @7.6m bgl (refusal on steel).
								30	8							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
								29	9							
								28	10							
								27	11							
								26	12							
								25	13							
								24	14							
								23	15							
								22	16							

COMMENTS:

Hole Depth 7.6m

Scale 1:83

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH114**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179034.00 mN 1561387.00 mE

R.L.: 39.00m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 03/10/2018

HOLE FINISHED: 03/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL / ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	RL (m)	DEPTH (m)	TESTS	CORE RECOVERY (%)	METHOD	WATER	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	Description and Additional Observations
FILL (Box 1, 0.0-3.0m; Box 2, 3.0-6.1m; Box 3, 6.1-9.3m)	38	1		86	PQ HFS		M	S	Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			3/3 3/2 2/2 **N=9**	100	SPT		M-W		
	37	2		100	PQ HFS				Transition material: gravelly SILT with some sand; brown. "Soft", moist, low plasticity, no dilatancy. Contains trace timber, metal, brick, plastic, white paint/plaster chips.
									0.9 to 1.1m - no recovery.
	36	3	5/8 5/4 5/3 **N=17**	100	SPT				Fill: organic and/or granular soils mixed with refuse.
	35	4		100	PQ HFS				For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
			32/2 3/4 4/2 **N=13**	100	SPT				
	34	5		100	PQ HFS				
	33	6	4/11 25/12 5/8 **N>=50** Bouncing	22	SPT				6.1 to 6.55m - no recovery from SPT; 100mm obtained from overcore.
	32	7		80	PQ HFS				7.4 to 7.6m - no recovery.
			3/4 4/4 5/5 **N=18**	100	SPT				
	31	8		100	PQ HFS				
	30	9	10/40 for 75mm **N>=50** Bouncing	0	SPT				9.1 to 9.25m - no recovery from SPT; sample not obtained. 9.1 to 10.6m - drilling equipment damaged; retrieval of equipment lost downhole may have resulted in mixed core.
	29	10		100	PQ HFS	03/10/2018 11.1 m bgl			
NATURAL (Box 4, 9.3-11.9m; Box 5, 11.9-15.7m)			12/16 14/26 10 for 30mm **N>=50** Solid Bouncing	100	SPT		W-S	VD	Sandy fine to coarse GRAVEL with trace silt; greyish brown. Very dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 10.6 to 10.93m - no recovery from SPT; sample obtained from overcore.
	28	11		100	PQ HFS				
	27	12	9/10 10/10 11/11 **N=42** Solid	100	SPT			D	12.2m - dense. 12.2 to 12.65m - no recovery from SPT; sample obtained from overcore.
	26	13		100	PQ HFS				
	25	14	7/5 4/5 5/4 **N=18** Solid	100	SPT			MD	13.7m - medium dense. 13.7 to 14.15m - no recovery from SPT; sample obtained from overcore.
	24	15	5/12 19/5 8/9 **N=41** Solid	100	PQ HFS				
				0	SPT				15.2m - dense. 15.2 to 15.65m - no recovery from SPT.
	23	16							End of borehole @ 15.65m bgl (target depth).

COMMENTS:

Hole Depth 15.65m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:34:25 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: **BH115**

SHEET: 1 OF 1

PROJECT: Kyle Park | LOCATION: Kyle Park, Waterloo Road, Hornby | JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179221.00 mN, 1561525.00 mE

R.L.: 38.66m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 05/10/2018

HOLE FINISHED: 05/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS | CHECKED: HJB

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Description and Additional Observations
FILL	Capping material: SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium. 0.3m - trace gravel, fine to medium, subangular to subrounded.
	Transition material: SILT with some sand and trace gravel, amorphous organics; dark brown mottled light brown and orange. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, medium to coarse, subangular to subrounded. 0.75m - some organics, spongy, brown.
	Fill: organic and/or granular soils mixed with refuse. 0.9 to 1.5m - no recovery. No SPT @ 1.5m (wood). 2.25 to 2.6m - no recovery.
NATURAL	Sandy fine to coarse GRAVEL with trace to minor silt and trace cobbles; grey. Medium dense, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 4.5m - dense. 4.5 to 4.95m - no recovery from SPT; sample obtained from overcore.
	6.1m - very dense. 6.1 to 6.48m - no recovery from SPT; sample obtained from overcore.
	7.6 to 7.97m - no recovery from SPT; sample obtained from overcore.
	8.5 to 9.1m - no recovery.
	9.1m - greyish brown. 9.1 to 9.34m - no recovery from SPT; sample obtained from overcore.
	10.6m - dense. 10.6 to 11.05m - no recovery from SPT; sample obtained from overcore.
	11.9m - brown. 12.2m - saturated. 12.2 to 12.65m - no recovery from SPT; sample obtained from overcore.
	13.3 to 13.7m - no recovery. 13.7 to 14.15m - no recovery from SPT; sample obtained from overcore.
	15.2 to 15.65m - no recovery from SPT.
	End of borehole @ 15.65m bgl (target depth).

DEPTH (m)	RL (m)	TESTS	CORE RECOVERY (%)	METHOD	WATER	MOISTURE CONDITION	STRENGTH/DENSITY CLASSIFICATION
1	38		60	PQ HFS		M	S
2	37		76	PQ HFS		M-W	
3	36	4/3 5/5 4/4 **N=18**	100	SPT		W	MD
4	35		100	PQ HFS			
5	34	6/17 12/8 12/11 **N=43** Solid	100	SPT			D
6	33		100	PQ HFS			
7	32	14/14 14/16 20 for 75mm **N>=50** Solid Bouncing	100	SPT			VD
8	31		100	PQ HFS			
9	30	12/14 18/18 14 for 70mm **N>=50** Solid Bouncing	46	PQ HFS			
10	29	6/16 35/15 for 15mm **N>=50** Solid Bouncing	100	SPT			
11	28		100	PQ HFS	05/10/2018 11.1 m bgl		D
12	27	8/8 10/10 11/13 **N=44** Solid	100	SPT			
13	26		100	PQ HFS			
14	25	8/16 11/8 8/10 **N=37** Solid	100	SPT		S	
15	24		61	PQ HFS			
	23	5/6 5/8 10/12 **N=35** Solid	100	SPT			
16			100	PQ HFS			
		6/6 5/7 9/13 **N=34** Solid	0	SPT			

Box 1, 0.0-3.9m | Box 2, 3.9-6.4m | Box 3, 6.4-9.6m | Box 4, 9.6-12.2m | Box 5, 12.2-15.7m

COMMENTS:

For a general description of the landfill materials see the Geotechnical Assessment Report.
Detailed field observations of the landfill material are available on request.

Hole Depth 15.65m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:34:30 PM - Produced with Core-GS by GeRoc

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH116**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179199.00 mN 1561554.00 mE

R.L.: 36.20m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 05/10/2018

HOLE FINISHED: 05/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL

ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL			76	PQ HFS				36			M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	SPT		1/1 0/1 2/1 **N=4**		35	1		W-S					Transition material: SILT with some sand and minor gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace concrete and bark; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			0	PQ HFS				34	2							0.95 to 1.3m - no recovery.
			30	PQ HFS				33	3							Fill: organic and/or granular soils mixed with refuse. Wet to saturated.
			100	SPT		1/1 2/2 4/4 **N=12**		32	4							1.95 to 3.0m - no recovery.
			100	PQ HFS				31	5							No SPT @ 3.0m (metal, core loss).
			100	SPT		5/7 5/4 2/2 **N=13**		30	6							3.45 to 4.5m - no recovery.
Box 1, 0.0-4.9m																For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
Box 2, 4.9-7.1m			100	PQ HFS				29	7							
			33	SPT		2/2 1/2 0/1 **N=4**		28	8							7.6 to 7.9m - no recovery in SPT; 150mm obtained from overcore.
Box 3, 7.1-9.7m			100	PQ HFS				27	9							
			100	SPT		2/0 1/2 12/35 for 70mm **N>=50** Bouncing		26	10		W	D				Sandy fine to coarse GRAVEL with minor silt and trace cobbles; bluish grey. Dense, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
	05/10/2018 10.6 m bgl	▼														10.4m - brownish grey.
			100	PQ HFS				25	11		S					10.6m - trace silt; saturated, brown.
			100	SPT		7/7 8/10 10/10 **N=38** Solid										10.6 to 11.05m - no recovery from SPT; 50mm obtained from overcore.
Box 4, 9.7-12.7m			100	PQ HFS				24	12			VD				12.2m - very dense.
NATURAL			100	SPT		9/12 14/14 16/6 for 15mm **N>=50** Solid Bouncing		23	13							12.2 to 12.59m - no recovery from SPT; sample obtained from overcore.
			100	PQ HFS				22	14							13.7 to 14.08m - no recovery from SPT; sample obtained from overcore.
			100	SPT		7/10 16/16 16/2 for 5mm **N>=50** Solid Bouncing		21	15							
Box 5, 12.7-15.5m			0	PQ HFS		19/20 25/25 for 75mm **N>=50** Solid Bouncing		20	16							15.2 to 15.5m - no recovery from SPT. End of borehole @ 15.50m bgl (target depth).

COMMENTS:

Hole Depth 15.5m

Scale 1:83

Rev.: A

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH117**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179182.00 mN 1561591.00 mE	DRILL TYPE: Fraste XL1	HOLE STARTED: 06/10/2018 HOLE FINISHED: 06/10/2018
R.L.:	36.19m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL — ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL Box 1, 0.0-3.8m Box 2, 3.8-7.0m			83	PQ HFS				36	0		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			0	SPT		0/0 0/0 0/1 **N=1**		35	1							Transition material: gravelly SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			80	PQ HFS				34	2		M-W					0.75 to 1.0m - no recovery.
			22	SPT		0/1 1/0 1/5 **N=7**		33	3							1.5 to 2.15m - no recovery.
			100	PQ HFS				32	4							Fill: organic and/or granular soils mixed with refuse. Moist to wet.
			44	SPT		4/2 2/1 1/2 **N=6**		31	5							3.1 to 3.45m - no recovery.
			69	PQ HFS				30	6							4.7 to 5.3m - no recovery.
			100	SPT		1/1 1/1 1/2 **N=5**		29	7							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
			100	PQ HFS				28	8							8.05 to 8.3m - no recovery.
NATURAL Box 3, 7.0-9.8m Box 4, 9.8-12.2m Box 5, 12.2-14.4m Box 6, 14.4-15.7m		06/10/2018 11.0 m bgl	76	PQ HFS				27	9		W	VD				Sandy fine to coarse GRAVEL with trace to minor cobbles and silt; dark grey. Very dense, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
			100	SPT		3/4 3/3 2/2 **N=10**		26	10							8.8m - grey.
			100	PQ HFS				25	11		S	MD				10.6m - medium dense, saturated.
			100	SPT		8/10 14/21 15 for 50mm **N>=50** Bouncing		24	12							11.0m - brown.
			100	PQ HFS				23	13							
			100	SPT		4/4 4/4 3/5 **N=16**		22	14							
			100	PQ HFS				21	15							
			0	SPT		5/5 4/4 6/7 **N=21**		20	16							End of borehole @ 15.65m bgl (target depth).
						6/6 7/7 4/5 **N=23**										
						3/4 4/5 5/7 **N=21**										

COMMENTS:

Hole Depth 15.65m

Scale 1:83

Rev.: A

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BOREHOLE LOG

BOREHOLE No.: **BH118**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179226.00 mN 1561614.00 mE	DRILL TYPE: Fraste XL1	HOLE STARTED: 06/10/2018 HOLE FINISHED: 06/10/2018
R.L.:	36.23m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL																	ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)		Description and Additional Observations
FILL			66	PQ HFS				36	1		M	S					Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	SPT		0/0 1/1 0/1 **N=3**		35	2								Transition material: gravelly SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace clinker; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded. 0.9m - contains trace brick.
			61	PQ HFS				34	3								1.0 to 1.5m - no recovery.
			100	SPT		0/0 0/0 2/2 **N=4**		33	4								2.0 to 2.4m - no recovery.
			100	PQ HFS				32	5								Fill: organic and/or granular soils mixed with refuse.
			100	SPT		1/1 0/1 0/0 **N=1**		31	6								For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
			82	PQ HFS				30	7								5.9 to 6.1m - no recovery.
			100	SPT		1/1 1/0 0/0 **N=1**		29	8								
			100	PQ HFS				28	9								
			100	SPT		2/2 1/2 3/4 **N=10**		27	10								
			100	PQ HFS				26	11		W S	D					Sandy fine to coarse GRAVEL with trace to minor silt and trace cobbles; bluish grey. Dense, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
		06/10/2018 10.8 m bgl	100	SPT		2/3 3/2 3/3 **N=11**		25	12								10.3m - saturated.
NATURAL			100	PQ HFS				24	13								11.0m - brown.
			100	SPT		14/12 10/10 10/12 **N=42**		23	14								11.8m - minor sand, trace silt.
			100	PQ HFS				22	15			VD					12.2m - very dense.
			100	SPT		7/10 12/13 20/5 for 10mm **N>=50** Bouncing		21	16			D					13.7m - dense.
			100	PQ HFS				20									
			0	SPT		7/7 7/7 8/8 **N=30** 6/6 8/9 8/10 **N=35**											End of borehole @ 15.65m bgl (target depth).

Box 1, 0.0-4.0m
Box 2, 4.0-6.9m
Box 3, 6.9-9.1m
Box 4, 9.1-11.4m
Box 5, 11.4-12m
Box 6, 14.2-15.7m

COMMENTS:

Hole Depth 15.65m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:34:44 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: **BH119**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179185.00 mN 1561641.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 06/10/2018
		DRILL METHOD: SNC	HOLE FINISHED: 06/10/2018
R.L.:	35.85m		DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Box	Water	Core Recovery (%)	Method	Tests	RL (m)	Depth (m)	Moisture Condition / Weathering	Strength/Density Classification	Description and Additional Observations
FILL	Box 1, 0.0-2.8m		100	PQ HFS		35	1	M	S	Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	SPT	3/2 1/0 1/1 **N=3**	34	2			Transition material: SILT with some sand and minor gravel, amorphous organics; brown to dark brown mottled yellowish brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace brick; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	PQ HFS		33	3			Fill: organic and/or granular soils mixed with refuse.
			100	SPT	2/11 8/6 2/2 **N=18**					
	Box 2, 2.8-6.4m		66	PQ HFS		32	4			3.45 to 3.8m - no recovery.
			0	SPT	1/1 0/1 1/2 **N=4**	31	5			4.5 to 5.0m - no recovery.
			100	PQ HFS						
			100	SPT	1/1 2/2 3/8 **N=15**	30	6			For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
	Box 3, 6.4-8.8m		100	PQ HFS		29	7			
			100	SPT	3/1 2/2 3/3 **N=10**	28	8			
			100	PQ HFS		27	9			
			100	SPT	5/4 5/7 5/5 **N=22**	26	10			
NATURAL	Box 4, 8.8-11.2m	06/10/2018 11.3 m bgl	100	PQ HFS				W	VD	Sandy fine to coarse GRAVEL with trace to minor silt and trace cobbles; bluish grey. Very dense, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
			100	SPT	18/18 18/18 14 for 55mm **N>=50** Solid Bouncing	25	11	S		10.6m - brownish grey; saturated. 10.6 to 10.96m - no recovery from SPT; sample obtained from overcore. 11.2m - brown.
			100	PQ HFS		24	12			
			100	SPT	10/12 24/26 for 35mm **N>=50** Solid Bouncing					12.2 to 12.46m - no recovery from SPT; sample obtained from overcore.
	Box 5, 11.2-14.8m		100	PQ HFS		23	13			
			100	SPT	5/12 12/9 12/15 **N=48** Solid	22	14			13.7 to 14.15m - no recovery from SPT; sample obtained from overcore.
	Box 6, 14.8-15.6m		100	PQ HFS		21	15			
			0	SPT	7/10 15/15 20 for 65mm **N>=50** Solid Bouncing					15.2 to 15.57m - no recovery from SPT.
						20	16			End of borehole @ 15.57m bgl (target depth).

COMMENTS:

Hole Depth 15.57m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:34:50 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: **BH120**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179207.00 mN 1561664.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 06/10/2018
		DRILL METHOD: SNC	HOLE FINISHED: 06/10/2018
R.L.:	36.10m		DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL			93	PQ HFS			Box 1, 0.0-3.0m	35	1		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	SPT		2/1 2/1 1/1 **N=5**										Transition material: SILT with some sand and minor to some gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	PQ HFS				34	2							Fill: organic and/or granular soils mixed with refuse.
			73	PQ HFS				33	3							1.4 to 1.5m - no recovery.
								32	4							No SPT @ 3.0m (wood). 3.0 to 3.4m - no recovery.
			0	SPT		2/2 1/0 2/2 **N=5**		31	5							4.5 to 5.1m - no recovery.
			86	PQ HFS			Box 2, 3.0-6.9m									For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
			100	SPT		4/2 2/1 2/3 **N=8**		30	6							
			100	PQ HFS				29	7							
			100	SPT		2/2 1/2 1/1 **N=5**		28	8							7.6 to 8.05m - no recovery in SPT.
			100	PQ HFS							W					8.05m - wet.
			0	SPT		7/6 7/5 5/5 **N=22**		27	9							9.1 to 9.7m - no recovery.
			85	PQ HFS			Box 3, 6.9-10.6m	26	10							
		06/10/2018 10.9 m bgl	100	SPT		14/18 15/18 17 for 70mm **N>=50** Solid Bouncing		25	11		S	VD				Sandy fine to coarse GRAVEL with trace to minor silt and trace cobbles; grey. Very dense, saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
			67	PQ HFS												10.6 to 10.97m - no recovery from SPT; sample obtained from overcore. 11.1m - brown.
			100	SPT		14/16 15/15 15/5 for 5mm **N>=50** Solid Bouncing		24	12							11.2 to 11.8m - no recovery.
NATURAL			100	PQ HFS			Box 4, 10.6-13.7m	23	13							12.2 to 12.58m - no recovery from SPT; sample obtained from overcore.
			100	SPT		6/14 16/15 15/4 for 6mm **N>=50** Solid Bouncing		22	14							13.7 to 14.08m - no recovery from SPT; sample obtained from overcore.
			100	PQ HFS			Box 5, 13.7-15.6m	21	15							
			0	SPT		16/16 16/18 16 for 70mm **N>=50** Solid Bouncing		20	16							15.2 to 15.57m - no recovery from SPT.
																End of borehole at 15.57m bgl (target depth).

COMMENTS:

Hole Depth 15.57m

Scale 1:83

Rev.: A

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Appendix C
Ground Contamination Assessment - Kyle Park, Hornby
Field screening records

Borehole	Depth (m bgl)	Stratum	PID (ppm)	Field logging notes
101	0.75	Capping	0.7	Organic odour
	3.5	Landfill	0.8	-
	5.4	Landfill	0.9	-
	7.2	Landfill	1.3	Sweet odour, ashy materials
102	2.9	Landfill	0.9	-
	4.3	Landfill	0.9	-
	6	Landfill	4.6	Organic odour
	7.3	Landfill	1.3	-
	7.8	Landfill	2.3	-
	8.9	Landfill	3	-
	10.2	Landfill	4.4	-
103	2	Landfill	1.9	-
	2.5	Landfill	2.4	-
	5	Landfill	3.2	-
	7.4	Landfill	11.9	Fuel hydrocarbon odour, black staining to strata
	10.5	Landfill	1.5	Sweet, musty odour
104	2.5	Landfill	1.7	-
	4	Landfill	2.2	-
	5.7	Landfill	8.4	-
	7.2	Landfill	3.4	-
105	1.35	Landfill	1.6	-
	2.9	Landfill	2.1	-
	3.4	Landfill	5.8	-
	4.5	Landfill	10.5	-
	4.55	Landfill	5.9	-
	6.1	Landfill	9.5	-
	6.9	Landfill	3.1	-
	7.6	Landfill	5.9	-
106	1.5	Landfill	0.4	-
	2.3	Landfill	0.6	Organic odour
	3	Landfill	0.7	Organic odour
	4.5	Landfill	0.7	-
	6.8	Landfill	1	-
	7.4	Landfill	0.6	-
	7.6	Landfill	1.5	-
	9.3	Landfill	1.2	-
	10.6	Natural	0.1	-
107	1.3	Landfill	2.1	Materials stained black
	1.5	Landfill	0.7	-
	3	Landfill	1.6	-
	3.9	Landfill	2.1	Sharp organic odour
	6.1	Natural	1.1	-
108	3.8	Landfill	1	-
	5.6	Landfill	27.2	Ashy materials
109	1.5	Landfill	2.8	Sharp organic odour
	3	Landfill	19.8	-
	4.5	Landfill	5.3	-
	6.1	Landfill	0.5	-
	7.6	Landfill	0.2	-
	9.1	Natural	0.3	-
110	2.5	Landfill	0.2	Organic odour
	4.25	Landfill	24.7	Grey sheen to materials
	5.7	Landfill	3.3	-
111	1	Landfill	0	-
	5.8	Landfill	0	
112	8.1	Landfill	3.1	Organic odour
	9.2	Natural	125.6	Hydrocarbon (petrol) odour
	9.5	Natural	45	Hydrocarbon (petrol) odour
	9.7	Natural	3	-
	10	Natural	76.8	Hydrocarbon (petrol) odour
	11.5	Natural	82.8	Hydrocarbon (petrol) odour
	11.7	Natural	3	-
113	3.9	Landfill	1.7	-
	7.3	Landfill	2.8	-
114	2.6	Landfill	0.4	-
	3.6	Landfill	2	-
	4.3	Landfill	0.5	-
116	1.4	Landfill	0.2	-
	3.2	Landfill	2.2	Sharp organic odour
	4.65	Landfill	1.7	Organic odour
	7.25	Landfill	2.3	-
117	7.4	Landfill	16.5	-
	8.35	Landfill	11.3	Hydrocarbon (diesel, grease) odour
118	3.8	Landfill	6.1	Sharp organic odour
119	2.45	Landfill	1.7	Burnt odour
	6.3	Landfill	4.6	-

Appendix D: Laboratory Result Transcripts

- Analytica references – 18-30938, 18-31313, 18-32437
- Precise references –S1809281149, S1810011340, S1810151050

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Certificate of Analysis

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Lab Reference: 18-30938
Submitted by: Katie Stephenson
Date Received: 28/09/2018
Date Completed: 5/10/2018
Order Number: 1003207
Reference:

Sampling Site: Kyle Park

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.

AMENDED REPORT. This report replaces in full a previous version [R00] sent on 05/10/2018. Previous revision did not contain a signature.

Soil Aggregate Properties and Nutrients

			Client Sample ID	BH101 7.2 7.2	BH103 7.4 7.4
			Date Sampled	20/09/2018	26/09/2018
Analyte	Unit	*Reporting Limit*		18-30938-3	18-30938-11
Total Cyanide*	mg/kg dry wt	*0.2*		2.58	<0.2

Heavy Metals in Soil

			Client Sample ID	BH101 3.45 3.45	BH101 7.2 7.2	BH102 0.5 0.5	BH102 9.6 9.6	BH103 0.3 0.3
			Date Sampled	20/09/2018	20/09/2018	21/09/2018	21/09/2018	21/09/2018
Analyte	Unit	*Reporting Limit*		18-30938-2	18-30938-3	18-30938-4	18-30938-6	18-30938-7
Arsenic	mg/kg dry wt	*0.125*		17.8	13.7	4.99	13.4	5.93
Cadmium	mg/kg dry wt	*0.005*		5.04	0.69	0.081	0.40	0.097
Chromium	mg/kg dry wt	*0.125*		45.7	17.5	14.4	19.0	15.2
Copper	mg/kg dry wt	*0.075*		270	76.9	9.00	24.3	14.8
Lead	mg/kg dry wt	*0.05*		406	166	28.8	183	20.8
Mercury	mg/kg dry wt	*0.025*		0.45	0.42	0.060	0.29	0.044
Nickel	mg/kg dry wt	*0.05*		112	31.5	11.3	16.9	11.3
Zinc	mg/kg dry wt	*0.05*		417	257	67.7	200	64.5

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation, with the exception of tests marked *, which are not accredited.

Heavy Metals in Soil

		Client Sample ID	BH103 10.5 10.5	BH104 1.0 1.0	BH104 7.7 7.7	BH105 0.9 0.9	BH105 6.0 6.0
		Date Sampled	26/09/2018	26/09/2018	26/09/2018	27/09/2018	27/09/2018
Analyte	Unit	*Reporting Limit*	18-30938-10	18-30938-12	18-30938-14	18-30938-15	18-30938-17
Arsenic	mg/kg dry wt	*0.125*	9.56	7.16	30.2	16.5	8.28
Cadmium	mg/kg dry wt	*0.005*	3.07	0.89	2.52	0.29	0.085
Chromium	mg/kg dry wt	*0.125*	26.1	17.3	31.6	17.2	13.5
Copper	mg/kg dry wt	*0.075*	27.5	54.5	108	62.5	9.53
Lead	mg/kg dry wt	*0.05*	77.2	90.2	281	105	32.7
Mercury	mg/kg dry wt	*0.025*	0.44	0.087	0.14	0.20	0.086
Nickel	mg/kg dry wt	*0.05*	31.5	14.3	40.2	17.2	11.4
Zinc	mg/kg dry wt	*0.05*	197	1,300	285	126	113

Semivolatile Organic Compounds - Soil

		Client Sample ID	BH101 3.45 3.45	BH101 7.2 7.2	BH102 0.5 0.5	BH102 9.6 9.6	BH103 0.3 0.3
		Date Sampled	20/09/2018	20/09/2018	21/09/2018	21/09/2018	21/09/2018
Analyte	Unit	*Reporting Limit*	18-30938-2	18-30938-3	18-30938-4	18-30938-6	18-30938-7
Phenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2-Chlorophenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2-Methylphenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2-Nitrophenol	mg/kg dry wt	*1.0*	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dichlorophenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dichlorophenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloro-3-methylphenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2,4,5-Trichlorophenol	mg/kg dry wt	*5*	<5	<5	<5	<5	<5
2,4,6-Trichlorophenol	mg/kg dry wt	*5*	<5.0	<5.0	<5.0	<5.0	<5.0
2,3,4,6-Tetrachlorophenol	mg/kg dry wt	*5*	<5	<5	<5	<5	<5
4-Methylphenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
4-Nitrophenol	mg/kg dry wt	*5*	<5	<5	<5	<5	<5
Naphthalene	mg/kg dry wt	*0.1*	0.4	<0.1	0.7	0.2	<0.1
2-Methylnaphthalene	mg/kg dry wt	*0.1*	0.1	<0.1	0.8	0.2	<0.1
2-Chloronaphthalene	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Acenaphthene	mg/kg dry wt	*0.1*	0.2	<0.1	3.2	<0.1	<0.1
Acenaphthylene	mg/kg dry wt	*0.1*	<0.1	<0.1	1.1	<0.1	<0.1
Fluorene	mg/kg dry wt	*0.1*	0.5	<0.1	6.2	0.2	<0.1
Phenanthrene	mg/kg dry wt	*0.1*	3.7	0.2	92.5	1.3	<0.1
Anthracene	mg/kg dry wt	*0.1*	0.6	0.1	9.9	0.2	<0.1
Fluoranthene	mg/kg dry wt	*0.1*	5.4	0.3	86.0	1.7	<0.1
Benzo[a]anthracene	mg/kg dry wt	*0.1*	2.3	0.1	15.5	0.5	<0.1
Chrysene	mg/kg dry wt	*0.1*	1.7	<0.1	10.5	0.5	<0.1
Benzo[b]fluoranthene	mg/kg dry wt	*0.1*	2.1	<0.1	11.2	0.5	<0.1
Benzo[k]fluoranthene	mg/kg dry wt	*0.1*	0.7	<0.1	4.8	0.3	<0.1
Benzo[a]pyrene	mg/kg dry wt	*0.1*	2.1	<0.1	10.0	0.3	<0.1
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	*0.1*	1.9	<0.1	7.3	<0.1	<0.1
Dibenzo[a,h]anthracene	mg/kg dry wt	*0.1*	0.4	<0.1	1.3	<0.1	<0.1
Benzo[g,h,i]perylene	mg/kg dry wt	*0.1*	1.7	<0.1	5.2	0.4	<0.1
Pyrene	mg/kg dry wt	*0.2*	6.0	0.2	62.9	1.5	<0.2
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.1*	3.3	0.3	16.2	0.6	0.2
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.1*	3.3	<0.1	16.2	0.5	<0.1
4,4'-DDD	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	7.0	<0.3

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH101 3.45 3.45	BH101 7.2 7.2	BH102 0.5 0.5	BH102 9.6 9.6	BH103 0.3 0.3
			Date Sampled	20/09/2018	20/09/2018	21/09/2018	21/09/2018	21/09/2018
4,4'-DDE	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4,4'-DDT	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
alpha-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
beta-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
gamma-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
delta-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Aldrin	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
cis-Chlordane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
trans-Chlordane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Dieldrin	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan I	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Endosulfan II	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan sulphate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin aldehyde	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin ketone	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor epoxide	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Methoxychlor	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-ethylhexyl) phthalate	mg/kg dry wt	*0.5*		1.2	2.4	<0.5	<0.5	<0.5
Butyl benzyl phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Di-n-butyl phthalate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Di-n-octyl phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Diethyl phthalate	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Dimethyl phthalate	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
N-Nitrosodiphenylamine	mg/kg dry wt	*0.3*		0.8	<0.3	<0.3	<0.3	<0.3
N-Nitrosodi-n-propylamine	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Azobenzene	mg/kg dry wt	*0.5*		<0.5	<0.5	7.0	<0.5	<0.5
Isophorone	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Nitrobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Bromophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chlorophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethyl) ether	mg/kg dry wt	*0.3*		<0.3	2.2	<0.3	<0.3	<0.3
Bis(2-Chloro-1-methylethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethoxy) methane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,2-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,3-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,4-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorobutadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorocylopentadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachloroethane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloroaniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
2-Nitroaniline	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
3-Nitroaniline	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Aniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
3,3'-Dichlorobenzidine	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH101 3.45 3.45	BH101 7.2 7.2	BH102 0.5 0.5	BH102 9.6 9.6	BH103 0.3 0.3
			Date Sampled	20/09/2018	20/09/2018	21/09/2018	21/09/2018	21/09/2018
Dibenzofuran	mg/kg dry wt	*0.3*		0.3	<0.3	3.6	<0.3	<0.3
Methyl methanesulfonate	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
Ethyl methanesulfonate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Benzyl alcohol	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Phenol-d5 (Surrogate)	%	*1*		70.4	93.4	109.0	71.2	73.1
2-Fluorophenol (Surrogate)	%	*1*		94.3	126.6	148.5	93.3	101.9
2-Fluorobiphenyl (Surrogate)	%	*1*		163.9	157.8	120.0	144.2	154.0
2,4,6-Tribromophenol (Surrogate)	%	*1*		123.3	124.9	115.7	99.4	88.4
p-Terphenyl-d14 (Surrogate)	%	*1*		156.1	161.4	139.2	140.9	123.9
Nitrobenzene-d5 (Surrogate)	%	*1*		131.6	121.3	120.8	107.0	115.3

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH103 10.5 10.5	BH104 1.0 1.0	BH104 7.7 7.7	BH105 0.9 0.9	BH105 6.0 6.0
			Date Sampled	26/09/2018	26/09/2018	26/09/2018	27/09/2018	27/09/2018
Analyte	Unit	*Reporting Limit*		18-30938-10	18-30938-12	18-30938-14	18-30938-15	18-30938-17
Phenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Chlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Nitrophenol	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dichlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dichlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloro-3-methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4,5-Trichlorophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
2,4,6-Trichlorophenol	mg/kg dry wt	*5*		<5.0	<5.0	<5.0	<5.0	<5.0
2,3,4,6-Tetrachlorophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
4-Methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Nitrophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
Naphthalene	mg/kg dry wt	*0.1*		<0.1	<0.1	1.1	1.5	16.4
2-Methylnaphthalene	mg/kg dry wt	*0.1*		<0.1	<0.1	0.1	0.9	13.0
2-Chloronaphthalene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Acenaphthene	mg/kg dry wt	*0.1*		<0.1	<0.1	0.2	1.4	24.6
Acenaphthylene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	2.6	3.9
Fluorene	mg/kg dry wt	*0.1*		<0.1	<0.1	0.3	6.8	61.6
Phenanthrene	mg/kg dry wt	*0.1*		<0.1	<0.1	0.6	75.6	739.4
Anthracene	mg/kg dry wt	*0.1*		<0.1	<0.1	0.1	7.1	80.2
Fluoranthene	mg/kg dry wt	*0.1*		0.2	0.1	0.8	73.2	355.9
Benzo[a]anthracene	mg/kg dry wt	*0.1*		<0.1	<0.1	0.4	17.9	89.9
Chrysene	mg/kg dry wt	*0.1*		<0.1	<0.1	0.3	13.0	62.9
Benzo[b]fluoranthene	mg/kg dry wt	*0.1*		<0.1	<0.1	0.6	15.0	68.7
Benzo[k]fluoranthene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	5.9	26.9
Benzo[a]pyrene	mg/kg dry wt	*0.1*		<0.1	<0.1	0.4	12.8	66.0
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	*0.1*		<0.1	<0.1	0.7	11.8	50.0
Dibenzo[a,h]anthracene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	2.0	6.4
Benzo[g,h,i]perylene	mg/kg dry wt	*0.1*		<0.1	0.3	0.5	8.7	37.5
Pyrene	mg/kg dry wt	*0.2*		<0.2	<0.2	0.7	61.9	343.7

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH103 10.5 10.5	BH104 1.0 1.0	BH104 7.7 7.7	BH105 0.9 0.9	BH105 6.0 6.0
			Date Sampled	26/09/2018	26/09/2018	26/09/2018	27/09/2018	27/09/2018
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.1*		0.2	0.2	0.7	20.7	100.2
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.1*		<0.1	<0.1	0.6	20.7	100.2
4,4'-DDD	mg/kg dry wt	*0.3*		3.5	<0.3	0.5	<0.3	<0.3
4,4'-DDE	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4,4'-DDT	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
alpha-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
beta-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
gamma-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
delta-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Aldrin	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
cis-Chlordane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
trans-Chlordane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Dieldrin	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	0.7	<0.5
Endosulfan I	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Endosulfan II	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan sulphate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin aldehyde	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin ketone	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor epoxide	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Methoxychlor	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-ethylhexyl) phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	1.3
Butyl benzyl phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Di-n-butyl phthalate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Di-n-octyl phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Diethyl phthalate	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Dimethyl phthalate	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
N-Nitrosodiphenylamine	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
N-Nitrosodi-n-propylamine	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Azobenzene	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	6.8	38.3
Isophorone	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Nitrobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Bromophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chlorophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloro-1-methylethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethoxy) methane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,2-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,3-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,4-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorobutadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorocylopentadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachloroethane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloroaniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH103 10.5 10.5	BH104 1.0 1.0	BH104 7.7 7.7	BH105 0.9 0.9	BH105 6.0 6.0
			Date Sampled	26/09/2018	26/09/2018	26/09/2018	27/09/2018	27/09/2018
2-Nitroaniline	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
3-Nitroaniline	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Aniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
3,3'-Dichlorobenzidine	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenzofuran	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	4.6	44.8
Methyl methanesulfonate	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
Ethyl methanesulfonate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Benzyl alcohol	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Phenol-d5 (Surrogate)	%	*1*		60.6	65.8	47.3	68.0	70.6
2-Fluorophenol (Surrogate)	%	*1*		80.7	89.0	60.8	96.5	92.0
2-Fluorobiphenyl (Surrogate)	%	*1*		207.6	193.4	169.0	128.4	108.3
2,4,6-Tribromophenol (Surrogate)	%	*1*		97.8	92.5	73.8	111.2	105.8
p-Terphenyl-d14 (Surrogate)	%	*1*		169.8	155.8	152.5	136.1	148.4
Nitrobenzene-d5 (Surrogate)	%	*1*		131.1	124.7	125.9	119.5	105.8

Moisture Content

			Client Sample ID	BH101 3.45 3.45	BH101 7.2 7.2	BH102 0.5 0.5	BH102 9.6 9.6	BH103 0.3 0.3
			Date Sampled	20/09/2018	20/09/2018	21/09/2018	21/09/2018	21/09/2018
Analyte	Unit	*Reporting Limit*		18-30938-2	18-30938-3	18-30938-4	18-30938-6	18-30938-7
Moisture Content	%	*1*		38	41	13	39	22

Moisture Content

			Client Sample ID	BH103 10.5 10.5	BH103 7.4 7.4	BH104 1.0 1.0	BH104 7.7 7.7	BH105 0.9 0.9
			Date Sampled	26/09/2018	26/09/2018	26/09/2018	26/09/2018	27/09/2018
Analyte	Unit	*Reporting Limit*		18-30938-10	18-30938-11	18-30938-12	18-30938-14	18-30938-15
Moisture Content	%	*1*		39	26	27	52	14

Moisture Content

			Client Sample ID	BH105 6.0 6.0
			Date Sampled	27/09/2018
Analyte	Unit	*Reporting Limit*		18-30938-17
Moisture Content	%	*1*		10

Method Summary

Cyanide	Water extraction followed by acid distillation, distillate measured by colourmetric analysis. APHA Method 4500-CN C and E.
Elements in Soil	Acid digestion followed by ICP-MS analysis. US EPA method 200.8.
SVOC in Soil	Solvent extraction, followed by GC-MS analysis.
Moisture	Moisture content is determined gravimetrically by drying at 103 °C.

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Technologist

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Technologist

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Certificate of Analysis

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Lab Reference: 18-31313
Submitted by: Katie Stephenson
Date Received: 2/10/2018
Date Completed: 17/10/2018
Order Number: 1003207
Reference:

Sampling Site: Kyle Park

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.

Heavy Metals in Soil

		Client Sample ID	BH106 2.3 2.3	BH106 7.5 7.5	BH107 0.3 0.3	BH107 4.3 4.3	BH109 5.2 5.2
		Date Sampled	28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018
Analyte	Unit	*Reporting Limit*	18-31313-1	18-31313-2	18-31313-4	18-31313-5	18-31313-8
Arsenic	mg/kg dry wt	*0.125*	10.4	36.0	5.99	4.98	15.1
Cadmium	mg/kg dry wt	*0.005*	0.20	0.32	0.13	0.51	0.50
Chromium	mg/kg dry wt	*0.125*	31.7	24.4	15.1	18.6	30.3
Copper	mg/kg dry wt	*0.075*	61.5	29.4	14.2	13.6	36.4
Lead	mg/kg dry wt	*0.05*	137	65.4	33.5	21.0	111
Mercury	mg/kg dry wt	*0.025*	0.077	0.35	0.064	0.20	0.12
Nickel	mg/kg dry wt	*0.05*	22.4	23.4	12.6	16.6	33.8
Zinc	mg/kg dry wt	*0.05*	109	143	74.1	371	149

Heavy Metals in Soil

		Client Sample ID	BH109 8.5 8.5
		Date Sampled	28/09/2018
Analyte	Unit	*Reporting Limit*	18-31313-9
Arsenic	mg/kg dry wt	*0.125*	4.04
Cadmium	mg/kg dry wt	*0.005*	0.033
Chromium	mg/kg dry wt	*0.125*	11.0
Copper	mg/kg dry wt	*0.075*	6.33
Lead	mg/kg dry wt	*0.05*	15.1
Mercury	mg/kg dry wt	*0.025*	0.052
Nickel	mg/kg dry wt	*0.05*	9.55
Zinc	mg/kg dry wt	*0.05*	45.3

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation, with the exception of tests marked *, which are not accredited.

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH106 2.3 2.3	BH106 7.5 7.5	BH107 0.3 0.3	BH107 4.3 4.3	BH109 5.2 5.2
			Date Sampled	28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018
Analyte	Unit	*Reporting Limit*		18-31313-1	18-31313-2	18-31313-4	18-31313-5	18-31313-8
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.1*		8.5	0.3	0.2	0.2	2.5
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.1*		8.5	<0.1	<0.1	<0.1	2.4
Phenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Chlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Nitrophenol	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	14.3	<0.3
2,4-Dichlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dichlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloro-3-methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4,5-Trichlorophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
2,4,6-Trichlorophenol	mg/kg dry wt	*5*		<5.0	<5.0	<5.0	<5.0	<5.0
2,3,4,6-Tetrachlorophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
4-Methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	10.9	<0.3
4-Nitrophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
Naphthalene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	0.4	0.1
2-Methylnaphthalene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	<0.1
2-Chloronaphthalene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Acenaphthene	mg/kg dry wt	*0.1*		0.4	<0.1	<0.1	<0.1	0.1
Acenaphthylene	mg/kg dry wt	*0.1*		0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg dry wt	*0.1*		0.9	<0.1	<0.1	<0.1	0.2
Phenanthrene	mg/kg dry wt	*0.1*		5.6	0.1	<0.1	<0.1	0.7
Anthracene	mg/kg dry wt	*0.1*		1.4	<0.1	<0.1	<0.1	0.1
Fluoranthene	mg/kg dry wt	*0.1*		11.7	0.4	0.2	0.3	2.5
Benzo[a]anthracene	mg/kg dry wt	*0.1*		4.5	0.2	<0.1	<0.1	1.0
Chrysene	mg/kg dry wt	*0.1*		3.0	<0.1	0.1	0.1	0.5
Benzo[b]fluoranthene	mg/kg dry wt	*0.1*		6.2	0.2	<0.1	<0.1	1.9
Benzo[k]fluoranthene	mg/kg dry wt	*0.1*		1.9	<0.1	<0.1	<0.1	0.4
Benzo[a]pyrene	mg/kg dry wt	*0.1*		6.5	<0.1	<0.1	<0.1	2.0
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	*0.1*		2.1	<0.1	<0.1	<0.1	<0.1
Dibenzo[a,h]anthracene	mg/kg dry wt	*0.1*		0.5	<0.1	<0.1	<0.1	<0.1
Benzo[g,h,i]perylene	mg/kg dry wt	*0.1*		1.6	<0.1	<0.1	<0.1	0.5
Pyrene	mg/kg dry wt	*0.2*		8.5	0.3	<0.2	<0.2	2.1
4,4'-DDD	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	0.9	<0.3
4,4'-DDE	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4,4'-DDT	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
alpha-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
beta-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
gamma-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
delta-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Aldrin	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
cis-Chlordane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
trans-Chlordane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Dieldrin	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan I	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Endosulfan II	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan sulphate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin aldehyde	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH106 2.3 2.3	BH106 7.5 7.5	BH107 0.3 0.3	BH107 4.3 4.3	BH109 5.2 5.2
			Date Sampled	28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018
Endrin ketone	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor epoxide	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Methoxychlor	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-ethylhexyl) phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	1.5	<0.5
Butyl benzyl phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Di-n-butyl phthalate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Di-n-octyl phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Diethyl phthalate	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Dimethyl phthalate	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
N-Nitrosodiphenylamine	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
N-Nitrosodi-n-propylamine	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Azobenzene	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Isophorone	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Nitrobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Bromophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chlorophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloro-1-methylethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethoxy) methane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,2-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,3-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,4-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorobutadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorocylopentadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachloroethane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloroaniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
2-Nitroaniline	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
3-Nitroaniline	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Aniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
3,3'-Dichlorobenzidine	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenzofuran	mg/kg dry wt	*0.3*		0.4	<0.3	<0.3	<0.3	<0.3
Methyl methanesulfonate	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
Ethyl methanesulfonate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Benzyl alcohol	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Phenol-d5 (Surrogate)	%	*1*		109.7	122.7	116.1	108.1	126.6
2-Fluorophenol (Surrogate)	%	*1*		108.8	127.6	124.9	94.4	150.6
2-Fluorobiphenyl (Surrogate)	%	*1*		115.1	138.5	134.6	124.4	106.5
2,4,6-Tribromophenol (Surrogate)	%	*1*		145.2	90.0	92.6	120.4	98.8
p-Terphenyl-d14 (Surrogate)	%	*1*		109.9	136.7	116.1	112.3	104.6
Nitrobenzene-d5 (Surrogate)	%	*1*		108.1	88.2	104.0	82.5	86.9

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH109 8.5 8.5
			Date Sampled	28/09/2018
Analyte		Unit	*Reporting Limit*	18-31313-9
Benzo[a]pyrene TEQ (LOR)		mg/kg dry wt	*0.1*	0.2
Benzo[a]pyrene TEQ (Zero)		mg/kg dry wt	*0.1*	<0.1
Phenol		mg/kg dry wt	*0.3*	<0.3
2-Chlorophenol		mg/kg dry wt	*0.3*	<0.3
2-Methylphenol		mg/kg dry wt	*0.3*	<0.3
2-Nitrophenol		mg/kg dry wt	*1.0*	<1.0
2,4-Dimethylphenol		mg/kg dry wt	*0.3*	<0.3
2,4-Dichlorophenol		mg/kg dry wt	*0.3*	<0.3
2,6-Dichlorophenol		mg/kg dry wt	*0.3*	<0.3
4-Chloro-3-methylphenol		mg/kg dry wt	*0.3*	<0.3
2,4,5-Trichlorophenol		mg/kg dry wt	*5*	<5
2,4,6-Trichlorophenol		mg/kg dry wt	*5*	<5.0
2,3,4,6-Tetrachlorophenol		mg/kg dry wt	*5*	<5
4-Methylphenol		mg/kg dry wt	*0.3*	<0.3
4-Nitrophenol		mg/kg dry wt	*5*	<5
Naphthalene		mg/kg dry wt	*0.1*	<0.1
2-Methylnaphthalene		mg/kg dry wt	*0.1*	<0.1
2-Chloronaphthalene		mg/kg dry wt	*0.3*	<0.3
Acenaphthene		mg/kg dry wt	*0.1*	<0.1
Acenaphthylene		mg/kg dry wt	*0.1*	<0.1
Fluorene		mg/kg dry wt	*0.1*	<0.1
Phenanthrene		mg/kg dry wt	*0.1*	<0.1
Anthracene		mg/kg dry wt	*0.1*	<0.1
Fluoranthene		mg/kg dry wt	*0.1*	0.1
Benzo[a]anthracene		mg/kg dry wt	*0.1*	<0.1
Chrysene		mg/kg dry wt	*0.1*	<0.1
Benzo[b]fluoranthene		mg/kg dry wt	*0.1*	<0.1
Benzo[k]fluoranthene		mg/kg dry wt	*0.1*	<0.1
Benzo[a]pyrene		mg/kg dry wt	*0.1*	<0.1
Indeno(1,2,3-c,d)pyrene		mg/kg dry wt	*0.1*	<0.1
Dibenzo[a,h]anthracene		mg/kg dry wt	*0.1*	<0.1
Benzo[g,h,i]perylene		mg/kg dry wt	*0.1*	<0.1
Pyrene		mg/kg dry wt	*0.2*	<0.2
4,4'-DDD		mg/kg dry wt	*0.3*	<0.3
4,4'-DDE		mg/kg dry wt	*0.3*	<0.3
4,4'-DDT		mg/kg dry wt	*0.5*	<0.5
alpha-BHC		mg/kg dry wt	*0.3*	<0.3
beta-BHC		mg/kg dry wt	*0.3*	<0.3
gamma-BHC		mg/kg dry wt	*0.3*	<0.3
delta-BHC		mg/kg dry wt	*0.3*	<0.3
Aldrin		mg/kg dry wt	*0.3*	<0.3
cis-Chlordane		mg/kg dry wt	*0.3*	<0.3
trans-Chlordane		mg/kg dry wt	*0.3*	<0.3
Dieldrin		mg/kg dry wt	*0.5*	<0.5
Endosulfan I		mg/kg dry wt	*0.3*	<0.3
Endosulfan II		mg/kg dry wt	*0.5*	<0.5
Endosulfan sulphate		mg/kg dry wt	*0.5*	<0.5
Endrin		mg/kg dry wt	*0.5*	<0.5
Endrin aldehyde		mg/kg dry wt	*0.5*	<0.5

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH109 8.5 8.5
			Date Sampled	28/09/2018
Endrin ketone	mg/kg dry wt	*0.5*	<0.5
Hexachlorobenzene	mg/kg dry wt	*0.3*	<0.3
Heptachlor	mg/kg dry wt	*0.3*	<0.3
Heptachlor epoxide	mg/kg dry wt	*0.3*	<0.3
Methoxychlor	mg/kg dry wt	*0.5*	<0.5
Bis(2-ethylhexyl) phthalate	mg/kg dry wt	*0.5*	<0.5
Butyl benzyl phthalate	mg/kg dry wt	*0.5*	<0.5
Di-n-butyl phthalate	mg/kg dry wt	*1*	<1
Di-n-octyl phthalate	mg/kg dry wt	*0.5*	<0.5
Diethyl phthalate	mg/kg dry wt	*0.3*	<0.3
Dimethyl phthalate	mg/kg dry wt	*0.3*	<0.3
N-Nitrosodiphenylamine	mg/kg dry wt	*0.3*	<0.3
N-Nitrosodi-n-propylamine	mg/kg dry wt	*0.3*	<0.3
2,4-Dinitrotoluene	mg/kg dry wt	*0.3*	<0.3
2,6-Dinitrotoluene	mg/kg dry wt	*0.3*	<0.3
Azobenzene	mg/kg dry wt	*0.5*	<0.5
Isophorone	mg/kg dry wt	*0.5*	<0.5
Nitrobenzene	mg/kg dry wt	*0.3*	<0.3
4-Bromophenyl phenyl ether	mg/kg dry wt	*0.3*	<0.3
4-Chlorophenyl phenyl ether	mg/kg dry wt	*0.3*	<0.3
Bis(2-Chloroethyl) ether	mg/kg dry wt	*0.3*	<0.3
Bis(2-Chloro-1-methylethyl) ether	mg/kg dry wt	*0.3*	<0.3
Bis(2-Chloroethoxy) methane	mg/kg dry wt	*0.3*	<0.3
1,2-Dichlorobenzene	mg/kg dry wt	*0.3*	<0.3
1,3-Dichlorobenzene	mg/kg dry wt	*0.3*	<0.3
1,4-Dichlorobenzene	mg/kg dry wt	*0.3*	<0.3
Hexachlorobutadiene	mg/kg dry wt	*0.3*	<0.3
Hexachlorocylopentadiene	mg/kg dry wt	*0.3*	<0.3
Hexachloroethane	mg/kg dry wt	*0.3*	<0.3
4-Chloroaniline	mg/kg dry wt	*1.0*	<1.0
2-Nitroaniline	mg/kg dry wt	*0.3*	<0.3
3-Nitroaniline	mg/kg dry wt	*0.5*	<0.5
Aniline	mg/kg dry wt	*1.0*	<1.0
3,3'-Dichlorobenzidine	mg/kg dry wt	*0.5*	<0.5
Dibenzofuran	mg/kg dry wt	*0.3*	<0.3
Methyl methanesulfonate	mg/kg dry wt	*1.0*	<1.0
Ethyl methanesulfonate	mg/kg dry wt	*1*	<1
Benzyl alcohol	mg/kg dry wt	*1*	<1
Phenol-d5 (Surrogate)	%	*1*	109.2
2-Fluorophenol (Surrogate)	%	*1*	114.7
2-Fluorobiphenyl (Surrogate)	%	*1*	121.6
2,4,6-Tribromophenol (Surrogate)	%	*1*	76.0
p-Terphenyl-d14 (Surrogate)	%	*1*	123.0
Nitrobenzene-d5 (Surrogate)	%	*1*	96.7

Moisture Content

	Client Sample ID		BH106 2.3 2.3	BH106 7.5 7.5	BH107 0.3 0.3	BH107 4.3 4.3	BH109 5.2 5.2
	Date Sampled		28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018
Analyte	Unit	*Reporting Limit*	18-31313-1	18-31313-2	18-31313-4	18-31313-5	18-31313-8
Moisture Content	%	*1*	14	30	18	32	13

Moisture Content

	Client Sample ID		BH109 8.5 8.5
	Date Sampled		28/09/2018
Analyte	Unit	*Reporting Limit*	18-31313-9
Moisture Content	%	*1*	17

Method Summary

Elements in Soil	Acid digestion followed by ICP-MS analysis. (US EPA method 200.8).
SVOC in Soil	Solvent extraction, followed by GC-MS analysis.(In-house based on US EPA 8270).
Moisture	Moisture content is determined gravimetrically by drying at 103 °C.

Sharelle Frank, B.Sc. (Tech)
Technologist

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Technologist

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Certificate of Analysis

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Lab Reference: 18-32437
Submitted by: Katie Stephenson
Date Received: 13/10/2018
Date Completed: 19/10/2018
Order Number: 1003207
Reference: Kyle Park

Sampling Site: Kyle Park

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.

Heavy Metals in Soil

			Client Sample ID	BH108 0.85	BH108 5.6	BH108 7.8	BH110 0.4	BH110 2.5
			Date Sampled	2/10/2018	2/10/2018	2/10/2018	1/10/2018	1/10/2018
Analyte	Unit	*Reporting Limit*		18-32437-1	18-32437-2	18-32437-3	18-32437-5	18-32437-6
Arsenic	mg/kg dry wt	*0.125*		8.58	4.15	3.76	4.86	11.9
Cadmium	mg/kg dry wt	*0.005*		0.82	0.17	0.049	0.10	0.069
Chromium	mg/kg dry wt	*0.125*		17.3	21.2	11.1	16.5	11.7
Copper	mg/kg dry wt	*0.075*		54.9	22.3	9.70	7.96	6.14
Lead	mg/kg dry wt	*0.05*		259	44.7	11.9	18.1	19.9
Mercury	mg/kg dry wt	*0.025*		0.077	0.11	0.75	0.059	<0.025
Nickel	mg/kg dry wt	*0.05*		14.5	31.2	10.7	13.2	7.10
Zinc	mg/kg dry wt	*0.05*		169	76.1	57.5	61.0	30.6

Heavy Metals in Soil

			Client Sample ID	BH111 1.0	BH111 3.5	BH112 1.0	BH112 9.2	BH113 0.2
			Date Sampled	8/10/2018	8/10/2018	5/10/2018	5/10/2018	2/10/2018
Analyte	Unit	*Reporting Limit*		18-32437-11	18-32437-12	18-32437-14	18-32437-15	18-32437-18
Arsenic	mg/kg dry wt	*0.125*		5.12	73.9	6.83	4.73	6.05
Cadmium	mg/kg dry wt	*0.005*		0.13	0.23	0.11	0.046	0.082
Chromium	mg/kg dry wt	*0.125*		4.29	27.9	15.6	15.7	17.5
Copper	mg/kg dry wt	*0.075*		11.3	79.8	13.9	9.18	10.6
Lead	mg/kg dry wt	*0.05*		27.5	71.7	31.8	18.5	28.9
Mercury	mg/kg dry wt	*0.025*		0.041	0.20	0.099	0.092	0.066
Nickel	mg/kg dry wt	*0.05*		4.90	45.4	12.1	13.1	14.4
Zinc	mg/kg dry wt	*0.05*		175	420	76.3	54.7	73.5

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation, with the exception of tests marked *, which are not accredited.

Heavy Metals in Soil

Client Sample ID			BH113 2.5	BH114 0.2	BH114 4.1	BH115 1.6	BH115 6.2
Date Sampled			2/10/2018	3/10/2018	3/10/2018	8/10/2018	8/10/2018
Analyte	Unit	*Reporting Limit*	18-32437-19	18-32437-21	18-32437-22	18-32437-25	18-32437-26
Arsenic	mg/kg dry wt	*0.125*	6.82	5.61	13.7	5.97	2.36
Cadmium	mg/kg dry wt	*0.005*	0.13	0.15	0.29	0.094	0.034
Chromium	mg/kg dry wt	*0.125*	16.5	16.1	28.3	17.9	12.6
Copper	mg/kg dry wt	*0.075*	14.0	24.2	159	9.84	5.72
Lead	mg/kg dry wt	*0.05*	45.6	48.6	56.4	28.8	11.3
Mercury	mg/kg dry wt	*0.025*	0.061	0.065	0.19	0.045	0.055
Nickel	mg/kg dry wt	*0.05*	12.3	14.3	41.9	13.3	9.58
Zinc	mg/kg dry wt	*0.05*	82.2	105	105	71.1	37.4

Heavy Metals in Soil

Client Sample ID			BH116 0.7	BH116 5.6	BH117 0.5	BH117 2.4	BH118 0.75
Date Sampled			8/10/2018	8/10/2018	9/10/2018	9/10/2018	9/10/2018
Analyte	Unit	*Reporting Limit*	18-32437-27	18-32437-28	18-32437-30	18-32437-31	18-32437-34
Arsenic	mg/kg dry wt	*0.125*	5.00	27.8	4.08	25.0	5.06
Cadmium	mg/kg dry wt	*0.005*	0.12	0.26	0.057	375	0.28
Chromium	mg/kg dry wt	*0.125*	14.1	20.5	13.7	40.7	14.2
Copper	mg/kg dry wt	*0.075*	26.1	51.4	7.95	129	15.9
Lead	mg/kg dry wt	*0.05*	48.3	33.6	38.1	3,890	71.3
Mercury	mg/kg dry wt	*0.025*	0.063	0.068	0.046	5.2	0.10
Nickel	mg/kg dry wt	*0.05*	11.4	39.3	11.3	63.1	11.2
Zinc	mg/kg dry wt	*0.05*	78.5	64.2	51.5	229	68.0

Heavy Metals in Soil

Client Sample ID			BH118 6.3	BH119 1.0	BH119 6.3	BH120 0.8	BH120 3.8
Date Sampled			9/10/2018	10/10/2018	10/10/2018	9/10/2018	9/10/2018
Analyte	Unit	*Reporting Limit*	18-32437-35	18-32437-37	18-32437-38	18-32437-39	18-32437-40
Arsenic	mg/kg dry wt	*0.125*	14.9	61.9	39.9	8.45	44.2
Cadmium	mg/kg dry wt	*0.005*	26.6	0.14	0.14	0.20	0.41
Chromium	mg/kg dry wt	*0.125*	117	15.4	16.5	12.5	18.8
Copper	mg/kg dry wt	*0.075*	24.8	15.4	15.3	20.7	16.4
Lead	mg/kg dry wt	*0.05*	160	33.1	151	126	87.8
Mercury	mg/kg dry wt	*0.025*	0.43	0.077	0.13	0.097	0.32
Nickel	mg/kg dry wt	*0.05*	34.3	11.2	11.1	10.2	10.5
Zinc	mg/kg dry wt	*0.05*	315	74.1	163	84.7	117

Heavy Metals in Soil

Client Sample ID			DUP 1	DUP 2	DUP 3	DUP 4
Date Sampled						
Analyte	Unit	*Reporting Limit*	18-32437-42	18-32437-43	18-32437-44	18-32437-45
Arsenic	mg/kg dry wt	*0.125*	6.57	4.62	5.70	31.4
Cadmium	mg/kg dry wt	*0.005*	0.14	0.047	0.072	0.14
Chromium	mg/kg dry wt	*0.125*	14.7	16.9	20.2	16.8
Copper	mg/kg dry wt	*0.075*	13.6	9.64	8.16	20.9
Lead	mg/kg dry wt	*0.05*	42.9	26.1	24.5	191
Mercury	mg/kg dry wt	*0.025*	0.055	0.092	0.045	0.28

Heavy Metals in Soil

Client Sample ID			DUP 1	DUP 2	DUP 3	DUP 4
Date Sampled						
Nickel	mg/kg dry wt	*0.05*	11.9	12.4	13.6	11.5
Zinc	mg/kg dry wt	*0.05*	81.4	55.2	60.3	149

Total Petroleum Hydrocarbons - Soil

Client Sample ID			BH112 9.2	BH114 15.0
Date Sampled			5/10/2018	3/10/2018
Analyte	Unit	*Reporting Limit*	18-32437-15	18-32437-24
C7-C9	mg/kg dry wt	*10*	<10	<10
C10-C14	mg/kg dry wt	*15*	2,052	<15
C15-C36	mg/kg dry wt	*25*	6,350	<25
C7-C36 (Total)	mg/kg dry wt	*50*	8,402	<50

Semivolatile Organic Compounds - Soil

Client Sample ID			BH108 0.85	BH108 5.6	BH108 7.8	BH110 0.4	BH110 2.5
Date Sampled			2/10/2018	2/10/2018	2/10/2018	1/10/2018	1/10/2018
Analyte	Unit	*Reporting Limit*	18-32437-1	18-32437-2	18-32437-3	18-32437-5	18-32437-6
Phenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2-Chlorophenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2-Methylphenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2-Nitrophenol	mg/kg dry wt	*1.0*	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dichlorophenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dichlorophenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloro-3-methylphenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2,4,5-Trichlorophenol	mg/kg dry wt	*5*	<5	<5	<5	<5	<5
2,4,6-Trichlorophenol	mg/kg dry wt	*5*	<5.0	<5.0	<5.0	<5.0	<5.0
2,3,4,6-Tetrachlorophenol	mg/kg dry wt	*5*	<5	<5	<5	<5	<5
4-Methylphenol	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
4-Nitrophenol	mg/kg dry wt	*5*	<5	<5	<5	<5	<5
Naphthalene	mg/kg dry wt	*0.1*	<0.1	0.4	<0.1	<0.1	<0.1
2-Methylnaphthalene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	<0.1	<0.1
2-Chloronaphthalene	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Acenaphthene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg dry wt	*0.1*	0.3	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg dry wt	*0.1*	0.4	0.1	<0.1	<0.1	<0.1
Benzo[a]anthracene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg dry wt	*0.1*	0.3	<0.1	<0.1	<0.1	<0.1
Benzo[b]fluoranthene	mg/kg dry wt	*0.1*	0.5	<0.1	<0.1	<0.1	<0.1
Benzo[k]fluoranthene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo[a]pyrene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo[a,h]anthracene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo[g,h,i]perylene	mg/kg dry wt	*0.1*	0.2	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg dry wt	*0.2*	0.5	<0.2	<0.2	<0.2	<0.2

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH108 0.85	BH108 5.6	BH108 7.8	BH110 0.4	BH110 2.5
			Date Sampled	2/10/2018	2/10/2018	2/10/2018	1/10/2018	1/10/2018
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.1*		0.3	0.2	0.2	0.2	0.2
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.1*		0.1	<0.1	<0.1	<0.1	<0.1
4,4'-DDD	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4,4'-DDE	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4,4'-DDT	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
alpha-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
beta-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
gamma-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
delta-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Aldrin	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
cis-Chlordane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
trans-Chlordane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Dieldrin	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan I	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Endosulfan II	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan sulphate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin aldehyde	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin ketone	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor epoxide	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Methoxychlor	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-ethylhexyl) phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Butyl benzyl phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Di-n-butyl phthalate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Di-n-octyl phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Diethyl phthalate	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Dimethyl phthalate	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
N-Nitrosodiphenylamine	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
N-Nitrosodi-n-propylamine	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Azobenzene	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Isophorone	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Nitrobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Bromophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chlorophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloro-1-methylethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethoxy) methane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,2-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,3-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,4-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorobutadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorocylopentadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachloroethane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloroaniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH108 0.85	BH108 5.6	BH108 7.8	BH110 0.4	BH110 2.5
			Date Sampled	2/10/2018	2/10/2018	2/10/2018	1/10/2018	1/10/2018
2-Nitroaniline	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
3-Nitroaniline	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Aniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
3,3'-Dichlorobenzidine	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenzofuran	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Methyl methanesulfonate	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
Ethyl methanesulfonate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Benzyl alcohol	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Phenol-d5 (Surrogate)	%	*1*		104.0	107.3	91.5	95.6	57.5
2-Fluorophenol (Surrogate)	%	*1*		109.2	110.5	108.0	115.7	67.4
2-Fluorobiphenyl (Surrogate)	%	*1*		135.3	110.1	119.0	128.5	158.7
2,4,6-Tribromophenol (Surrogate)	%	*1*		112.1	154.5	103.8	103.5	107.1
p-Terphenyl-d14 (Surrogate)	%	*1*		141.2	131.2	128.9	91.9	186.2
Nitrobenzene-d5 (Surrogate)	%	*1*		146.4	120.3	136.1	143.9	154.5

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH111 1.0	BH111 3.5	BH112 1.0	BH112 9.2	BH113 0.2
			Date Sampled	8/10/2018	8/10/2018	5/10/2018	5/10/2018	2/10/2018
Analyte	Unit	*Reporting Limit*		18-32437-11	18-32437-12	18-32437-14	18-32437-15	18-32437-18
Phenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Chlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Nitrophenol	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dichlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dichlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloro-3-methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4,5-Trichlorophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
2,4,6-Trichlorophenol	mg/kg dry wt	*5*		<5.0	<5.0	<5.0	<5.0	<5.0
2,3,4,6-Tetrachlorophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
4-Methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Nitrophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
Naphthalene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	17.5	<0.1
2-Chloronaphthalene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Acenaphthene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	1.0	<0.1
Acenaphthylene	mg/kg dry wt	*0.1*		0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg dry wt	*0.1*		2.9	0.3	<0.1	3.3	0.1
Anthracene	mg/kg dry wt	*0.1*		0.6	0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg dry wt	*0.1*		3.6	0.6	<0.1	<0.1	0.3
Benzo[a]anthracene	mg/kg dry wt	*0.1*		2.0	0.6	<0.1	<0.1	0.5
Chrysene	mg/kg dry wt	*0.1*		0.8	0.3	<0.1	<0.1	0.2
Benzo[b]fluoranthene	mg/kg dry wt	*0.1*		1.4	0.6	<0.1	<0.1	0.5
Benzo[k]fluoranthene	mg/kg dry wt	*0.1*		0.4	0.2	<0.1	<0.1	0.2
Benzo[a]pyrene	mg/kg dry wt	*0.1*		1.4	0.8	<0.1	<0.1	0.4

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH111 1.0	BH111 3.5	BH112 1.0	BH112 9.2	BH113 0.2
			Date Sampled	8/10/2018	8/10/2018	5/10/2018	5/10/2018	2/10/2018
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	*0.1*		0.3	0.2	<0.1	<0.1	0.2
Dibenzo[a,h]anthracene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	<0.1
Benzo[g,h,i]perylene	mg/kg dry wt	*0.1*		0.3	0.2	<0.1	<0.1	0.2
Pyrene	mg/kg dry wt	*0.2*		4.1	0.9	<0.2	<0.2	0.5
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.1*		1.9	1.0	0.2	0.2	0.6
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.1*		1.8	0.9	<0.1	<0.1	0.5
4,4'-DDD	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4,4'-DDE	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4,4'-DDT	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
alpha-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
beta-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
gamma-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
delta-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Aldrin	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
cis-Chlordane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
trans-Chlordane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Dieldrin	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan I	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Endosulfan II	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan sulphate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin aldehyde	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin ketone	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor epoxide	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Methoxychlor	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-ethylhexyl) phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Butyl benzyl phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Di-n-butyl phthalate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Di-n-octyl phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Diethyl phthalate	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Dimethyl phthalate	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
N-Nitrosodiphenylamine	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
N-Nitrosodi-n-propylamine	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Azobenzene	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Isophorone	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Nitrobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Bromophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chlorophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloro-1-methylethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethoxy) methane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,2-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,3-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,4-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH111 1.0	BH111 3.5	BH112 1.0	BH112 9.2	BH113 0.2
			Date Sampled	8/10/2018	8/10/2018	5/10/2018	5/10/2018	2/10/2018
Hexachlorobutadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorocylopentadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachloroethane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloroaniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
2-Nitroaniline	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
3-Nitroaniline	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Aniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
3,3'-Dichlorobenzidine	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenzofuran	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Methyl methanesulfonate	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
Ethyl methanesulfonate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Benzyl alcohol	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Phenol-d5 (Surrogate)	%	*1*		104.1	95.4	102.1	91.2	96.5
2-Fluorophenol (Surrogate)	%	*1*		117.5	121.0	128.3	88.4	106.4
2-Fluorobiphenyl (Surrogate)	%	*1*		118.2	124.0	119.7	74.2	127.1
2,4,6-Tribromophenol (Surrogate)	%	*1*		118.2	107.7	98.3	90.5	112.4
p-Terphenyl-d14 (Surrogate)	%	*1*		193.0	186.9	119.6	109.8	178.9
Nitrobenzene-d5 (Surrogate)	%	*1*		138.9	144.4	141.7	97.5	145.6

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH113 2.5	BH114 0.2	BH114 4.1	BH115 1.6	BH115 6.2
			Date Sampled	2/10/2018	3/10/2018	3/10/2018	8/10/2018	8/10/2018
Analyte	Unit	*Reporting Limit*		18-32437-19	18-32437-21	18-32437-22	18-32437-25	18-32437-26
Phenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Chlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Nitrophenol	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dichlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dichlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloro-3-methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4,5-Trichlorophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
2,4,6-Trichlorophenol	mg/kg dry wt	*5*		<5.0	<5.0	<5.0	<5.0	<5.0
2,3,4,6-Tetrachlorophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
4-Methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Nitrophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
Naphthalene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	<0.1
2-Chloronaphthalene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Acenaphthene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg dry wt	*0.1*		0.3	0.1	<0.1	0.3	<0.1
Anthracene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg dry wt	*0.1*		0.4	0.2	<0.1	0.6	<0.1

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH113 2.5	BH114 0.2	BH114 4.1	BH115 1.6	BH115 6.2
			Date Sampled	2/10/2018	3/10/2018	3/10/2018	8/10/2018	8/10/2018
Benzo[a]anthracene	mg/kg dry wt	*0.1*		0.5	0.2	<0.1	0.6	<0.1
Chrysene	mg/kg dry wt	*0.1*		0.2	0.2	<0.1	0.3	<0.1
Benzo[b]fluoranthene	mg/kg dry wt	*0.1*		0.4	0.4	<0.1	0.4	<0.1
Benzo[k]fluoranthene	mg/kg dry wt	*0.1*		0.2	0.1	<0.1	0.2	<0.1
Benzo[a]pyrene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	0.4	<0.1
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo[a,h]anthracene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	<0.1
Benzo[g,h,i]perylene	mg/kg dry wt	*0.1*		0.1	<0.1	<0.1	0.2	<0.1
Pyrene	mg/kg dry wt	*0.2*		0.5	0.3	<0.2	0.9	<0.2
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.1*		0.3	0.3	0.2	0.7	0.2
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.1*		0.1	0.1	<0.1	0.6	<0.1
4,4'-DDD	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4,4'-DDE	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4,4'-DDT	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
alpha-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
beta-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
gamma-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
delta-BHC	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Aldrin	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
cis-Chlordane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
trans-Chlordane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Dieldrin	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan I	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Endosulfan II	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan sulphate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin aldehyde	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin ketone	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor epoxide	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Methoxychlor	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-ethylhexyl) phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Butyl benzyl phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Di-n-butyl phthalate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Di-n-octyl phthalate	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Diethyl phthalate	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Dimethyl phthalate	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
N-Nitrosodiphenylamine	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
N-Nitrosodi-n-propylamine	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Azobenzene	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Isophorone	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Nitrobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Bromophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chlorophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloro-1-methylethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH113 2.5	BH114 0.2	BH114 4.1	BH115 1.6	BH115 6.2
			Date Sampled	2/10/2018	3/10/2018	3/10/2018	8/10/2018	8/10/2018
Bis(2-Chloroethoxy) methane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,2-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,3-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,4-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorobutadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorocylopenta diene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachloroethane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloroaniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
2-Nitroaniline	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
3-Nitroaniline	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Aniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
3,3'-Dichlorobenzidine	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenzofuran	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Methyl methanesulfonate	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
Ethyl methanesulfonate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Benzyl alcohol	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Phenol-d5 (Surrogate)	%	*1*		104.9	89.7	98.0	100.0	101.1
2-Fluorophenol (Surrogate)	%	*1*		120.1	109.3	101.4	108.9	116.4
2-Fluorobiphenyl (Surrogate)	%	*1*		120.1	129.3	99.1	118.4	117.1
2,4,6-Tribromophenol (Surrogate)	%	*1*		104.2	95.9	100.1	101.9	94.2
p-Terphenyl-d14 (Surrogate)	%	*1*		175.0	115.9	138.8	191.1	110.8
Nitrobenzene-d5 (Surrogate)	%	*1*		135.2	149.9	126.0	137.4	139.7

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH116 0.7	BH116 5.6	BH117 0.5	BH117 2.4	BH118 0.75
			Date Sampled	8/10/2018	8/10/2018	9/10/2018	9/10/2018	9/10/2018
Analyte	Unit	*Reporting Limit*		18-32437-27	18-32437-28	18-32437-30	18-32437-31	18-32437-34
Phenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Chlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Nitrophenol	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dichlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dichlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloro-3-methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4,5-Trichlorophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
2,4,6-Trichlorophenol	mg/kg dry wt	*5*		<5.0	<5.0	<5.0	<5.0	<5.0
2,3,4,6-Tetrachlorophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
4-Methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Nitrophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
Naphthalene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	0.1
2-Methylnaphthalene	mg/kg dry wt	*0.1*		<0.1	0.2	<0.1	<0.1	0.1
2-Chloronaphthalene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Acenaphthene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	0.3
Acenaphthylene	mg/kg dry wt	*0.1*		<0.1	<0.1	<0.1	<0.1	<0.1

Semivolatile Organic Compounds - Soil

Client Sample ID			BH116 0.7	BH116 5.6	BH117 0.5	BH117 2.4	BH118 0.75
Date Sampled			8/10/2018	8/10/2018	9/10/2018	9/10/2018	9/10/2018
Fluorene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	0.2	0.3
Phenanthrene	mg/kg dry wt	*0.1*	0.7	0.4	<0.1	0.6	5.3
Anthracene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	<0.1	0.9
Fluoranthene	mg/kg dry wt	*0.1*	1.3	0.9	<0.1	1.7	6.9
Benzo[a]anthracene	mg/kg dry wt	*0.1*	1.1	0.7	<0.1	1.2	3.7
Chrysene	mg/kg dry wt	*0.1*	0.7	0.4	<0.1	0.6	1.2
Benzo[b]fluoranthene	mg/kg dry wt	*0.1*	0.9	0.9	<0.1	1.3	2.3
Benzo[k]fluoranthene	mg/kg dry wt	*0.1*	0.3	0.4	0.1	0.4	0.7
Benzo[a]pyrene	mg/kg dry wt	*0.1*	0.9	0.9	<0.1	1.2	2.4
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	0.3	0.6
Dibenzo[a,h]anthracene	mg/kg dry wt	*0.1*	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo[g,h,i]perylene	mg/kg dry wt	*0.1*	0.2	0.2	<0.1	0.3	0.5
Pyrene	mg/kg dry wt	*0.2*	1.7	1.1	<0.2	1.8	7.6
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.1*	1.3	1.2	0.2	1.7	3.3
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.1*	1.2	1.1	<0.1	1.6	3.2
4,4'-DDD	mg/kg dry wt	*0.3*	<0.3	1.5	<0.3	0.5	<0.3
4,4'-DDE	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
4,4'-DDT	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
alpha-BHC	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
beta-BHC	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
gamma-BHC	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
delta-BHC	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Aldrin	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
cis-Chlordane	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
trans-Chlordane	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Dieldrin	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan I	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Endosulfan II	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan sulphate	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Endrin	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Endrin aldehyde	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Endrin ketone	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobenzene	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor epoxide	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Methoxychlor	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-ethylhexyl) phthalate	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Butyl benzyl phthalate	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Di-n-butyl phthalate	mg/kg dry wt	*1*	<1	<1	<1	<1	<1
Di-n-octyl phthalate	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Diethyl phthalate	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Dimethyl phthalate	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
N-Nitrosodiphenylamine	mg/kg dry wt	*0.3*	<0.3	0.5	<0.3	<0.3	<0.3
N-Nitrosodi-n-propylamine	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dinitrotoluene	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dinitrotoluene	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Azobenzene	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Isophorone	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrobenzene	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
4-Bromophenyl phenyl ether	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH116 0.7	BH116 5.6	BH117 0.5	BH117 2.4	BH118 0.75
			Date Sampled	8/10/2018	8/10/2018	9/10/2018	9/10/2018	9/10/2018
4-Chlorophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloro-1-methylethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethoxy) methane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,2-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,3-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,4-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorobutadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorocylopentadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachloroethane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloroaniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
2-Nitroaniline	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
3-Nitroaniline	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Aniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
3,3'-Dichlorobenzidine	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenzofuran	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Methyl methanesulfonate	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
Ethyl methanesulfonate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Benzyl alcohol	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Phenol-d5 (Surrogate)	%	*1*		97.5	90.2	111.0	87.9	95.2
2-Fluorophenol (Surrogate)	%	*1*		106.1	88.1	154.7	100.4	121.4
2-Fluorobiphenyl (Surrogate)	%	*1*		121.5	89.4	124.5	111.3	106.5
2,4,6-Tribromophenol (Surrogate)	%	*1*		105.0	141.3	104.8	119.9	102.8
p-Terphenyl-d14 (Surrogate)	%	*1*		160.2	134.1	104.4	135.9	212.3
Nitrobenzene-d5 (Surrogate)	%	*1*		148.2	135.7	132.3	108.1	130.1

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH118 6.3	BH119 1.0	BH119 6.3	BH120 0.8	BH120 3.8
			Date Sampled	9/10/2018	10/10/2018	10/10/2018	9/10/2018	9/10/2018
Analyte	Unit	*Reporting Limit*		18-32437-35	18-32437-37	18-32437-38	18-32437-39	18-32437-40
Phenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Chlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2-Nitrophenol	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dichlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dichlorophenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloro-3-methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
2,4,5-Trichlorophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
2,4,6-Trichlorophenol	mg/kg dry wt	*5*		<5.0	<5.0	<5.0	<5.0	<5.0
2,3,4,6-Tetrachlorophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5
4-Methylphenol	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Nitrophenol	mg/kg dry wt	*5*		<5	<5	<5	<5	<5

Semivolatile Organic Compounds - Soil

Client Sample ID			BH118 6.3	BH119 1.0	BH119 6.3	BH120 0.8	BH120 3.8
Date Sampled			9/10/2018	10/10/2018	10/10/2018	9/10/2018	9/10/2018
Naphthalene	mg/kg dry wt	*0.1*	<0.1	<0.1	8.2	3.9	0.3
2-Methylnaphthalene	mg/kg dry wt	*0.1*	0.1	<0.1	7.2	2.6	<0.1
2-Chloronaphthalene	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Acenaphthene	mg/kg dry wt	*0.1*	0.2	<0.1	2.4	1.3	0.1
Acenaphthylene	mg/kg dry wt	*0.1*	<0.1	<0.1	2.1	6.4	<0.1
Fluorene	mg/kg dry wt	*0.1*	0.3	<0.1	15.5	7.9	0.3
Phenanthrene	mg/kg dry wt	*0.1*	0.7	<0.1	101.7	169.1	1.3
Anthracene	mg/kg dry wt	*0.1*	<0.1	<0.1	10.2	111.4	0.4
Fluoranthene	mg/kg dry wt	*0.1*	1.1	0.1	77.2	266.5	2.0
Benzo[a]anthracene	mg/kg dry wt	*0.1*	0.5	0.2	15.3	137.5	1.1
Chrysene	mg/kg dry wt	*0.1*	0.3	<0.1	12.4	86.3	0.5
Benzo[b]fluoranthene	mg/kg dry wt	*0.1*	0.5	<0.1	14.2	93.6	1.0
Benzo[k]fluoranthene	mg/kg dry wt	*0.1*	0.2	<0.1	7.2	41.0	0.4
Benzo[a]pyrene	mg/kg dry wt	*0.1*	0.5	<0.1	14.9	90.3	1.0
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	*0.1*	0.1	<0.1	4.6	12.4	0.2
Dibenzo[a,h]anthracene	mg/kg dry wt	*0.1*	<0.1	<0.1	0.9	4.8	<0.1
Benzo[g,h,i]perylene	mg/kg dry wt	*0.1*	<0.1	<0.1	2.9	8.9	<0.1
Pyrene	mg/kg dry wt	*0.2*	1.2	0.2	83.5	183.4	2.1
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.1*	0.8	0.3	20.9	127.0	1.4
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.1*	0.7	<0.1	20.9	127.0	1.3
4,4'-DDD	mg/kg dry wt	*0.3*	8.3	<0.3	<0.3	<0.3	<0.3
4,4'-DDE	mg/kg dry wt	*0.3*	0.5	<0.3	<0.3	<0.3	<0.3
4,4'-DDT	mg/kg dry wt	*0.5*	0.6	<0.5	<0.5	<0.5	<0.5
alpha-BHC	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
beta-BHC	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
gamma-BHC	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
delta-BHC	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Aldrin	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
cis-Chlordane	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
trans-Chlordane	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Dieldrin	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan I	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Endosulfan II	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan sulphate	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Endrin	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Endrin aldehyde	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Endrin ketone	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobenzene	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Heptachlor epoxide	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Methoxychlor	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-ethylhexyl) phthalate	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Butyl benzyl phthalate	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Di-n-butyl phthalate	mg/kg dry wt	*1*	<1	<1	<1	<1	<1
Di-n-octyl phthalate	mg/kg dry wt	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5
Diethyl phthalate	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
Dimethyl phthalate	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
N-Nitrosodiphenylamine	mg/kg dry wt	*0.3*	0.7	<0.3	<0.3	<0.3	<0.3
N-Nitrosodi-n-propylamine	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dinitrotoluene	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
2,6-Dinitrotoluene	mg/kg dry wt	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3

Semivolatile Organic Compounds - Soil

			Client Sample ID	BH118 6.3	BH119 1.0	BH119 6.3	BH120 0.8	BH120 3.8
			Date Sampled	9/10/2018	10/10/2018	10/10/2018	9/10/2018	9/10/2018
Azobenzene	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Isophorone	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Nitrobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Bromophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chlorophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloro-1-methylethyl) ether	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-Chloroethoxy) methane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,2-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,3-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
1,4-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorobutadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachlorocylopentadiene	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
Hexachloroethane	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
4-Chloroaniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
2-Nitroaniline	mg/kg dry wt	*0.3*		<0.3	<0.3	<0.3	<0.3	<0.3
3-Nitroaniline	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Aniline	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
3,3'-Dichlorobenzidine	mg/kg dry wt	*0.5*		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenzofuran	mg/kg dry wt	*0.3*		<0.3	<0.3	11.2	4.6	<0.3
Methyl methanesulfonate	mg/kg dry wt	*1.0*		<1.0	<1.0	<1.0	<1.0	<1.0
Ethyl methanesulfonate	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Benzyl alcohol	mg/kg dry wt	*1*		<1	<1	<1	<1	<1
Phenol-d5 (Surrogate)	%	*1*		86.4	90.7	82.9	120.0	124.8
2-Fluorophenol (Surrogate)	%	*1*		100.1	99.5	107.5	155.8	142.0
2-Fluorobiphenyl (Surrogate)	%	*1*		123.1	113.4	82.5	72.9	98.8
2,4,6-Tribromophenol (Surrogate)	%	*1*		116.2	99.0	136.2	136.5	117.2
p-Terphenyl-d14 (Surrogate)	%	*1*		173.7	242.4	117.9	122.3	115.9
Nitrobenzene-d5 (Surrogate)	%	*1*		135.4	133.1	112.8	107.5	94.1

Moisture Content

		Client Sample ID	BH108 0.85	BH108 5.6	BH108 7.8	BH110 0.4	BH110 2.5
		Date Sampled	2/10/2018	2/10/2018	2/10/2018	1/10/2018	1/10/2018
Analyte	Unit	*Reporting Limit*	18-32437-1	18-32437-2	18-32437-3	18-32437-5	18-32437-6
Moisture Content	%	*1*	20	13	14	11	68

Moisture Content

	Client Sample ID		BH111 1.0	BH111 3.5	BH112 1.0	BH112 9.2	BH113 0.2
	Date Sampled		8/10/2018	8/10/2018	5/10/2018	5/10/2018	2/10/2018
Analyte	Unit	*Reporting Limit*	18-32437-11	18-32437-12	18-32437-14	18-32437-15	18-32437-18
Moisture Content	%	*1*	13	21	16	9	14

Moisture Content

	Client Sample ID		BH113 2.5	BH114 0.2	BH114 4.1	BH114 15.0	BH115 1.6
	Date Sampled		2/10/2018	3/10/2018	3/10/2018	3/10/2018	8/10/2018
Analyte	Unit	*Reporting Limit*	18-32437-19	18-32437-21	18-32437-22	18-32437-24	18-32437-25
Moisture Content	%	*1*	16	11	10	12	17

Moisture Content

	Client Sample ID		BH115 6.2	BH116 0.7	BH116 5.6	BH117 0.5	BH117 2.4
	Date Sampled		8/10/2018	8/10/2018	8/10/2018	9/10/2018	9/10/2018
Analyte	Unit	*Reporting Limit*	18-32437-26	18-32437-27	18-32437-28	18-32437-30	18-32437-31
Moisture Content	%	*1*	5	5	59	14	23

Moisture Content

	Client Sample ID		BH118 0.75	BH118 6.3	BH119 1.0	BH119 6.3	BH120 0.8
	Date Sampled		9/10/2018	9/10/2018	10/10/2018	10/10/2018	9/10/2018
Analyte	Unit	*Reporting Limit*	18-32437-34	18-32437-35	18-32437-37	18-32437-38	18-32437-39
Moisture Content	%	*1*	13	41	21	17	13

Moisture Content

	Client Sample ID		BH120 3.8
	Date Sampled		9/10/2018
Analyte	Unit	*Reporting Limit*	18-32437-40
Moisture Content	%	*1*	16

Method Summary

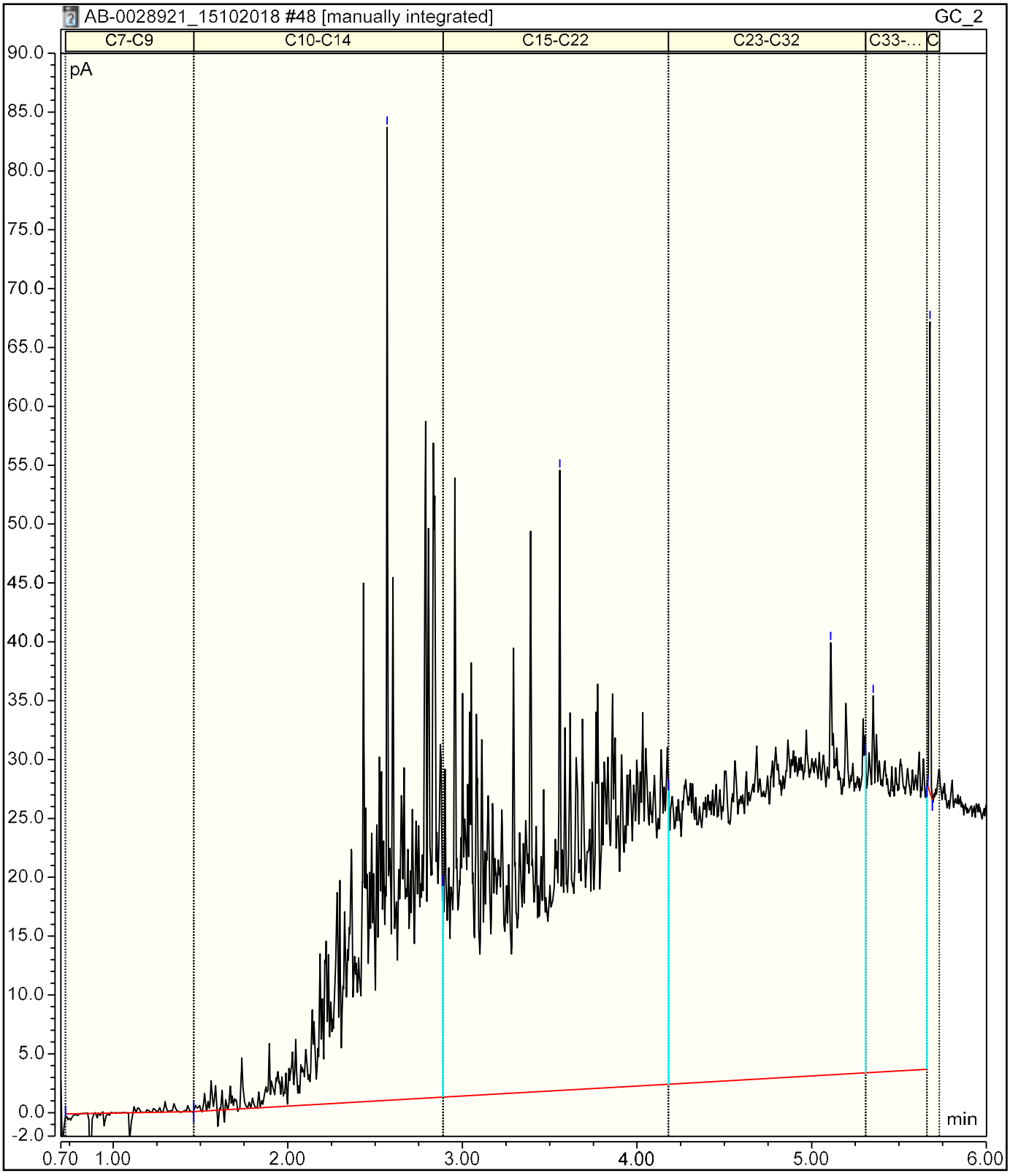
Elements in Soil	Acid digestion followed by ICP-MS analysis. (US EPA method 200.8).
TPH in Soil	Solvent extraction, silica cleanup, followed by GC-FID analysis. (C7-C36)
SVOC in Soil	Solvent extraction, followed by GC-MS analysis.(In-house based on US EPA 8270).
Moisture	Moisture content is determined gravimetrically by drying at 103 °C.

Sharelle Frank, B.Sc. (Tech)
Technologist

Tom Featonby, M.Sc.
Technologist

Chromatogram

18-32437-15



Report Date: 03 Oct 2018

Certificate Number: S1809281149

Analytica Laboratories
Ruakura Research Centre, 10 Bisley Road, Private Bag 3123,

Client Reference: 1003207

Dear Rachael Casey,

Re: Asbestos Soil Identification Analysis – 1003207

10 sample(s) received on 28 Sep 2018 by Victoria Sheppard.

The results of fibre analysis were performed by Nick Wells of Precise Consulting and Laboratory Ltd on 03 Oct 2018.

The sample(s) were stated to be from 1003207.

Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with *AS4964-2004 Method for the qualitative identification of asbestos in soil samples.*

The results of the fibre analysis are presented in the appended table.

Should you require further information please contact Nick Wells.

Yours sincerely

Nick Wells
PRECISE LABORATORY IDENTIFIER

Sample Analysis Results

Certificate Number: S1809281149
Report Date: 03 Oct 2018
Site Location: 1003207

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Note 1: The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques.

Note 2: If mineral fibres of unknown type are detected (UMF), by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised.

Note 3: The samples in this report are "As Received". The laboratory does not take responsibility for the sampling procedure or accuracy of sample location description. This document may not be reproduced except in full.

Identified by:

Approved Identifier: Nick Wells

Reviewed by:

Key Technical Person: Nick Wells

Sample ID	Client Sample ID	Sample Location/Description/Dimensions	Analysis Results
S001	BH101 3.5	BH101 3.5 Non-Homogeneous Soil 720.63g	No Asbestos Detected Organic Fibres Synthetic Mineral Fibres
S002	BH101 7.35	BH101 7.35 Non-Homogeneous Soil 315.43g	Chrysotile (white asbestos) Fibres Organic Fibres Amosite (brown asbestos) Fibres Synthetic Mineral Fibres Crocidolite (blue asbestos) Fibres
S003	BH102 2.0	BH102 2.0 Non-Homogeneous Soil 538.80g	No Asbestos Detected Organic Fibres
S004	BH102 9.8	BH102 9.8 Non-Homogeneous Soil 297.26g	No Asbestos Detected Organic Fibres
S005	BH103 7.15	BH103 7.15 Non-Homogeneous Soil 669.61g	Chrysotile (white asbestos) Fibres Organic Fibres
S006	BH103 10.2	BH103 10.2 Non-Homogeneous Soil 380.24g	Chrysotile (white asbestos) Fibres Organic Fibres Amosite (brown asbestos) Fibres Crocidolite (blue asbestos) Fibres

Precise Consulting & Laboratory Limited
Unit 4, 91 Byron Street, Sydenham, Christchurch 8023

P: 03 943 5394 W: www.preciseconsulting.co.nz

IANZ ACCREDITED LABORATORY
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Sample Analysis Results

Certificate Number: S1809281149
Report Date: 03 Oct 2018
Site Location: 1003207

PRECISE
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Sample ID	Client Sample ID	Sample Location/Description/Dimensions	Analysis Results
S007	BH104 1.1	BH104 1.1 Non-Homogeneous Soil 643.96g	Chrysotile (white asbestos) Fibres Organic Fibres
S008	BH104 5.5	BH104 5.5 Non-Homogeneous Soil 139.90g	No Asbestos Detected Organic Fibres
S009	BH105 2.2	BH105 2.2 Non-Homogeneous Soil 569.05g	No Asbestos Detected Organic Fibres
S010	BH105 5.1	BH105 5.1 Non-Homogeneous Soil 193.36g	Chrysotile (white asbestos) Fibres Organic Fibres

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Appendix 1: Soil Analysis Raw Data

Certificate Number: S1809281149
Report Date: 03 Oct 2018
Site Location: 1003207

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Quantitative Results (non IANZ)																	
Sample ID	Client Sample ID	Total 500mL Sub-Sample (g)	ACM (>10mm)*				AF / FA (2-10mm) (100% ACM)*				AF / FA (<2mm) (100% ACM)*				<2mm Excess (g)	Trace Asbestos Detected **	W/W% Asbestos as ACM	W/W% Asbestos as AF / FA
			>10mm Weight (g)	>10mm ACM (g)	ACM Form	Form %***	2-10mm Weight (g)	2-10mm AF/FA (g)	ACM Form	Form %***	<2mm Weight (g)	<2mm AF/FA (g)	ACM Form	Form %***				
S001	BH101 3.5	720.63	210.65	No Asbestos Detected	N/A	N/A	284.87	No Asbestos Detected	N/A	N/A	100.54	No Asbestos Detected	N/A	N/A	124.57	No	<0.001	<0.001
S002	BH101 7.35	315.43	45.01	No Asbestos Detected	N/A	N/A	167.06	0.018	Insulation Board	70%	102.08	0.001	Free Fibres	100%	1.28	Yes	<0.001	0.0043
S003	BH102 2.0	538.80	174.57	No Asbestos Detected	N/A	N/A	178.04	No Asbestos Detected	N/A	N/A	101.13	No Asbestos Detected	N/A	N/A	85.06	No	<0.001	<0.001
S004	BH102 9.8	297.26	59.10	No Asbestos Detected	N/A	N/A	123.55	No Asbestos Detected	N/A	N/A	100.63	No Asbestos Detected	N/A	N/A	13.98	No	<0.001	<0.001
S005	BH103 7.15	669.61	178.59	No Asbestos Detected	N/A	N/A	206.98	0.020	Free Fibres	100%	100.56	0.003	Free Fibres	100%	183.48	Yes	<0.001	0.0043
S006	BH103 10.2	380.24	125.32	16.128	Cement Sheet	20%	114.11	0.240	Cement Sheet	20%	100.08	0.002	Free Fibres	100%	40.73	Yes	0.848	0.0134
S007	BH104 1.1	643.96	136.85	No Asbestos Detected	N/A	N/A	143.99	No Asbestos Detected	N/A	N/A	100.13	0.001	Free Fibres	100%	262.99	Yes	<0.001	<0.001
S008	BH104 5.5	139.90	108.86	No Asbestos Detected	N/A	N/A	14.87	No Asbestos Detected	N/A	N/A	16.17	No Asbestos Detected	N/A	N/A	No Excess	No	<0.001	<0.001
S009	BH105 2.2	569.05	253.88	No Asbestos Detected	N/A	N/A	190.01	No Asbestos Detected	N/A	N/A	100.23	No Asbestos Detected	N/A	N/A	24.93	No	<0.001	<0.001

Precise Consulting & Laboratory Ltd Limited
Unit 4, 91 Byron Street, Sydenham, Christchurch 8023

P: 03 943 5394 W: www.preciseconsulting.co.nz

Appendix 1: Soil Analysis Raw Data

Certificate Number: S1809281149
Report Date: 03 Oct 2018
Site Location: 1003207

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Quantitative Results (non IANZ)																	
Sample ID	Client Sample ID	Total 500mL Sub-Sample (g)	ACM (>10mm)*				AF / FA (2-10mm) (100% ACM)*				AF / FA (<2mm) (100% ACM)*				<2mm Excess (g)	Trace Asbestos Detected **	W/W% Asbestos as ACM	W/W% Asbestos as AF / FA
			>10mm Weight (g)	>10mm ACM (g)	ACM Form	Form %***	2-10mm Weight (g)	2-10mm AF/FA (g)	ACM Form	Form %***	<2mm Weight (g)	<2mm AF/FA (g)	ACM Form	Form %***				
S010	BH105 5.1	193.36	14.89	No Asbestos Detected	N/A	N/A	82.71	No Asbestos Detected	N/A	N/A	95.76	0.001	Free Fibres	100%	No Excess	Yes	<0.001	<0.001

* These results are raw weighed data presented as per the BRANZ New Zealand Guidelines for Assessing and Managing Asbestos Soil and may be under the reporting limit for guidelines AS4964 of 0.1g/kg
** Trace asbestos detected is indicative that freely liberated respirable fibres are present and dust control measures should be implemented or increased on site. This is not the sole indicator for the friable nature of the asbestos present.
*** Asbestos percentage is determined using EPA-600-R-93-116: Method for the Determination of Asbestos in Bulk Building Materials and are outside of IANZ accreditation #1097 and is therefore not endorsed by IANZ.

Precise Consulting & Laboratory Limited
Unit 4, 91 Byron Street, Sydenham, Christchurch 8023

P: 03 943 5394 W: www.preciseconsulting.co.nz

Report Date: 08 Oct 2018

Certificate Number: S1810011340

Analytica Laboratories
Ruakura Research Centre, 10 Bisley Road, Private Bag 3123,

Client Reference: 1003207

Dear Rachael Casey,

Re: Asbestos Soil Identification Analysis – 1003207

6 sample(s) received on 01 Oct 2018 by Victoria Sheppard.

The results of fibre analysis were performed by Nick Wells of Precise Consulting and Laboratory Ltd on 08 Oct 2018.

The sample(s) were stated to be from 1003207.

Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with *AS4964-2004 Method for the qualitative identification of asbestos in soil samples.*

The results of the fibre analysis are presented in the appended table.

Should you require further information please contact Nick Wells.

Yours sincerely

Nick Wells
PRECISE LABORATORY IDENTIFIER

Sample Analysis Results

Certificate Number: S1810011340
Report Date: 08 Oct 2018
Site Location: 1003207

PRECISE
CONSULTING & LABORATORY

Note 1: The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques.

Note 2: If mineral fibres of unknown type are detected (UMF), by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised.

Note 3: The samples in this report are "As Received". The laboratory does not take responsibility for the sampling procedure or accuracy of sample location description. This document may not be reproduced except in full.

Identified by:

Approved Identifier: Nick Wells

Reviewed by:

Key Technical Person: Nick Wells

Sample ID	Client Sample ID	Sample Location/Description/Dimensions	Analysis Results
S001	BH106 0.5	BH106 0.5 Non-Homogeneous Soil 547.86g	No Asbestos Detected Organic Fibres
S002	BH106 6.3	BH106 6.3 Non-Homogeneous Soil 42.69g	No Asbestos Detected Organic Fibres
S003	BH107 2.3	BH107 2.3 Non-Homogeneous Soil 540.11g	Chrysotile (white asbestos) Fibres Organic Fibres
S004	BH107 4.6	BH107 4.6 Non-Homogeneous Soil 407.95g	Chrysotile (white asbestos) Fibres Organic Fibres Synthetic Mineral Fibres
S005	BH109 1.3	BH109 1.3 Non-Homogeneous Soil 577.96g	No Asbestos Detected Organic Fibres
S006	BH109 5.4	BH109 5.4 Non-Homogeneous Soil 619.75g	No Asbestos Detected Organic Fibres

Precise Consulting & Laboratory Limited
Unit 4, 91 Byron Street, Sydenham, Christchurch 8023

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Appendix 1: Soil Analysis Raw Data

Certificate Number: S1810011340
Report Date: 08 Oct 2018
Site Location: 1003207

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Quantitative Results (non IANZ)																	
Sample ID	Client Sample ID	Total 500mL Sub-Sample (g)	ACM (>10mm)*				AF / FA (2-10mm) (100% ACM)*				AF / FA (<2mm) (100% ACM)*				<2mm Excess (g)	Trace Asbestos Detected **	W/W% Asbestos as ACM	W/W% Asbestos as AF / FA
			>10mm Weight (g)	>10mm ACM (g)	ACM Form	Form %***	2-10mm Weight (g)	2-10mm AF/FA (g)	ACM Form	Form %***	<2mm Weight (g)	<2mm AF/FA (g)	ACM Form	Form %***				
S001	BH106 0.5	547.86	No Material Present	N/A	N/A	N/A	143.07	No Asbestos Detected	N/A	N/A	101.37	No Asbestos Detected	N/A	N/A	303.42	No	<0.001	<0.001
S002	BH106 6.3	42.69	No Material Present	N/A	N/A	N/A	3.28	No Asbestos Detected	N/A	N/A	39.41	No Asbestos Detected	N/A	N/A	No Material Present	No	<0.001	<0.001
S003	BH107 2.3	540.11	210.33	No Asbestos Detected	N/A	N/A	215.42	0.085	Bitumastic Material	40%	100.74	0.002	Free Fibres	100%	13.62	Yes	<0.001	0.0067
S004	BH107 4.6	407.95	No Material Present	N/A	N/A	N/A	144.19	0.429	Cement Sheet	20%	102.81	0.004	Free Fibres	100%	160.95	Yes	<0.001	0.0235
S005	BH109 1.3	577.96	27.81	No Asbestos Detected	N/A	N/A	98.40	No Asbestos Detected	N/A	N/A	100.63	No Asbestos Detected	N/A	N/A	351.12	No	<0.001	<0.001
S006	BH109 5.4	619.75	139.91	No Asbestos Detected	N/A	N/A	231.13	No Asbestos Detected	N/A	N/A	100.95	No Asbestos Detected	N/A	N/A	147.76	No	<0.001	<0.001

* These results are raw weighed data presented as per the BRANZ New Zealand Guidelines for Assessing and Managing Asbestos Soil and may be under the reporting limit for guidelines AS4964 of 0.1g/kg
** Trace asbestos detected is indicative that freely liberated respirable fibres are present and dust control measures should be implemented or increased on site. This is not the sole indicator for the friable nature of the asbestos present.
*** Asbestos percentage is determined using EPA-600-R-93-116: Method for the Determination of Asbestos in Bulk Building Materials and are outside of IANZ accreditation #1097 and is therefore not endorsed by IANZ.

Precise Consulting & Laboratory Ltd Limited
Unit 4, 91 Byron Street, Sydenham, Christchurch 8023

P: 03 943 5394 W: www.preciseconsulting.co.nz

Report Date: 19 Oct 2018

Certificate Number: S1810151050

Analytica Laboratories
Ruakura Research Centre, 10 Bisley Road, Private Bag 3123

Client Reference: Kyle Park / 1003207 / 18-32437

Dear Analytica Laboratories,

Re: Asbestos Soil Identification Analysis – Kyle Park / 1003207

14 sample(s) received on 15 Oct 2018 by Victoria Sheppard.

The results of fibre analysis were performed by Nick Wells of Precise Consulting and Laboratory Ltd on 19 Oct 2018.

The sample(s) were stated to be from Kyle Park / 1003207.

Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with *AS4964-2004 Method for the qualitative identification of asbestos in soil samples.*

The results of the fibre analysis are presented in the appended table.

Should you require further information please contact Nick Wells.

Yours sincerely

Nick Wells
PRECISE LABORATORY IDENTIFIER

Sample Analysis Results

Certificate Number: S1810151050
Report Date: 19 Oct 2018
Site Location: Kyle Park / 1003207

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Note 1: The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques.

Note 2: If mineral fibres of unknown type are detected (UMF), by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised.

Note 3: The samples in this report are "As Received". The laboratory does not take responsibility for the sampling procedure or accuracy of sample location description. This document may not be reproduced except in full.

Identified by:

Approved Identifier: Nick Wells

Reviewed by:

Key Technical Person: Nick Wells

Sample ID	Client Sample ID	Sample Location/Description/Dimensions	Analysis Results
S001	BH108 2.35	BH108 2.35 Non-Homogeneous Soil 735.58g	Chrysotile (white asbestos) Fibres Organic Fibres Amosite (brown asbestos) Fibres Crocidolite (blue asbestos) Fibres
S002	BH117 2.4	BH117 2.4 Non-Homogeneous Soil 529.97g	No Asbestos Detected Organic Fibres
S003	BH110 0.6	BH110 0.6 Non-Homogeneous Soil 767.76g	Chrysotile (white asbestos) Fibres Organic Fibres Amosite (brown asbestos) Fibres Crocidolite (blue asbestos) Fibres
S004	BH111 0.5	BH111 0.5 Non-Homogeneous Soil 847.42g	Chrysotile (white asbestos) Fibres Organic Fibres Amosite (brown asbestos) Fibres Crocidolite (blue asbestos) Fibres
S005	BH111 1.95	BH111 1.95 Non-Homogeneous Soil 802.58g	Chrysotile (white asbestos) Fibres Organic Fibres Amosite (brown asbestos) Fibres Crocidolite (blue asbestos) Fibres
S006	BH112 0.5	BH112 0.5 Non-Homogeneous Soil 1032.32g	No Asbestos Detected Organic Fibres

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Sample Analysis Results

Certificate Number: S1810151050
Report Date: 19 Oct 2018
Site Location: Kyle Park / 1003207

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Sample ID	Client Sample ID	Sample Location/Description/Dimensions	Analysis Results
S007	BH113 2.8	BH113 2.8 Non-Homogeneous Soil 363.91g	Chrysotile (white asbestos) Fibres Organic Fibres Amosite (brown asbestos) Fibres Synthetic Mineral Fibres
S008	BH114 0.1	BH114 0.1 Non-Homogeneous Soil 783.91g	No Asbestos Detected Organic Fibres
S009	BH115 0.1	BH115 0.1 Non-Homogeneous Soil 651.17g	No Asbestos Detected Organic Fibres
S010	BH116 3.2	BH116 3.2 Non-Homogeneous Soil 826.54g	No Asbestos Detected Organic Fibres
S011	BH118 0.3	BH118 0.3 Non-Homogeneous Soil 548.18g	No Asbestos Detected Organic Fibres
S012	BH118 2.6	BH118 2.6 Non-Homogeneous Soil 876.55g	Chrysotile (white asbestos) Fibres Organic Fibres Synthetic Mineral Fibres
S013	BH119 1.1	BH119 1.1 Non-Homogeneous Soil 837.21g	Chrysotile (white asbestos) Fibres Organic Fibres Amosite (brown asbestos) Fibres Crocidolite (blue asbestos) Fibres
S014	BH120 2.0	BH120 2.0 Non-Homogeneous Soil 700.56g	Chrysotile (white asbestos) Fibres Organic Fibres Amosite (brown asbestos) Fibres Crocidolite (blue asbestos) Fibres

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Appendix 1: Soil Analysis Raw Data

Certificate Number: S1810151050
Report Date: 19 Oct 2018
Site Location: Kyle Park / 1003207

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Quantitative Results (non IANZ)																		
Sample ID	Client Sample ID	Total 500mL Sub-Sample (g)	ACM (>10mm)*				AF / FA (2-10mm) (100% ACM)*				AF / FA (<2mm) (100% ACM)*				<2mm Excess (g)	Trace Asbestos Detected **	W/W% Asbestos as ACM	W/W% Asbestos as AF / FA
			>10mm Weight (g)	>10mm ACM (g)	ACM Form	Form %***	2-10mm Weight (g)	2-10mm AF/FA (g)	ACM Form	Form %***	<2mm Weight (g)	<2mm AF/FA (g)	ACM Form	Form %***				
S001	BH108 2.35	735.58	276.35	126.421	Cement Sheet	20%	271.80	245.018	Cement Sheet	20%	102.87	0.305	Free Fibres	100%	84.56	Yes	3.437	6.7374
S002	BH117 2.4	529.97	102.53	No Asbestos Detected	N/A	N/A	166.32	No Asbestos Detected	N/A	N/A	102.49	No Asbestos Detected	N/A	N/A	158.63	No	<0.001	<0.001
S003	BH110 0.6	767.76	56.91	No Asbestos Detected	N/A	N/A	349.92	0.035	Free Fibres	100%	101.35	0.005	Free Fibres	100%	259.58	Yes	<0.001	0.0069
S004	BH111 0.5	847.42	163.01	4.284	Cement Sheet	20%	341.58	2.229	Cement Sheet	20%	102.31	0.045	Free Fibres	100%	240.52	Yes	0.101	0.0704
S005	BH111 1.95	802.58	526.13	120.020	Cement Sheet	20%	203.86	9.091	Cement Sheet	20%	72.59	0.205	Cement Sheet	20%	No Excess Present	Yes	2.991	0.2317
S006	BH112 0.5	1032.32	543.27	No Asbestos Detected	N/A	N/A	239.86	No Asbestos Detected	N/A	N/A	100.63	No Asbestos Detected	N/A	N/A	148.56	No	<0.001	<0.001
S007	BH113 2.8	363.91	22.55	No Asbestos Detected	N/A	N/A	135.44	0.014	Free Fibres	100	101.81	0.003	Free Fibres	100%	104.11	Yes	<0.001	0.0055
S008	BH114 0.1	783.91	157.81	No Asbestos Detected	N/A	N/A	307.99	No Asbestos Detected	N/A	N/A	100.65	No Asbestos Detected	N/A	N/A	217.46	No	<0.001	<0.001
S009	BH115 0.1	651.17	17.14	No Asbestos Detected	N/A	N/A	210.81	No Asbestos Detected	N/A	N/A	100.65	No Asbestos Detected	N/A	N/A	322.57	No	<0.001	<0.001
S010	BH116 3.2	826.54	144.45	No Asbestos Detected	N/A	N/A	358.36	No Asbestos Detected	N/A	N/A	101.90	No Asbestos Detected	N/A	N/A	221.83	No	<0.001	<0.001

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Appendix 1: Soil Analysis Raw Data

Certificate Number: S1810151050
Report Date: 19 Oct 2018
Site Location: Kyle Park / 1003207

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Quantitative Results (non IANZ)																	
Sample ID	Client Sample ID	Total 500mL Sub-Sample (g)	ACM (>10mm)*				AF / FA (2-10mm) (100% ACM)*				AF / FA (<2mm) (100% ACM)*				<2mm Excess (g)	Trace Asbestos Detected **	W/W% Asbestos as ACM	W/W% Asbestos as AF / FA
			>10mm Weight (g)	>10mm ACM (g)	ACM Form	Form %***	2-10mm Weight (g)	2-10mm AF/FA (g)	ACM Form	Form %***	<2mm Weight (g)	<2mm AF/FA (g)	ACM Form	Form %***				
S011	BH118 0.3	548.18	No Material Present	N/A	N/A	N/A	79.09	No Asbestos Detected	N/A	N/A	100.11	No Asbestos Detected	N/A	N/A	368.98	No	<0.001	<0.001
S012	BH118 2.6	876.55	151.07	No Asbestos Detected	N/A	N/A	369.34	0.003	Bitumastic Material	40%	102.77	0.002	Fibrous Material	30%	253.37	Yes	<0.001	<0.001
S013	BH119 1.1	837.21	217.71	No Asbestos Detected	N/A	N/A	360.24	0.006	Fibrous Material	40%	101.87	0.001	Free Fibres	100%	157.39	Yes	<0.001	<0.001
S014	BH120 2.0	700.56	367.75	45.715	Cement Sheet	20%	202.42	13.849	Cement Sheet	20%	101.61	0.150	Cement Sheet	20%	28.78	Yes	1.305	0.4009

* These results are raw weighed data presented as per the BRANZ New Zealand Guidelines for Assessing and Managing Asbestos Soil and may be under the reporting limit for guidelines AS4964 of 0.1g/kg
** Trace asbestos detected is indicative that freely liberated respirable fibres are present and dust control measures should be implemented or increased on site. This is not the sole indicator for the friable nature of the asbestos present.
*** Asbestos percentage is determined using EPA-600-R-93-116: Method for the Determination of Asbestos in Bulk Building Materials and are outside of IANZ accreditation #1097 and is therefore not endorsed by IANZ.

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Appendix E: Laboratory Results Data Assessment

Table E1 - whole site

		Assessment criteria					Analytical data																					
Sample ID		NES Soil SCS(health) [1]					BH101 3.45	BH101 7.2	BH101 7.35	BH102 0.5	BH102 2.0	BH102 9.6	BH102 9.8	BH103 0.3	BH103 7.15	BH103 7.4	BH103 10.2	BH103 10.5	BH104 1.0	BH104 1.1	BH104 5.5	BH104 7.7	BH105 0.9	BH105 2.2	BH105 5.1	BH105 6.0	BH106 0.5	BH106 2.3	BH106 6.3	BH106 7.5
Depth (m bgl)							3.45	7.2	7.35	0.5	2.0	9.6	9.8	0.3	7.15	7.4	10.2	10.5	1.0	1.1	5.5	7.7	0.9	2.2	5.1	6.0	0.5	2.3	6.3	7.5
Sample date							20/09/2018	20/09/2018	20/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018	26/09/2018	26/09/2018	26/09/2018	26/09/2018	26/09/2018	26/09/2018	26/09/2018	26/09/2018	27/09/2018	27/09/2018	27/09/2018	27/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018
Material type (cap/fill)	**Units**	**Recreational**	**Outdoor worker**	**Burwood [2]**	**Background [3]**	**Maximum concentration**	Fill	Fill	Fill	Cap	Fill	Fill	Fill	Cap	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Cap	Fill	Fill	Fill
Metals																														
Arsenic	mg/kg	80	70	80	16.3	36	**17.8**	13.7	-	4.99	-	13.4	-	5.93	-	-	-	9.56	7.16	-	-	**30.2**	**16.5**	-	-	8.28	-	10.4	-	**36**
Cadmium	mg/kg	400	1,300	400	0.2	5.04	**5.04**	**0.69**	-	0.081	-	**0.4**	-	0.097	-	-	-	**3.07**	**0.89**	-	-	**2.52**	**0.29**	-	-	0.085	-	0.2	-	**0.32**
Chromium	mg/kg	2,700	6,300	2,700	20.1	45.7	**45.7**	17.5	-	14.4	-	19	-	15.2	-	-	-	**26.1**	17.3	-	-	**31.6**	17.2	-	-	13.5	-	**31.7**	-	**24.4**
Copper	mg/kg	>10,000	>10,000	>10,000	19.5	270	**270**	**76.9**	-	9	-	**24.3**	-	14.8	-	-	-	**27.5**	**54.5**	-	-	**108**	**62.5**	-	-	9.53	-	**61.5**	-	**29.4**
Lead	mg/kg	880	3,300	880	128.8	406	**406**	**166**	-	28.8	-	**183**	-	20.8	-	-	-	77.2	90.2	-	-	**281**	105	-	-	32.7	-	**137**	-	65.4
Mercury	mg/kg	1,800	4,200	1,800	0.1	0.45	**0.45**	**0.42**	-	0.06	-	**0.29**	-	0.044	-	-	-	**0.44**	0.087	-	-	**0.14**	**0.2**	-	-	0.086	-	0.077	-	**0.35**
Nickel	mg/kg	1,200 [4]	6,000 [4]	600	18	112	**112**	**31.5**	-	11.3	-	16.9	-	11.3	-	-	-	**31.5**	14.3	-	-	**40.2**	17.2	-	-	11.4	-	**22.4**	-	**23.4**
Zinc	mg/kg	30,000 [4]	400,000 [4]	14,000	166.8	1300	**417**	**257**	-	67.7	-	**200**	-	64.5	-	-	-	**197**	**1300**	-	-	**285**	126	-	-	113	-	109	-	143
Cyanide	mg/kg	240 [4]	1,500 [4]	NGV	NGV	2.58	-	2.58	-	-	-	-	-	-	-	<0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																														
Benzo[a]pyrene TEQ (LOR)	mg/kg	40	35	40	0.922 [5]	100.2	**3.3**	0.3	-	**16.2**	-	0.6	-	0.2	-	-	-	0.2	0.2	-	-	0.7	**20.7**	-	-	100.2	-	**8.5**	-	0.3
Total Phenols	mg/kg	40,000 [4]	240,000 [4]	40,000	NGV	0	<12	<12	-	<12	-	<12	-	<12	-	-	-	<12	<12	-	-	<12	<12	-	-	<12	-	<12	-	<12
Σ DDT	mg/kg	400	1,000	400	0.431 [9]	7	<0.6	<0.6	-	**7**	-	<0.6	-	<0.6	-	-	-	<0.6	<0.6	-	-	<0.6	<0.6	-	-	<0.6	-	<0.6	-	<0.6
Deildrin	mg/kg	70	160	70	NGV	0.7	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	-	-	<0.5	<0.5	-	-	<0.5	0.7	-	-	<0.5	-	<0.5	-	<0.5
Asbestos																														
Asbestos presence/absence		N/A	N/A	Not present	Not present	0	NAD	-	**Chrysotile, Amosite, Crocidolite**	-	NAD	-	NAD	-	**Chrysotile**	-	**Chrysotile, Amosite, Crocidolite**	-	-	**Chrysotile**	NAD	-	-	NAD	**Chrysotile**	-	NAD	-	NAD	-
Asbestos form		N/A	N/A			0	-	-	**Insulation board, free fibres**	-	-	-	-	-	**Free fibres**	-	**Cement sheet, free fibres**	-	-	**Free fibres**	-	-	-	-	**Free fibres**	-	-	-	-	-
Weight of asebtos in ACM (non-friable) [6]	%w/w	0.02	0.05			0.848	NAD	-	0	-	NAD	-	NAD	-	0	-	0.848	-	-	0	NAD	-	-	NAD	0	-	NAD	-	NAD	-
Combined FA + AF [8]	%w/w	0.001	0.001			0.0134	NAD	-	0.0043	-	NAD	-	NAD	-	0.0043	-	0.0134	-	-	**<0.001**	NAD	-	-	NAD	**<0.001**	-	NAD	-	NAD	-

		Assessment criteria					Analytical data																					
Sample ID		NES Soil SCS(health) [1]					BH107 0.3	BH107 2.3	BH107 4.3	BH107 4.6	BH109 1.3	BH109 5.2	BH109 5.4	BH109 8.5	BH108 0.85	BH108 2.35	BH108 5.6	BH108 7.8	BH110 0.4	BH110 0.6	BH110 2.5	BH111 0.5	BH111 1.0	BH111 1.95	BH111 3.5	BH112 0.5	BH112 1.0	BH112 9.2	BH113 0.2
Depth (m bgl)							0.3	2.3	4.3	4.6	1.3	5.2	5.4	8.5	0.85	2.35	5.6	7.8	0.4	0.6	2.5	0.5	1	1.95	3.5	0.5	1	9.2	0.2
Sample date							28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018	2/10/2018	2/10/2018	2/10/2018	2/10/2018	1/10/2018	1/10/2018	1/10/2018	8/10/2018	8/10/2018	8/10/2018	8/10/2018	5/10/2018	5/10/2018	5/10/2018	2/10/2018
Material type (cap/fill)	**Units**	**Recreational**	**Outdoor worker**	**Burwood [2]**	**Background [3]**	**Maximum concentration**	Cap	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Cap	Cap	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Natural	Cap
Metals																													
Arsenic	mg/kg	80	70	80	16.3	73.9	5.99	-	4.98	-	-	15.1	-	4.04	8.58	-	4.15	3.76	4.86	-	11.9	-	5.12	-	73.9	-	6.83	4.73	6.05
Cadmium	mg/kg	400	1,300	400	0.2	0.82	0.13	-	**0.51**	-	-	**0.5**	-	0.033	**0.82**	-	0.17	0.049	0.1	-	0.069	-	0.13	-	**0.23**	-	0.11	0.046	0.082
Chromium	mg/kg	2,700	6,300	2,700	20.1	30.3	15.1	-	18.6	-	-	**30.3**	-	11	17.3	-	**21.2**	11.1	16.5	-	11.7	-	4.29	-	**27.9**	-	15.6	15.7	17.5
Copper	mg/kg	>10,000	>10,000	>10,000	19.5	79.8	14.2	-	13.6	-	-	**36.4**	-	6.33	**54.9**	-	**22.3**	9.7	7.96	-	6.14	-	11.3	-	**79.8**	-	13.9	9.18	10.6
Lead	mg/kg	880	3,300	880	128.8	259	33.5	-	21	-	-	111	-	15.1	**259**	-	44.7	11.9	18.1	-	19.9	-	27.5	-	71.7	-	31.8	18.5	28.9
Mercury	mg/kg	1,800	4,200	1,800	0.1	0.75	0.064	-	**0.2**	-	-	**0.12**	-	0.052	0.077	-	**0.11**	**0.75**	0.059	-	<0.025	-	0.041	-	**0.2**	-	0.099	0.092	0.066
Nickel	mg/kg	1,200 [4]	6,000 [4]	600	18	45.4	12.6	-	16.6	-	-	**33.8**	-	9.55	14.5	-	**31.2**	10.7	13.2	-	7.1	-	4.9	-	**45.4**	-	12.1	13.1	14.4
Zinc	mg/kg	30,000 [4]	400,000 [4]	14,000	166.8	420	74.1	-	**371**	-	-	149	-	45.3	**169**	-	76.1	57.5	61	-	30.6	-	175	-	**420**	-	76.3	54.7	73.5
Semi-Volatile Organic Compounds																													
Benzo[a]pyrene TEQ (LOR)	mg/kg	40	35	40	0.922 [5]	2.5	0.2	-	0.2	-	-	**2.5**	-	0.2	0.3	-	0.2	0.2	0.2	-	0.2	-	**1.9**	-	**1**	-	0.2	0.2	0.6
Total Phenols	mg/kg	40,000 [4]	240,000 [4]	40,000	NGV	25.2	<12	-	25.2	-	-	<12	-	<12	<12	-	<12	<12	<12	-	<12	-	<12	-	<12	-	<12	<12	<12
Σ DDT	mg/kg	400	1,000	400	0.431 [9]	0.9	<0.6	-	**0.9**	-	-	<0.6	-	<0.6	<0.6	-	<0.6	<0.6	<0.6	-	<0.6	-	<0.6	-	<0.6	-	<0.6	<0.6	<0.6
Deildrin	mg/kg	70	160	70	NGV	0	<0.5	-	<0.5	-	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	<0.5
Total Petroleum Hydrocarbons																													
C7- C9	mg/kg	500 [7]	500 [8]	500	NGV		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10		
C10- C14	mg/kg	510 [7]	510 [8]	510	NGV		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,052		
C7- C36	mg/kg	NL [7]	NL [8]	NL	NGV		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,350		
C7- C36 (total)	mg/kg	-	-	-	NGV																						8,402		
Asbestos																													
Asbestos presence/absence		N/A	N/A	Not present	Not present	N/A	-	**Chrysotile**	-	**Chrysotile**	NAD	-	NAD	-	-	**Chrysotile, Amosite, Crocidolite**	-	-	-	**Chrysotile, Amosite, Crocidolite**	-	**Chrysotile, Amosite, Crocidolite**	-	**Chrysotile, Amosite, Crocidolite**	-	NAD	-	-	-
Asbestos form		N/A	N/A			N/A	-	**Bitumastic material, free fibres**	-	**Cement sheet, free fibres**	-	-	-	-	-	**Cement sheet, free fibres**	-	-	-	**Free fibres**	-	**Cement sheet, free fibres**	-	**Cement sheet**	-	-	-	-	-
Weight of asebtos in ACM (non-friable) [6]	%w/w	0.02	0.05			3.437	-	0	-	0	NAD	-	NAD	-	-	**3.437**	-	-	-	0	-	**0.101**	-	**2.991**	-	NAD	-	-	-
Combined FA + AF [8]	%w/w	0.001	0.001			6.7374	-	0.0067	-	0.0235	NAD	-	NAD	-	-	6.7374	-	-	-	0.0069	-	0.0704	-	0.2317	-	NAD	-	-	-

		Assessment criteria					Analytical data																					
Sample ID		NES Soil SCS(health) [1]					BH113 2.5	BH113 2.8	BH114 0.1	BH114 0.2	BH114 4.1	BH115 0.1	BH115 1.6	BH115 6.2	BH116 0.7	BH116 3.2	BH116 5.6	BH117 0.5	BH117 2.4	BH118 0.3	BH118 0.75	BH118 2.6	BH118 6.3	BH119 1.0	BH119 1.1	BH119 6.3	BH120 0.8	BH120 2.0	BH120 3.8
Depth (m bgl)							2.5	2.8	0.1	0.2	4.1	0.1	1.6	6.2	0.7	3.2	5.6	0.5	2.4	0.3	0.75	2.6	6.30	1.0	1.1	6.3	0.8	2.0	3.8
Sample date							2/10/2018	2/10/2018	3/10/2018	3/10/2018	3/10/2018	8/10/2018	8/10/2018	8/10/2018	8/10/2018	8/10/2018	8/10/2018	9/10/2018	9/10/2018	9/10/2018	9/10/2018	9/10/2018	9/10/2018	10/10/2018	10/10/2018	10/10/2018	9/10/2018	9/10/2018	9/10/2018
Material type (cap/fill)	**Units**	**Recreational**	**Outdoor worker**	**Burwood [2]**	**Background [3]**	**Maximum concentration**	Fill	Fill	Cap	Cap	Fill	Cap	Fill	Natural	Cap	Fill	Fill	Cap	Fill	Cap	Cap	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill
Metals																													
Arsenic	mg/kg	80	70	80	16.3	61.9	6.82	-	-	5.61	13.7	-	5.97	2.36	5	-	**27.8**	4.08	25	-	5.06	-	14.9	**61.9**	-	**39.9**	8.45	-	**44.2**
Cadmium	mg/kg	400	1,300	400	0.2	375	0.13	-	-	0.15	0.29	-	0.094	0.034	0.12	-	**0.26**	0.057	**375**	-	**0.28**	-	**26.6**	0.14	-	0.14	0.2	-	0.41
Chromium	mg/kg	2,700	6,300	2,700	20.1	117	16.5	-	-	16.1	**28.3**	-	17.9	12.6	14.1	-	**20.5**	13.7	**40.7**	-	14.2	-	**117**	15.4	-	16.5	12.5	-	18.8
Copper	mg/kg	>10,000	>10,000	>10,000	19.5	159	14	-	-	24.2	**159**	-	9.84	5.72	**26.1**	-	**51.4**	7.95	**129**	-	15.9	-	**24.8**	15.4	-	15.3	**20.7**	-	16.4
Lead	mg/kg	880	3,300	880	128.8	3890	45.6	-	-	48.6	56.4	-	28.8	11.3	48.3	-	33.6	38.1	3890	-	71.3	-	**160**	33.1	-	**151**	**126**	-	87.8
Mercury	mg/kg	1,800	4,200	1,800	0.1	5.2	0.061	-	-	0.065	**0.19**	-	0.045	0.055	0.063	-	0.068	0.046	**5.2**	-	0.1	-	**0.43**	0.077	-	**0.13**	0.097	-	**0.32**
Nickel	mg/kg	1,200 [4]	6,000 [4]	600	18	63.1	12.3	-	-	14.3	**41.9**	-	13.3	9.58	11.4	-	**39.3**	11.3	**63.1**	-	11.2	-	**34.3**	11.2	-	11.1	10.2	-	10.5
Zinc	mg/kg	30,000 [4]	400,000 [4]	14,000	166.8	315	82.2	-	-	105	105	-	71.1	37.4	78.5	-	64.2	51.5	**229**	-	68	-	**315**	74.1	-	163	84.7	-	117
Semi-Volatile Organic Compounds																													
Benzo[a]pyrene TEQ (LOR)	mg/kg	40	35	40	0.922 [5]	127	0.3	-	-	0.3	0.2	-	0.9	0.2	**1.3**	-	**1.2**	0.2	**1.7**	-	**3.3**	-	0.8	0.3	-	**20.9**	127	-	**1.4**
Total Phenols	mg/kg	40,000 [4]	240,000 [4]	40,000	NGV	0	<12	-	-	<12	<12	-	<12	<12	<12	-	<12	<12	<12	-	<12	-	<12	<12	-	<12	<12	-	<12
Σ DDT	mg/kg	400	1,000	400	0.431 [9]	9.4		-	-	<0.6	<0.6	-	<0.6	<0.6	<0.6	-	**1.5**	<0.6	0.5	-	<0.6	-	**9.4**	<0.6	-	<0.6	<0.6	-	<0.6
Deildrin	mg/kg	70	160	70	NGV	0	<0.5	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5
Asbestos																													
Asbestos presence/absence		N/A	N/A	Not present	Not present	N/A	-	**Chrysotile, Amosite**	NAD	-	-	NAD	-	-	-	NAD	-	-	NAD	NAD	-	**Chrysotile**	-	-	**Chrysotile, Amosite, Crocidolite**	-	-	**Chrysotile, Amosite, Crocidolite**	-
Asbestos form		N/A	N/A			N/A	-	**Free fibres**	-	-	-	-	-	-	-	-	-	-	-	-	-	**Bitumastic material, fibrous material**	-	-	**Fibrous material, free fibres**	-	-	**Cement sheet**	-
Weight of asebtos in ACM (non-friable) [6]	%w/w	0.02	0.05			1.305	-	0	NAD	-	-	NAD	-	-	-	NAD	-	-	NAD	NAD	-	0	-	-	0	-	-	**1.305**	-
Combined FA + AF [8]	%w/w	0.001	0.001			0.4009	-	0.0055	NAD	-	-	NAD	-	-	-	NAD	-	-	NAD	NAD	-	**<0.001**	-	-	**<0.001**	-	-	0.4009	-

Notes:
Bold indicates that published background concentrations are exceeded.
Red indicates that outdoor worker health criteria are exceeded.
Underlined indicates that recreational land use criteria are exceeded.
Highlighted indicates that Burwood acceptance criteria are exceeded.
- indicates sample has not been analysed.
NAD indicates No Asbestos Detected.
NGV indicates No Guideline Value.
N/A indicates Not Applicable.

1- MfE, 2012 - National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (unless otherwise stated).
2- Burwood Resource Recovery Park acceptance criteria, pers. comms. M Morely (CCC), 16.03.2011 and updated with the NES recreational criteria as he instructed in January 2012.
3- ECan GIS, Trace elements Level 2 from "Background concentrations of selected trace elements in Canterbury soils" prepared for Environment Canterbury by Tonkin and Taylor Ltd, July 2006.
4- ASC NEPM Toolbox - Update Febrary 2014 - www.nepc.gov.au/nepms/assessment-site-contamination/toolbox.
5- ECan 2007, Background concentrations of polycyclic aromatic hydrocarbons in Christchurch urban soils.
6- BRANZ 2017, New Zealand Guidelines for Assessing and Managing Asbestos in Soil; ACM- asbetsos containing material, AF- asbestos fines, FA- fibrous asbestos.
7- MfE, June 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Tier 1 Soil ac ceptance criteria: Commercial/ industrial use, sandy silt, <1 m.Residential is used on a conservative basis
8- MfE, June 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Tier 1 Soil a cceptance criteria: residential use, sandy silt, <1 m.

Table E1 - whole site

		Assessment criteria					Analytical data																					
Sample ID		NES Soil SCS(health) [1]					BH101 3.45	BH101 7.2	BH101 7.35	BH102 0.5	BH102 2.0	BH102 9.6	BH102 9.8	BH103 0.3	BH103 7.15	BH103 7.4	BH103 10.2	BH103 10.5	BH104 1.0	BH104 1.1	BH104 5.5	BH104 7.7	BH105 0.9	BH105 2.2	BH105 5.1	BH105 6.0	BH106 0.5	BH106 2.3	BH106 6.3	BH106 7.5
Depth (m bgl)							3.45	7.2	7.35	0.5	2.0	9.6	9.8	0.3	7.15	7.4	10.2	10.5	1.0	1.1	5.5	7.7	0.9	2.2	5.1	6.0	0.5	2.3	6.3	7.5
Sample date							20/09/2018	20/09/2018	20/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018	26/09/2018	26/09/2018	26/09/2018	26/09/2018	26/09/2018	26/09/2018	26/09/2018	26/09/2018	27/09/2018	27/09/2018	27/09/2018	27/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018
Material type (cap/fill)	**Units**	**Recreational**	**Outdoor worker**	**Burwood [2]**	**Background [3]**	**Maximum concentration**	Fill	Fill	Fill	Cap	Fill	Fill	Fill	Cap	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Cap	Fill	Fill	Fill
Metals																														
Arsenic	mg/kg	80	70	80	16.3	36	**17.8**	13.7	-	4.99	-	13.4	-	5.93	-	-	-	9.56	7.16	-	-	**30.2**	**16.5**	-	-	8.28	-	10.4	-	**36**
Cadmium	mg/kg	400	1,300	400	0.2	5.04	**5.04**	**0.69**	-	0.081	-	**0.4**	-	0.097	-	-	-	**3.07**	**0.89**	-	-	**2.52**	**0.29**	-	-	0.085	-	0.2	-	**0.32**
Chromium	mg/kg	2,700	6,300	2,700	20.1	45.7	**45.7**	17.5	-	14.4	-	19	-	15.2	-	-	-	**26.1**	17.3	-	-	**31.6**	17.2	-	-	13.5	-	**31.7**	-	**24.4**
Copper	mg/kg	>10,000	>10,000	>10,000	19.5	270	**270**	**76.9**	-	9	-	**24.3**	-	14.8	-	-	-	**27.5**	**54.5**	-	-	**108**	**62.5**	-	-	9.53	-	**61.5**	-	**29.4**
Lead	mg/kg	880	3,300	880	128.8	406	**406**	**166**	-	28.8	-	**183**	-	20.8	-	-	-	77.2	90.2	-	-	**281**	105	-	-	32.7	-	**137**	-	65.4
Mercury	mg/kg	1,800	4,200	1,800	0.1	0.45	**0.45**	**0.42**	-	0.06	-	**0.29**	-	0.044	-	-	-	**0.44**	0.087	-	-	**0.14**	**0.2**	-	-	0.086	-	0.077	-	**0.35**
Nickel	mg/kg	1,200 [4]	6,000 [4]	600	18	112	**112**	**31.5**	-	11.3	-	16.9	-	11.3	-	-	-	**31.5**	14.3	-	-	**40.2**	17.2	-	-	11.4	-	**22.4**	-	**23.4**
Zinc	mg/kg	30,000 [4]	400,000 [4]	14,000	166.8	1300	**417**	**257**	-	67.7	-	**200**	-	64.5	-	-	-	**197**	**1300**	-	-	**285**	126	-	-	113	-	109	-	143
Cyanide	mg/kg	240 [4]	1,500 [4]	NGV	NGV	2.58	-	2.58	-	-	-	-	-	-	-	<0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																														
Benzo[a]pyrene TEQ (LOR)	mg/kg	40	35	40	0.922 [5]	100.2	**3.3**	0.3	-	**16.2**	-	0.6	-	0.2	-	-	-	0.2	0.2	-	-	0.7	**20.7**	-	-	100.2	-	**8.5**	-	0.3
Total Phenols	mg/kg	40,000 [4]	240,000 [4]	40,000	NGV	0	<12	<12	-	<12	-	<12	-	<12	-	-	-	<12	<12	-	-	<12	<12	-	-	<12	-	<12	-	<12
Σ DDT	mg/kg	400	1,000	400	0.431 [9]	7	<0.6	<0.6	-	**7**	-	<0.6	-	<0.6	-	-	-	<0.6	<0.6	-	-	<0.6	<0.6	-	-	<0.6	-	<0.6	-	<0.6
Deildrin	mg/kg	70	160	70	NGV	0.7	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	-	-	<0.5	<0.5	-	-	<0.5	0.7	-	-	<0.5	-	<0.5	-	<0.5
Asbestos																														
Asbestos presence/absence		N/A	N/A	Not present	Not present	0	NAD	-	**Chrysotile, Amosite, Crocidolite**	-	NAD	-	NAD	-	**Chrysotile**	-	**Chrysotile, Amosite, Crocidolite**	-	-	**Chrysotile**	NAD	-	-	NAD	**Chrysotile**	-	NAD	-	NAD	-
Asbestos form		N/A	N/A			0	-	-	**Insulation board, free fibres**	-	-	-	-	-	**Free fibres**	-	**Cement sheet, free fibres**	-	-	**Free fibres**	-	-	-	-	**Free fibres**	-	-	-	-	-
Weight of asebtos in ACM (non-friable) [6]	%w/w	0.02	0.05			0.848	NAD	-	0	-	NAD	-	NAD	-	0	-	0.848	-	-	0	NAD	-	-	NAD	0	-	NAD	-	NAD	-
Combined FA + AF [8]	%w/w	0.001	0.001			0.0134	NAD	-	0.0043	-	NAD	-	NAD	-	0.0043	-	0.0134	-	-	**<0.001**	NAD	-	-	NAD	**<0.001**	-	NAD	-	NAD	-

		Assessment criteria					Analytical data																					
Sample ID		NES Soil SCS(health) [1]					BH107 0.3	BH107 2.3	BH107 4.3	BH107 4.6	BH109 1.3	BH109 5.2	BH109 5.4	BH109 8.5	BH108 0.85	BH108 2.35	BH108 5.6	BH108 7.8	BH110 0.4	BH110 0.6	BH110 2.5	BH111 0.5	BH111 1.0	BH111 1.95	BH111 3.5	BH112 0.5	BH112 1.0	BH112 9.2	BH113 0.2
Depth (m bgl)							0.3	2.3	4.3	4.6	1.3	5.2	5.4	8.5	0.85	2.35	5.6	7.8	0.4	0.6	2.5	0.5	1	1.95	3.5	0.5	1	9.2	0.2
Sample date							28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018	28/09/2018	2/10/2018	2/10/2018	2/10/2018	2/10/2018	1/10/2018	1/10/2018	1/10/2018	8/10/2018	8/10/2018	8/10/2018	8/10/2018	5/10/2018	5/10/2018	5/10/2018	2/10/2018
Material type (cap/fill)	**Units**	**Recreational**	**Outdoor worker**	**Burwood [2]**	**Background [3]**	**Maximum concentration**	Cap	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Cap	Cap	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Natural	Cap
Metals																													
Arsenic	mg/kg	80	70	80	16.3	73.9	5.99	-	4.98	-	-	15.1	-	4.04	8.58	-	4.15	3.76	4.86	-	11.9	-	5.12	-	73.9	-	6.83	4.73	6.05
Cadmium	mg/kg	400	1,300	400	0.2	0.82	0.13	-	**0.51**	-	-	**0.5**	-	0.033	**0.82**	-	0.17	0.049	0.1	-	0.069	-	0.13	-	**0.23**	-	0.11	0.046	0.082
Chromium	mg/kg	2,700	6,300	2,700	20.1	30.3	15.1	-	18.6	-	-	**30.3**	-	11	17.3	-	**21.2**	11.1	16.5	-	11.7	-	4.29	-	**27.9**	-	15.6	15.7	17.5
Copper	mg/kg	>10,000	>10,000	>10,000	19.5	79.8	14.2	-	13.6	-	-	**36.4**	-	6.33	**54.9**	-	**22.3**	9.7	7.96	-	6.14	-	11.3	-	**79.8**	-	13.9	9.18	10.6
Lead	mg/kg	880	3,300	880	128.8	259	33.5	-	21	-	-	111	-	15.1	**259**	-	44.7	11.9	18.1	-	19.9	-	27.5	-	71.7	-	31.8	18.5	28.9
Mercury	mg/kg	1,800	4,200	1,800	0.1	0.75	0.064	-	**0.2**	-	-	**0.12**	-	0.052	0.077	-	**0.11**	**0.75**	0.059	-	<0.025	-	0.041	-	**0.2**	-	0.099	0.092	0.066
Nickel	mg/kg	1,200 [4]	6,000 [4]	600	18	45.4	12.6	-	16.6	-	-	**33.8**	-	9.55	14.5	-	**31.2**	10.7	13.2	-	7.1	-	4.9	-	**45.4**	-	12.1	13.1	14.4
Zinc	mg/kg	30,000 [4]	400,000 [4]	14,000	166.8	420	74.1	-	**371**	-	-	149	-	45.3	**169**	-	76.1	57.5	61	-	30.6	-	175	-	**420**	-	76.3	54.7	73.5
Semi-Volatile Organic Compounds																													
Benzo[a]pyrene TEQ (LOR)	mg/kg	40	35	40	0.922 [5]	2.5	0.2	-	0.2	-	-	**2.5**	-	0.2	0.3	-	0.2	0.2	0.2	-	0.2	-	**1.9**	-	**1**	-	0.2	0.2	0.6
Total Phenols	mg/kg	40,000 [4]	240,000 [4]	40,000	NGV	25.2	<12	-	25.2	-	-	<12	-	<12	<12	-	<12	<12	<12	-	<12	-	<12	-	<12	-	<12	<12	<12
Σ DDT	mg/kg	400	1,000	400	0.431 [9]	0.9	<0.6	-	**0.9**	-	-	<0.6	-	<0.6	<0.6	-	<0.6	<0.6	<0.6	-	<0.6	-	<0.6	-	<0.6	-	<0.6	<0.6	<0.6
Deildrin	mg/kg	70	160	70	NGV	0	<0.5	-	<0.5	-	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	<0.5
Total Petroleum Hydrocarbons																													
C7- C9	mg/kg	500 [7]	500 [8]	500	NGV		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10		
C10- C14	mg/kg	510 [7]	510 [8]	510	NGV		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,052		
C7- C36	mg/kg	NL [7]	NL [8]	NL	NGV		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,350		
C7- C36 (total)	mg/kg	-	-	-	NGV																						8,402		
Asbestos																													
Asbestos presence/absence		N/A	N/A	Not present	Not present	N/A	-	**Chrysotile**	-	**Chrysotile**	NAD	-	NAD	-	-	**Chrysotile, Amosite, Crocidolite**	-	-	-	**Chrysotile, Amosite, Crocidolite**	-	**Chrysotile, Amosite, Crocidolite**	-	**Chrysotile, Amosite, Crocidolite**	-	NAD	-	-	-
Asbestos form		N/A	N/A			N/A	-	**Bitumastic material, free fibres**	-	**Cement sheet, free fibres**	-	-	-	-	-	**Cement sheet, free fibres**	-	-	-	**Free fibres**	-	**Cement sheet, free fibres**	-	**Cement sheet**	-	-	-	-	-
Weight of asebtos in ACM (non-friable) [6]	%w/w	0.02	0.05			3.437	-	0	-	0	NAD	-	NAD	-	-	**3.437**	-	-	-	0	-	**0.101**	-	**2.991**	-	NAD	-	-	-
Combined FA + AF [8]	%w/w	0.001	0.001			6.7374	-	0.0067	-	0.0235	NAD	-	NAD	-	-	6.7374	-	-	-	0.0069	-	0.0704	-	0.2317	-	NAD	-	-	-

		Assessment criteria					Analytical data																					
Sample ID		NES Soil SCS(health) [1]					BH113 2.5	BH113 2.8	BH114 0.1	BH114 0.2	BH114 4.1	BH115 0.1	BH115 1.6	BH115 6.2	BH116 0.7	BH116 3.2	BH116 5.6	BH117 0.5	BH117 2.4	BH118 0.3	BH118 0.75	BH118 2.6	BH118 6.3	BH119 1.0	BH119 1.1	BH119 6.3	BH120 0.8	BH120 2.0	BH120 3.8
Depth (m bgl)							2.5	2.8	0.1	0.2	4.1	0.1	1.6	6.2	0.7	3.2	5.6	0.5	2.4	0.3	0.75	2.6	6.30	1.0	1.1	6.3	0.8	2.0	3.8
Sample date							2/10/2018	2/10/2018	3/10/2018	3/10/2018	3/10/2018	8/10/2018	8/10/2018	8/10/2018	8/10/2018	8/10/2018	8/10/2018	9/10/2018	9/10/2018	9/10/2018	9/10/2018	9/10/2018	9/10/2018	10/10/2018	10/10/2018	10/10/2018	9/10/2018	9/10/2018	9/10/2018
Material type (cap/fill)	**Units**	**Recreational**	**Outdoor worker**	**Burwood [2]**	**Background [3]**	**Maximum concentration**	Fill	Fill	Cap	Cap	Fill	Cap	Fill	Natural	Cap	Fill	Fill	Cap	Fill	Cap	Cap	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill
Metals																													
Arsenic	mg/kg	80	70	80	16.3	61.9	6.82	-	-	5.61	13.7	-	5.97	2.36	5	-	**27.8**	4.08	25	-	5.06	-	14.9	**61.9**	-	**39.9**	8.45	-	**44.2**
Cadmium	mg/kg	400	1,300	400	0.2	375	0.13	-	-	0.15	0.29	-	0.094	0.034	0.12	-	**0.26**	0.057	**375**	-	**0.28**	-	**26.6**	0.14	-	0.14	0.2	-	0.41
Chromium	mg/kg	2,700	6,300	2,700	20.1	117	16.5	-	-	16.1	**28.3**	-	17.9	12.6	14.1	-	**20.5**	13.7	**40.7**	-	14.2	-	**117**	15.4	-	16.5	12.5	-	18.8
Copper	mg/kg	>10,000	>10,000	>10,000	19.5	159	14	-	-	24.2	**159**	-	9.84	5.72	**26.1**	-	**51.4**	7.95	**129**	-	15.9	-	**24.8**	15.4	-	15.3	**20.7**	-	16.4
Lead	mg/kg	880	3,300	880	128.8	3890	45.6	-	-	48.6	56.4	-	28.8	11.3	48.3	-	33.6	38.1	3890	-	71.3	-	**160**	33.1	-	**151**	**126**	-	87.8
Mercury	mg/kg	1,800	4,200	1,800	0.1	5.2	0.061	-	-	0.065	**0.19**	-	0.045	0.055	0.063	-	0.068	0.046	**5.2**	-	0.1	-	**0.43**	0.077	-	**0.13**	0.097	-	**0.32**
Nickel	mg/kg	1,200 [4]	6,000 [4]	600	18	63.1	12.3	-	-	14.3	**41.9**	-	13.3	9.58	11.4	-	**39.3**	11.3	**63.1**	-	11.2	-	**34.3**	11.2	-	11.1	10.2	-	10.5
Zinc	mg/kg	30,000 [4]	400,000 [4]	14,000	166.8	315	82.2	-	-	105	105	-	71.1	37.4	78.5	-	64.2	51.5	**229**	-	68	-	**315**	74.1	-	163	84.7	-	117
Semi-Volatile Organic Compounds																													
Benzo[a]pyrene TEQ (LOR)	mg/kg	40	35	40	0.922 [5]	127	0.3	-	-	0.3	0.2	-	0.9	0.2	**1.3**	-	**1.2**	0.2	**1.7**	-	**3.3**	-	0.8	0.3	-	**20.9**	127	-	**1.4**
Total Phenols	mg/kg	40,000 [4]	240,000 [4]	40,000	NGV	0	<12	-	-	<12	<12	-	<12	<12	<12	-	<12	<12	<12	-	<12	-	<12	<12	-	<12	<12	-	<12
Σ DDT	mg/kg	400	1,000	400	0.431 [9]	9.4		-	-	<0.6	<0.6	-	<0.6	<0.6	<0.6	-	**1.5**	<0.6	0.5	-	<0.6	-	**9.4**	<0.6	-	<0.6	<0.6	-	<0.6
Deildrin	mg/kg	70	160	70	NGV	0	<0.5	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5
Asbestos																													
Asbestos presence/absence		N/A	N/A	Not present	Not present	N/A	-	**Chrysotile, Amosite**	NAD	-	-	NAD	-	-	-	NAD	-	-	NAD	NAD	-	**Chrysotile**	-	-	**Chrysotile, Amosite, Crocidolite**	-	-	**Chrysotile, Amosite, Crocidolite**	-
Asbestos form		N/A	N/A			N/A	-	**Free fibres**	-	-	-	-	-	-	-	-	-	-	-	-	-	**Bitumastic material, fibrous material**	-	-	**Fibrous material, free fibres**	-	-	**Cement sheet**	-
Weight of asebtos in ACM (non-friable) [6]	%w/w	0.02	0.05			1.305	-	0	NAD	-	-	NAD	-	-	-	NAD	-	-	NAD	NAD	-	0	-	-	0	-	-	**1.305**	-
Combined FA + AF [8]	%w/w	0.001	0.001			0.4009	-	0.0055	NAD	-	-	NAD	-	-	-	NAD	-	-	NAD	NAD	-	**<0.001**	-	-	**<0.001**	-	-	0.4009	-

Notes:
Bold indicates that published background concentrations are exceeded.
Red indicates that outdoor worker health criteria are exceeded.
Underlined indicates that recreational land use criteria are exceeded.
Highlighted indicates that Burwood acceptance criteria are exceeded.
- indicates sample has not been analysed.
NAD indicates No Asbestos Detected.
NGV indicates No Guideline Value.
N/A indicates Not Applicable.

1- MfE, 2012 - National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (unless otherwise stated).
2- Burwood Resource Recovery Park acceptance criteria, pers. comms. M Morely (CCC), 16.03.2011 and updated with the NES recreational criteria as he instructed in January 2012.
3- ECan GIS, Trace elements Level 2 from "Background concentrations of selected trace elements in Canterbury soils" prepared for Environment Canterbury by Tonkin and Taylor Ltd, July 2006.
4- ASC NEPM Toolbox - Update Febrary 2014 - www.nepc.gov.au/nepms/assessment-site-contamination/toolbox.
5- ECan 2007, Background concentrations of polycyclic aromatic hydrocarbons in Christchurch urban soils.
6- BRANZ 2017, New Zealand Guidelines for Assessing and Managing Asbestos in Soil; ACM- asbetsos containing material, AF- asbestos fines, FA- fibrous asbestos.
7- MfE, June 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Tier 1 Soil ac ceptance criteria: Commercial/ industrial use, sandy silt, <1 m.Residential is used on a conservative basis
8- MfE, June 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Tier 1 Soil a cceptance criteria: residential use, sandy silt, <1 m.

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